Institut nordique du Québec

Together for the North

2023 | 2024

ACTIVITY REPORT

This activity report covers the period from April 1, 2023, to March 31, 2024.
Cover photo credit: Alice Cavalerie (Quaqtaq, April 2023)

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INQ AT A GLANCE

16

Quebec university member institutions

85+

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

65+

Research Chairs with an INQ-affiliated chairholder

4

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

5

committees and working groups devoted to priority issues in the North

272

affiliated researchers

3

INQ Research Chairs

11

research projects underway as part of the For *A Sustainable North* program

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 Quebec 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

Photo : David Dumas

A WORD FROM THE EXECUTIVE

Dear members, collaborators, and partners,

As we wrap up another year filled with exciting events and discoveries, we are delighted to share with you the Institut nordique du Québec highlights from this period. Our commitment to scientific excellence and our quest to unlock the mysteries of the North and the Arctic have never been as relevant as they are today.

This year, our international outreach was truly remarkable, and is a testament to the importance and value of our research. We forged fruitful collaborations with renowned institutions, further cementing our position as a leader in the field of Arctic research.

We were also honoured to finalize an important agreement with the Swiss Polar Institute, a milestone that strengthens our collaborative network and underscores our shared commitment to scientific excellence in the study of the polar regions.

The University of the Arctic (UArctic) Assembly was another highlight, attracting representatives from some 15 countries and 7 Canadian provinces. This virtual university created by the Arctic Council embodies our collective aspiration to forge close ties between universities so that, together, we can meet the challenges posed by the mysteries of the North and the Arctic, and by climate change.

Training our young researchers has always been central to our mission. We saw our students excel at the 7th Arctic Circle Assembly in Reykjavik, Iceland, inspired by their passion for the North and the Arctic, and supported by first-rate professors. We are proud to share their success and contribute to the training of the next generation of scientists dedicated to the North and the Arctic.

Our research efforts have been a resounding success thanks to the funding of projects that are relevant to the North and that have enabled us to shed new light on issues crucial to our communities.

Our annual scientific meeting at Université du Québec à Trois-Rivières (UQTR) on the theme of the green economy was a platform for discussions and the dissemination of knowledge, consolidating our role as a leader in northern and Arctic research. This key event, which brought together so many brilliant minds around current and future issues facing the North and the Arctic, spurred lively discussions, with promising proposals set to pave the way for new avenues of research.

As we look to the future, we are galvanized by an unwavering determination to continue pushing to better understand the North and the Arctic, for the benefit of all. We would like to thank each and every one of you for your dedication, passion, and hard work in making INQ a place of excellence.

We would also like to express our heartfelt gratitude to all those who played a role in these accomplishments. Your devotion and passion for northern and Arctic research are the driving force behind our Institute.

Together, we will continue to help build a sustainable future for the North and the Arctic, guided by our mission to understand and preserve this unique environment for generations to come.

Thank you, and here's to many more exciting years!

Eugénie Brouillet
Chair, Executive Committee,
Institut nordique du Québec

Jean-Éric Tremblay
Director, Institut nordique
du Québec

Brigitte Bigué
Director, Administration
and Development, Institut
nordique du Québec

The team at Institut nordique du Québec is proud to present this activity report, reflecting, as it does, the diversity of our actions, the scope of our network, and our commitment to evidence-based decision-making. Our objective is to provide governments, northern communities, and the private sector with the knowledge and expertise they need to promote the sustainable development of Northern Quebec and the Canadian Arctic.

2023-2024 HIGHLIGHTS

APRIL 13, 2023 | NEW MEMORANDUM OF UNDERSTANDING FOR INQ

Institut nordique du Québec, the Swiss Polar Institute, and Université Laval signed a memorandum of understanding designed to strengthen collaboration between the Swiss and Canadian scientific communities in the fields of polar and high-altitude science. This strategic agreement facilitates the sharing of research infrastructures, as well as the exchange of human resources, data, and other key elements of research.

MAY 22 TO 26, 2023 | ANNUAL ASSEMBLY OF UARCTIC IN QUEBEC CITY

INQ and Université Laval were selected to host the fourth annual UArctic Assembly

This international gathering attracted nearly 150 attendees from about 15 different countries. The discussions surrounding the sustainable development of circumpolar regions enabled INQ and Université Laval to reinforce their position as key players in this field on the international stage.

UArctic, which is headquartered in Finland, is an international cooperative network of universities, colleges, and other organizations with an interest in promoting education and research in the Arctic regions. INQ and UArctic have been collaborating on a number of projects since 2017, while Université Laval has been a member of UArctic since 2002.

MAY 26, 2023 | ADDITIONAL FUNDING SECURED FOR THE INQ SCIENTIFIC COMPLEX

May 26, 2023, marked the kick-off of construction on the Institut nordique du Québec scientific complex. An additional $8 million announced by the Government of Canada and $14.63 million granted by the Gouvernement du Québec has been secured to meet the INQ scientific complex construction budget.

As with other major builds in Quebec in recent years, the scientific complex has experienced significant cost overruns due to inflation and the overheated construction sector. With the announcement of this additional funding, the project was able to proceed according to plan, and a call for tenders was launched for the construction of the INQ complex on the Université Laval campus.

Photo : Jean Rodier

Press conference held May 26, 2023, on the Université Laval campus as part of UArctic's annual meeting. Left to right: Joël Lightbound, MP for Louis-Hébert; Michèle Audette, Senator, Canadian Parliament; Joëlle Boutin, Parliamentary Assistant to the Minister of Economy, Innovation, and Energy (science and innovation) and MNA for Jean-Talon; Dominic LeBlanc, Minister of Intergovernmental Affairs, Infrastructure and Communities; Sophie D'Amour, Rector, Université Laval; Olga Farman, Honorary Co-chair, Major Fundraising Campaign, Carrefour international Brian-Mulroney; Robert Sauvé, Strategic Advisor for the North and the Arctic at Université Laval; Brigitte Bigué, Director, Administration and Development, Institut nordique du Québec (INQ); Jean-Éric Tremblay, Director, INQ; Eugénie Brouillet, Chair, Executive Committee, Institut nordique du Québec, and Vice-Rector, Research, Creation, and Innovation, Université Laval; Jonatan Julien, Minister Responsible for Infrastructure, Minister Responsible for the Capitale-Nationale Region, and MNA for Charlesbourg; Jean-Yves Duclos, Minister of Health and MP for the riding of Québec.

JUNE 5 AND 6, 2023 | INQ NORTHERN DAYS

On June 5 and 6, INQ organized its annual knowledge transfer event, Northern Days, hosted this year by Université du Québec à Trois-Rivières (UQTR), one of its regular members. The event, which revolved around the theme "Imprints of a Green Economy in a Northern Context" attracted over one hundred people. What made this meeting so special was the diversity of the participants: distinguished keynote speakers, industry representatives involved in sustainable energy transition projects, members of Indigenous and northern communities central to promising and transformative initiatives, researchers from various fields, provincial and federal government representatives, and numerous students.

The event was also a prime opportunity for students to present their research, either as oral presentations in the context of the Mon projet nordique / My Northern Project science popularization competition, or as scientific posters.

Photo : Stéphanie Lavoie

Group photo taken June 5, 2023, during INQ Northern Days at UQTR.

JUNE 5, 2023 | MON PROJET NORDIQUE / MY NORTHERN PROJECT

The provincial finals of the Mon projet nordique / My Northern Project science popularization competition were held before an audience at INQ Northern Days on June 5, 2023. A total of 16 candidates from five INQ member institutions (ÉTS, INRS, ULaval, UQAC, and UQAR) took part in the competition. At the end of the day, five candidates were chosen to represent Quebec at the international finals held in Reykjavik, Iceland, at the *Arctic Circle Assembly* in October 2023.

Photo : Stéphanie Lavoie

Students selected to represent Quebec at the international finals of the Mon projet nordique / My Northern Project competition (left to right): Pénélope Blackburn, UQAC; Alice Cavalerie, ULaval; David Dumas, ULaval; Karel Cadoret, ULaval; Margaux Rougier, UQAR

Photo : Geneviève Vachon

JULY 6, 2023 | FUNDING FOR SIX NEW RESEARCH PROJECTS

The *For a Sustainable North* program has been administered jointly since 2019 by Institut nordique du Québec and Université Laval's Sentinel North research strategy. As part of the program, 13 teams received funding to conduct research on sustainable development and the well-being of northern communities. The third and most recent call for projects under this program was launched in September 2022. Six teams were selected.

Modelling the Coupling of Terrestrial-Aquatic Carbon Fluxes in the Regional Forest Landscape in a Changing Climate

Lead Investigator: Jean-François Boucher, UQAC
Co-applicants: Catherine Girard, UQAC; Milla Rautio, ULaval; Patrick Faubert, UQAC; Maxime Boivin, UQAC; Paul George, ULaval; Olivier Riffon, UQAC

Inhabiting the Saint-Augustin-Pakua Shipu Sand River: Biogeomorphological and Social Transformations

Lead investigators: Daniel Germain, UQAM, Laurie Guimond, UQAM
Co-applicants: Caroline Desbiens, ULaval, Justine Gagnon, ULaval

Back on Traces: Detection of Contaminants and Nanoparticles as Markers of the Anthropocene in the Arctic

Lead investigator: Julien Gigault, ULaval
Co-applicants: Mélanie Lemire, ULaval; Catherine-Alexandra Gagnon, Erebia; Philippe Archambault, ULaval; Pierre Legagneux, ULaval

COMIRCHAN Project: Co-construction of an Intersectoral Model of Heat Networks in Nunavik

Lead investigator: Christophe Krolik, ULaval
Co-applicants: Jasmin Raymond, INRS, Louis Gosselin, ULaval, Ali Hakkaki-Fard, ULaval

Manicouagan-Uapishka Imaging through Aquatic and Cultural Territory Prospection

Lead investigator: Patrick Lajeunesse, ULaval
Co-applicants: Caroline Desbiens, ULaval; Justine Gagnon, ULaval; Pierre Francus, INRS; Dermot Antoniades, ULaval; Catherine Girard, UQAC; Mark Patterson, Northeastern University

Study on the Preparation, Use, and Chemical Composition of Northern Labrador Tea (Rhododendron subarticum) Decoctions as Consumed by the Whapmagoostui-Kuujjuaraapik Communities

Lead investigator: Normand Voyer, ULaval
Co-applicants: Caroline Hervé, ULaval, Stéphane Boudreau, ULaval

It is worth recalling that this third call, launched in September 2022, began with a request for intentions in which research teams were asked to present outlines of the projects they wished to undertake. Thirteen teams responded to the call. An independent committee subsequently evaluated the intentions, and ten teams, comprising 53 scientists from 14 universities, were selected to **receive $10,000 in financial support and were given four months to develop a full proposal**. The purpose of this additional period was to **allow teams and their partners to strengthen their ties in the field, identify and involve all stakeholders from the outset of projects, and foster the co-construction of research with northern communities.**

FALL 2023 TO SPRING 2024 | SERIES OF WORKSHOPS ON RESEARCH PRIORITIES — REDEFINING THE CURRENT INQ RESEARCH PROGRAM

INQ's first scientific program was published in 2017, after many hours of consultation involving hundreds of specialists from diverse backgrounds whose skills align with key northern issues. Nearly a decade later, the INQ Scientific and Development Committee decided to revisit and review the program. The new version of the scientific program will include a section dedicated to cross-cutting research issues in the North. This section will better reflect the multisectoral research conducted within the INQ community, and build bridges between the multiple areas of expertise needed to resolve issues specific to northern environments.

To help produce this update, four workshops were held over the past year, each attended by 12 to 25 participants. These workshops enabled us to gather ideas and experiences from a broad range of actors in the field. Other workshops will be held in 2024 and 2025. Ultimately, this exercise will allow the new scientific program to be incorporated into INQ's overall 2025-2030 strategic plan, which is also currently being revised.

Photo taken at the Axis 4 (Infrastructure and Technology) workshop, held on November 23, 2023.

OCTOBER 3 TO 5, 2023 | FORUM: "THE IMPACT OF CLIMATE CHANGE ON INDIGENOUS ECOSYSTEMS AND RESEARCH"

Institut nordique du Québec's First Peoples' Committee (FPC) organized a Forum entitled "The Impact of Climate Change on Indigenous Ecosystems and Research."

FPC's goals for this forum were to:

1. Create a collaborative space for Indigenous researchers and actors
2. Promote interaction between those involved in research from both Indigenous and academic communities
3. Revisit the ethical principles and guidelines for research in northern settings, and update the Research Guidelines document published in 2017 by INQ

With the participation of over 50 Indigenous and non-Indigenous representatives from Quebec's research entities, communities, and funding agencies, the event confirmed that a meaningful dialogue has been established.

The event revolved around five main themes:

> Responsible protection and management of resources
> Food security and traditional activities
> Recognition and valorization of indigenous knowledge
> Adaptation and innovations in the face of climate change
> Research and self-determination

A detailed report on the forum's discussions and findings will be published by the end of 2024. The report will be available on the INQ website.

Event Partners:

> Secrétariat aux relations avec les Premières Nations et les Inuit
> Centre des Premières Nations Nikanite, Université du Québec à Chicoutimi
> Société du Plan Nord
> Research Chair on Relations with Inuit Societies
> Université Laval

OCTOBER 20, 2023 | INTERNATIONAL FINALS OF MON PROJET NORDIQUE / MY NORTHERN PROJECT

The international finals of the Mon projet nordique / My Northern Project science popularization competition have been held since 2017 during the *Arctic Circle Assembly*. The finals were organized in conjunction with UArctic, a long-standing INQ partner, and with the financial support of the Nordic Council of Ministers and Ministère des Relations internationales et de la Francophonie (MRIF).

Over the years, the event has showcased some truly talented science communicators from Quebec and the Nordic countries. The 2023 edition of the competition was no exception, with 11 students taking part in the international finals, highlighting the next generation of scientists in the field of northern sciences.

The competition ended in a tie between David Dumas from Université Laval and Najaaraq Demant-Poort from the University of Greenland.

The 11 students selected for the 2023 international finals of the Mon projet nordique / My Northern Project science popularization competition.

Quebec was represented by five up-and-coming scientists:

Pénélope Blackburn-Desbiens
PhD candidate in biology, Université du Québec à Chicoutimi

Karel Cadoret
Master's student in microbiology, Université Laval

Alice Cavalerie
Master's student in mechanical engineering, Université Laval

David Dumas
Master's student in mechanical engineering, Université Laval

Margaux Rougier
Master's student in oceanography, Université du Québec à Rimouski

OCTOBER 31 TO NOVEMBER 3, 2023 | THIRD EDITION OF THE IMMERSIVE TRAINING SESSION "INTRODUCTION TO NORTHERN RESEARCH AND ISSUES"

The INQ training session *Introduction to Northern Research and Issues*, designed for early-career researchers, was held October 31 to November 3 at Station Duchesnay, just outside Quebec City. Accompanied by ten invited mentors, the 24 participants from 12 Canadian universities enjoyed a remarkable experience of knowledge sharing and collaboration. For more details on the training session, see pages 15 to 17 of this report.

FEBRUARY 22, 2024 | PUBLIC ANNOUNCEMENT AND OFFICIAL GROUND-BREAKING CEREMONY FOR THE INQ SCIENTIFIC COMPLEX

Half a dozen dignitaries representing the Gouvernement du Québec, the Government of Canada, Quebec City, and Université Laval held a ground-breaking ceremony to mark the public announcement of the start of construction work on the future Institut nordique du Québec (INQ) scientific complex.

The event garnered extensive media coverage, underscoring the importance and future impact of this project. The complex is slated to open in 2026, and promises to significantly boost research capabilities and academic collaborations in northern and Arctic research.

Photo : Yan Doublet

Left to right: Joël Lightbound, Liberal MP for the Louis-Hébert riding; Jean-Yves Duclos, Minister of Public Services and Procurement of Canada, MP for the riding of Québec; Jean-Éric Tremblay, Director, Institut nordique du Québec and Professor, Department of Biology, Université Laval; Jonatan Julien, Minister Responsible for Infrastructure, Minister Responsible for the Capitale-Nationale Region, and MNA for Charlesbourg, Maïté Blanchette Vézina, Quebec Minister of Natural Resources and Forests, MNA for the Rimouski riding; Sophie D'Amours, Rector, Université Laval; and Bruno Marchand, Mayor of Quebec City.

FEBRUARY 14, 2024 | INQ TEAMS UP WITH CENTRE D'ÉTUDES NORDIQUES (CEN) FOR THE TRAINING COMPONENT OF THE CEN ANNUAL CONFERENCE

Training the next generation of scientists is a key priority for Institut nordique du Québec. INQ responded with great enthusiasm when it was approached by CEN about partnering on the training component of CEN's annual conference. This partnership resulted in two high-quality training courses being offered to participants at the symposium held February 14 to 16, 2024, at Université Laval:

> Making great figures using Inkscape (graphics)
> Linguistic introduction to the properties and workings of Inuktitut

Photo : Rachel Hussherr

Training is one of the pillars of INQ's mission. Two resounding successes bear testament to its commitment to train the next generation of skilled scientific researchers and raise public awareness of the singular realities facing northern communities and regions.

TRAINING AT INQ: IMMERSIVE, IMPACTFUL, AND TRANSFORMATIVE

OCTOBER 31 TO NOVEMBER 3, 2023 | INTRODUCTION TO NORTHERN RESEARCH AND ISSUES

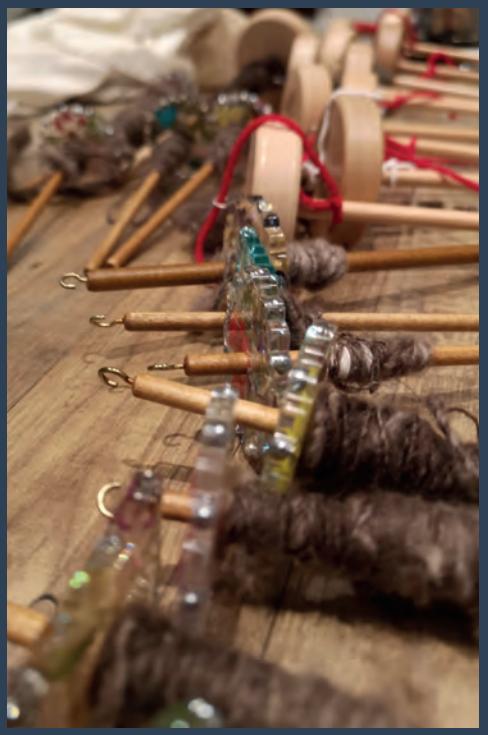
This training is offered every two years and aims to arm young researchers with the tools they need to prepare and carry out their research projects in the North. The 2023 edition focused on knowledge mobilization and transfer, and was attended by 24 participants, including 12 master's students, nine PhD students, two post-doctoral fellows, and one professor.

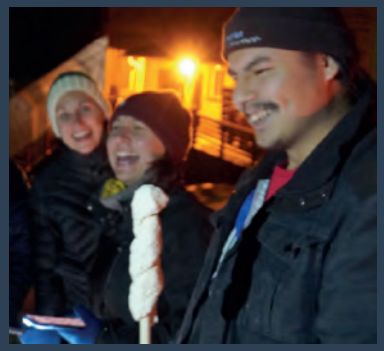
PARTICIPANT AFFILIATION

- École nationale d'administration publique
- École Polytechnique de Montréal
- HEC Montréal
- Institut national de la recherche scientifique
- Université de Montréal
- Université de Sherbrooke
- Université of Manitoba
- Université du Québec à Chicoutimi
- Université du Québec à Montréal
- Université du Québec à Rimouski
- Université du Québec à Trois-Rivières
- Université du Québec en Abitibi-Témiscamingue
- Université du Québec en Outaouais
- Université Laval

Marie-Eve Marchand, a research professional at the Sentinel North Research Chair on Relations with Inuit Societies, and **Marie-France Gévry**, Program Manager at Sentinel North (Université Laval), played a key role as facilitators throughout the training. Their expertise and dedication enabled participants to make deep connections between the various topics, enriching discussions and solidifying learning outcomes.

The training also benefited from the contribution of nine mentors, who are profiled in the following pages. Institut nordique du Québec is proud to have assembled such a qualified team to provide the next generation of scientists with training that is both relevant and impactful.





TRAINING ENRICHED BY DIVERSE KNOWLEDGE AND EXPERIENCE

Mentors

Photo courtesy of: William Alger

William Alger, Land Guardian

Originally from Fort Simpson in the Northwest Territories, William Alger is a member of the Dene First Nation. He grew up in his community before spending two years studying in Nanaimo, British Columbia. Since 2020, he has been working as a steward at Edéhzhíe, overseeing the protected area. In 2021, he was elected to the Liidlii Kue First Nation Band Council. He is also a lead for the project group *Overcoming Barriers to Indigenous ECRs* with the Association of Polar Early Career Scientists (APECS).

Photo courtesy of: Anne Deslauriers

Anne Deslauriers, Nutritionist

Anne Deslauriers graduated from Université Laval with a degree in nutrition in 2000, and has worked since 2019 in Whapmagoostui as a community and clinical nutritionist for the Cree Board of Health and Social Services of James Bay (CBHSSJB). Prior to that, she spent 10 years in private practice and with Institut sur la nutrition et les aliments fonctionnels (INAF) as a clinician and consultant. She is also a collaborator on a research project on Northern Labrador Tea studying its implications for the health of community members.

Photo courtesy of: Elise Devoie

Elise Devoie, Assistant Professor, Department of Mechanical Engineering, Queen's University

Élise Devoie's area of expertise combines modelling, fieldwork, and laboratory investigation to study permafrost and freeze/thaw cycles. Her research deals with the effects of global warming on soil hydrology, geophysics and thermal regimes, and is aimed at strengthening the capacity and resilience of the North. She collaborates with APECS Canada and APECS International.

Photo courtesy of: Catherine-Alexandra Gagnon

Catherine-Alexandra Gagnon, Consultant and President of the environmental consulting firm, Érébia

Catherine-Alexandra Gagnon has vast expertise in working collaboratively with Indigenous communities. With 20 years of experience under her belt, from Mongolia to Canada's far North, she has developed a deep interest in knowledge co-production and community-based environmental monitoring. She works to build respect and trust between communities and the various actors involved in environmental monitoring and management.

Photo courtesy of: Rachel Guindon

Rachel Guindon, Biologist

Rachel Guindon studied biology at Université Laval, and is passionate about northern issues. Her master's thesis on muskox in Nunavik led her to develop an innovative collaboration with Inuit communities, combining textile, traditional, and ecological knowledge relating to this animal. She also works with the Nunavimmiut on wildlife management projects.

Photo courtesy of: Janice Parsons

Janice Parsons, Nunavik Artist and Young Leader

Janice Parsons is an artist and young leader from Kuujjuaq, Nunavik. As president of the Qarjuit Youth Council, she represents over 5,000 young people from Nunavik and Chisasibi, advocating for their interests and future in Inuktitut. She shares her cultural knowledge with the next generation on a volunteer basis, while advocating for better school curriculums at international forums and touring the North as a traditional artist.

Nadine Rousselot, Director, First Peoples' Affairs
Originally from Pessamit, Nadine Rousselot is the director of the Office of First Peoples at Université Laval. She is involved in setting up various programs and services to support Indigenous students. For instance, she has helped develop the Land Guardian certificate, designed in collaboration with the First Nations, and is involved in organizing events to promote Indigenous culture within the student community.

Jean-Éric Tremblay, Oceanographer and Director, Institut nordique du Québec
Jean-Éric Tremblay has been a professor in the biology department at Université Laval since 2004, focusing on Arctic and sub-Arctic oceanography. The INQ director earned a PhD from Université Laval in 1996, then did post-doctoral research in Germany and Japan, and was a research associate at McGill University. His research explores the impact of climate change on the biological and biogeochemical productivity of the Arctic seas, as well as its influence on the North Atlantic and the east coast of North America, which is crucial for coastal communities dependent on Arctic marine resources.

Photo courtesy of: Normand Voyer

Normand Voyer, Chemist and Professor, Université Laval
Normand Voyer is a chemist and professor at Université Laval. He is renowned for his research into the identification of bioactive natural products. In recent years, his work has demonstrated the molecular richness of plants and lichens in Arctic and sub-Arctic ecosystems. His discoveries have earned him a number of awards, including Prix Urgel-Archambault in 2019.

MOOC | NORTHERN QUEBEC: ISSUES, SPACES, AND CULTURES

The French version of our MOOC, offered from February 5 to April 5, 2024, attracted 518 registrants. This online course, which has been offered on an annual basis since 2017 under the direction of Professor Thierry Rodon (Political Science Department, Université Laval) has earned a solid reputation as a go-to reference on Northern Quebec. Participant feedback attests to the significant impact of this course on their educational and professional careers. This free MOOC focuses on the sociopolitical issues of Northern Quebec, the ancestral territory of several Indigenous nations, and is open to anyone interested in discovering and understanding this territory and its history, societies, and contemporary challenges.

DID YOU KNOW?

To help prepare the next generation of scientists specializing in northern research, many INQ-affiliated scientists urge their students to sign up for the MOOC before they begin their research projects.

Since the launch of the MOOC in 2017, over 13,000 people have signed up for the course, reflecting a keen interest in themes surrounding Northern Quebec. INQ is proud to play a key role in raising awareness and educating people who wish to further their understanding of this unique region.

Photo : Amélie Breton

INSTITUT NORDIQUE DU QUÉBEC COMMUNITY

INQ-affiliated scientists hail from institutions of higher learning that are members of INQ and that are each renowned for their strengths and expertise. This dynamic network committed to the sustainable and ethical development of northern regions helps bolster the quality and scope of our actions.

THE INQ COMMUNITY

INQ REGULAR MEMBERS (April 1, 2023, to March 31, 2024)	NUMBER OF AFFILIATED RESEARCHERS	NUMBER OF AFFILIATED CENTRES	NUMBER OF AFFILIATED CHAIRS
École de technologie supérieure	5	2	–
École nationale d'administration publique	3	2	–
Institut national de la recherche scientifique	20	4	4
Polytechnique Montréal	10	2	1
Université du Québec network	–	–	–
Concordia University	2	–	2
Université de Montréal	10	4	3
Université de Sherbrooke	16	7	–
Université du Québec à Chicoutimi	18	10	9
Université du Québec à Montréal	15	5	2
Université du Québec à Rimouski	20	5	8
Université du Québec à Trois-Rivières	7	2	–
Université du Québec en Abitibi-Témiscamingue	3	1	–
Université Laval	75	12	23
McGill University	68	30	14
Université TÉLUQ	–	–	–
TOTAL	**272**	**86**	**66**

AFFILIATION OF ASSOCIATED RESEARCHERS

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

REGULAR MEMBERS

INQ regular members consist of Quebec 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 Quebec; 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 Envrionnement is devoted to Quebec'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 Quebec. 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.

Photo : Émilie Bouchard/ArcticNet

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 two of the INQ-affiliated research entities at the heart of leading-edge northern research:

AFFILIATED RESEARCH ENTITIES

The Sentinel North Research Chair on Relations with Inuit Societies strives to promote the development of harmonious relations with Inuit societies. Headed by Caroline Hervé, a professor in the Department of Anthropology at Université Laval, it aims to generate new knowledge about the history of relations between Inuit and non-Inuit, to create training and pedagogical tools for non-Inuit so that they can adapt their professional practices to the regional and cultural specificities of Nunavimmiut, and to give the Inuit a central role in the production of research. Building on its considerable expertise, the Chair team works closely with INQ on a range of files and plays a leading role on the INQ Training Committee. The Chair has also created a twelve-hour permanent training course funded in part by INQ entitled Inuit History, Culture, and Contemporary Realities. This online training course offers an introduction into the history and political, social, and cultural singularities of the Inuit of Nunavik. In addition, for the past two years, the INQ First Peoples' Committee has been coordinated by Marie-Eve Marchand, a researcher at the Chair.

In 2023 and 2024, much of the Chair's activities were devoted to justice, with a view to documenting, mobilizing, and promoting Inuit legal practices and knowledge so they are recognized by and integrated into the justice system. The project findings were presented to regional, provincial, and national partners at a regional round table on justice in Nunavik (February 7-8, 2024) organized by the Chair team. The Chair is also working to create a virtual museum based on Bernard Saladin d'Anglure's collection of objects, a co-creation activity with the community of Igloolik, Nunavut, and has contributed to interdisciplinary research activities such as food security in Cambridge Bay, Nunavut, and the study of Northern Labrador Tea in Whapmagoostui/Kuujjuarapik. Lastly, the Chair forged a new partnership with Atanniuvik, Nunavik's future research authority, to conduct an inventory of research produced in Nunavik, and signed a partnership agreement with Makivvik to develop Inuit history and culture awareness training for its employees.

The Canada Research Chair in Ecotoxicology and Global Changes, headed by Marc Amyot, PhD, Université de Montréal, conducts research to gain a better understanding of the movement and transformation of contaminants in a changing world. By studying the complex interactions between global changes and contaminant behaviour, the Chair seeks to generate essential knowledge about ecosystem contamination.

For example, the Chair team is studying how melting northern permafrost, which is exacerbated by climate change, influences contaminant mobility. This issue is particularly relevant in a northern context given mining and industrial development, which can release toxic substances that threaten fragile ecosystems.

Mr. Amyot and his team are also exploring the transfer of contaminants along the food chain, with a particular focus on northern communities that are dependent on local resources. In addition, they are developing biological methods for contaminated soil restoration that are adapted to northern conditions and based on local products and a circular economy approach.

This research will provide environmental managers with the scientific tools they need to better manage the risks associated with contaminants in a changing world.

INQ-AFFILIATED SCIENTISTS: A SNAPSHOT

INQ brings together 272 researchers. Here's a look at two scientists who, each in their own field, are driving scientific progress forward.

EMILIE FORTIN-LEFEBVRE has been a professor in the UQAM Department of Management's School of Management Sciences since 2017, where she teaches entrepreneurship and management.

She is especially interested in economic reconciliation with the First Nations and Inuit, which is a major challenge for Quebec and Canadian society. That is why, in 2019, she founded Centre d'études pour l'autonomie économique des peuples autochtones (AEPA), which brings together Indigenous and academic experts to develop shared knowledge that addresses the specific needs of Indigenous Peoples. More broadly, her interest lies in the relationships between entrepreneurship, entrepreneurial support, economic development, alternative economic models, and creative methodologies for co-creation and knowledge transfer.

Her research focuses on collaboration, co-construction, and the promotion of Indigenous voices in order to create meaningful knowledge that addresses the needs of Indigenous populations. Her "alternate approach to research" is reflected, for one, in her use of innovative, artistic, and participatory methodologies. In this way, she seeks to reach a wider audience than just academic circles, by giving a voice to Indigenous People and promoting their experiences and knowledge with the aim of boosting their autonomy and economic resilience while highlighting their essential contribution to Quebec's economy.

JEAN-PASCAL BILODEAU has been Assistant Professor in the Department of Civil and Water Engineering since 2021. Upon joining, he assumed the scientific leadership of the Sentinel North Chair on Northern Infrastructure (2022-2027), which aims to develop resilient and sustainable infrastructure for the North. This program allowed him to expand his collaborations and launch innovative projects in northern engineering, strengthening Université Laval's position in this field.

Building on this momentum, he has developed a thriving ecosystem of research projects and partnerships, contributing to the training of a new generation of engineers and scientists ready to tackle the complex challenges of northern regions. This expertise acquired over the years has led to the creation of Laboratoire Universitaire sur les Chaussées et les Infrastructures Linéaires (LUCIL, of which he will be the scientific director. The official launch of this laboratory is scheduled for the fall of 2024.

Jean-Pascal Bilodeau is the author or co-author of more than 200 publications in the field of road engineering, including nearly 108 in peer-reviewed scientific journals or international conferences.

INTERDISCIPLINARY COLLABORATION: AN EXPANDED NETWORK

Collaborators bring diverse perspectives and valuable expertise to the table, enriching the research by taking into account real-world conditions.

Their involvement—whether as community members, private sector representatives, NGOs, or government officials—is crucial for translating research into tangible and sustainable outcomes. To showcase the breadth of our collaboration, we spotlight two key partners: an energy sector expert who advances the integration of sustainable solutions and a science journalist who highlights the work of INQ researchers on a monthly basis.

Joë Lance, Director General of Tarquti

Recognized for his social and organizational commitment, Joë Lance has nearly 30 years of management experience in both the public and private sectors. Visionary and passionate, he uses his dynamic leadership to serve the Inuit of Nunavik. Throughout his career, he has held key management positions with the Kativik Regional Government and Makivvik Corporation.

Joë Lance has been associated with Institut nordique du Québec (INQ) for several years, contributing in particular to INQ's working group on new and renewable energies. In May 2023, as a panelist at INQ's Northern Days, he highlighted the importance of direct community involvement in energy transition projects. Since 2019, Mr. Lance has been leading the creation and development of a Nunavik-based company, Tarquti Energy, which specializes in clean energy projects tailored to the needs of Inuit communities in the region, in partnership with land corporations and local cooperatives.

Valérie Levée, science journalist

Valérie Levée holds a Ph.D. in plant biotechnology from the University of Orléans in France. She came to Quebec in 1996 for a postdoctoral internship at the Laurentian Forestry Centre in Quebec City. She then held various research positions in government, academia, and the private sector with Medicago.

After 10 years of exploring plant genomes, she decided to trade her pipettes for a pen and pursue a career in science communication. Since 2008, she has contributed to numerous magazines such as Quatre-Temps, Québec-Oiseaux, FORMES, PLAN, and L'actualité. On the radio, she hosts Futur Simple on CKRL 89.1 and is a columnist for Moteur de recherche on Radio-Canada. She stays connected to the academic world by collaborating with research centers such as the Quebec Centre for Functional Materials and Institut nordique du Québec. She also hosts for Déclic, a center dedicated to promoting dialogue between scientists and the public. In partnership with the Association francophone pour le savoir (Acfas) and the Association des communicateurs scientifiques (ACS), she provides training in science communication for researchers and students.

UP-AND-COMING SCIENTISTS

The next generation of scientists are at the heart of INQ's actions. Training them, providing them concrete opportunities to put into practice what they've learned, and offering them a dynamic and adaptive support framework are just some of the actions we take. Following is a snapshot of two students from the INQ community:

Photo courtesy of: Mariane St-Aubin

MARIANE ST-AUBIN

Master's program in biological sciences at Université de Montréal under the direction of Professor Marc Amyot

Project: First run-of-river hydroelectric plant in Nunavik: Short-term impacts on the mercury and carbon cycle

Mariane is a master's student in biological sciences with the Canada Research Chair in Ecotoxicology and Global Changes. She has a keen academic interest in the fate of inorganic contaminants and in environmental injustice issues. She is originally from Montreal, where she earned a technical diploma in bioecology and a bachelor's degree in biology. After graduating, she travelled, including in the Caribbean and to all four corners of Quebec, while completing a specialized diploma in environmental management. Since 2021, she has been a nature conservation project manager.

Photo courtesy of: Estéban Hamel Jomphe

ESTÉBAN HAMEL JOMPHE

PhD in remoting sensing at Université de Sherbrooke under the direction of Professor Alexandre Roy (UQTR)

Projet : Télédétection de la végétation dans l'habitat du caribou de Peary

Estéban studied in forestry at Université Laval and holds a bachelor's degree in forest management. His interest in the North and in environmental science spurred him to deepen his knowledge of wildlife conservation in Sweden for a semester before undertaking a master's degree in environmental science at UQTR. He is currently integrating aspects of geography, biology, and forestry into his PhD in remote sensing at Université de Sherbrooke.

Photo : Rachel Hussherr

COMMITTEES AND WORKING GROUPS

These committees and working groups are made up of INQ-affiliated scientists, partners from the public and private sectors, and representatives of northern communities. Composed of individuals from different backgrounds and complementary areas of expertise, these teams develop strategies, tools, and activities to fuel reflection and spur engagement of the INQ community around priority issues in northern and Arctic regions.

While the committees are permanent INQ structures, working groups are formed on a temporary basis according to the specific needs expressed by our partners, and are disbanded once their objectives have been met.

WORKING GROUP ON NEW AND RENEWABLE ENERGIES

This group is actively seeking alternatives to fossil fuels in the North, which have a negative impact on the ecological footprint of northern regions. The costs associated with both the fuel itself and its transport also place an economic burden on these areas. Additionally, the working group is exploring several other options to meet the energy needs of Quebec's remote regions. All these options focus on new and renewable energy to support the energy transition essential for the sustainable development of Northern Quebec.

Main achievements in 2023-2024:

The group members played a crucial role in programming INQ's 2023 Northern Days.

Leaders

Jasmin Raymond
Institut national de la recherche scientifique (INRS)

Louis Gosselin
Université Laval (ULaval)

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
Université McGill

Martin Bourbonnais
Cégep de Jonquière

Aline Brasil
Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP)

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

Pierre Brisson
Transition énergétique Québec (TEQ)

Christian Carrier
Carboniq

Marilys Clement
Nergica

Jérôme Cros
ULaval

Guy Dumas
ULaval

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

Alain Forcione
IREQ

Richard Gagnon
TEQ

Véronique Gilbert
Kativik Regional Government

Nicolo Giordano
INRS

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

Didier Haillot
École de technologie supérieure (ÉTS)

Ali Hakkaki-Fard
ULaval

Marianne Huot
ArcellorMital

Innocent Kamwa
ULaval

Christophe Krolik
ULaval

Patrick Labbé
Hydro-Québec

Joë Lance
Tarquti Energy

Rachid Laouamer
IREQ

Daniel Martineau
Natural Resources Canada

Félix Ménard-Saint-Denis
SHQ

Alexandre Myre
Englobe

Fuzhan Narsiri
Université Concordia

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
Ministère des Ressources naturelles et des Forêts (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 2023-2024

The committee continued its reflection on the future procurement for INQ's scientific complex

Leader

Marie-Hélène Forget
Takuvik

Members

Karolane Dufour
Québec-Océan

Alexandre Forest
Amundsen Science

Mickaël Lemay
Centre d'études nordiques

Lise Rancourt
INRS

Coordinator

Pierre-Yves Savard
INQ

TRAINING COMMITTEE

The committee has five main objectives: Make an inventory of existing training programs on Northern Quebec 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 Quebec 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 2023-2024 :

> The Committee developed and launched the 2024 edition of the Introduction to Northern Research and Issues training program. Details about this course are provided on pages 15 to 17 of this report.

> MOOC Northern Quebec: Issues spaces and cultures, offered annually, was held in French from February 5 to April 5, 2024

Leader
Catherine Girard
Université du Québec à Chicoutimi

Membres
Marie-France Gévry
Sentinel North

Marie-Eve Marchand
ULaval

Loretta Robinson
First Nations Education Council

Stéphanie Guilherme
ULaval

Isabelle Laurion
INRS

Coordinator
Pierre-Yves Savard
INQ

FIRST PEOPLES COMMITTEE

The First Peoples Committee, composed of representatives from the Inuit, Innu, Cree, and Naskapi nations, ensures that the aspirations and interests of First Peoples are integrated into research projects. It promotes the co-production of research, supports traditional knowledge, and fosters mutual respect between Indigenous researchers and academics. By facilitating exchanges and showcasing research methodologies adapted to Indigenous and Northern contexts, this committee contributes to more inclusive and collaborative research.

Main achievements in 2023-2024 :

The First Peoples Committee organized a forum on 'The Impact of Climate Change on Indigenous Ecosystems and Research' from October 3 to 5. See page 11 of this report for more details on the Forum.

Leader
Melissa Saganash
Representative of the Cree Nation

Membres
Serge Ashini Goupil
Representative of the Innu Nation

Jérôme Pelletier
Representative of Makivvik and the Inuit of Nunavik

Loretta Robinson
Representative of the Naskapi Nation

Glenda Sandy
Representative of the Naskapi Nation

Coordinator
Marie-Eve Marchand
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.

Leader
Faiz Ahmad Khan
McGill University

Coordinator
vacant position

Photo : Émilie Hallett/ArcticNet

Research at Institut nordique du Québec revolves around five main priorities. It is carried out within the INQ Research Chairs and through the *For a Sustainable North* program. Following is an overview of our research program dedicated to the sustainable development of the North.

RESEARCH AT INQ

AXIS 1

SOCIETIES AND CULTURES

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

CO-DIRECTORS

Emilie Fortin-Lefebvre
Professor
Department of Management
Université du Québec à Montréal

Thierry Rodon
Professor
Political Science Department
Université Laval

AXIS 2

HEALTH

In keeping with the themes and priorities identified by people in the North, and using a partnership approach, this axis 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

Faiz Ahmad Khan (interim)
Professor
Department of Medicine
McGill University

Cathy Vaillancourt
Professor
Armand-Frappier Santé
Biotechnologie Research Centre
INRS

AXIS 3

ECOSYSTEM FUNCTIONING AND ENVIRONMENTAL PROTECTION

The ecosystems of high northern latitudes are feeling the combined effect of accelerated socioeconomic development, strong demographic growth, and global warming. This axis 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
Professor
Department of Biology
Université Laval

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

AXIS 4

INFRASTRUCTURE AND TECHNOLOGY

Developing Northern Quebec 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 axis 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

Jean-Pascal Bilodeau
Assistant Professor
Department of Civil and Water Engineering
Université Laval

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

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.

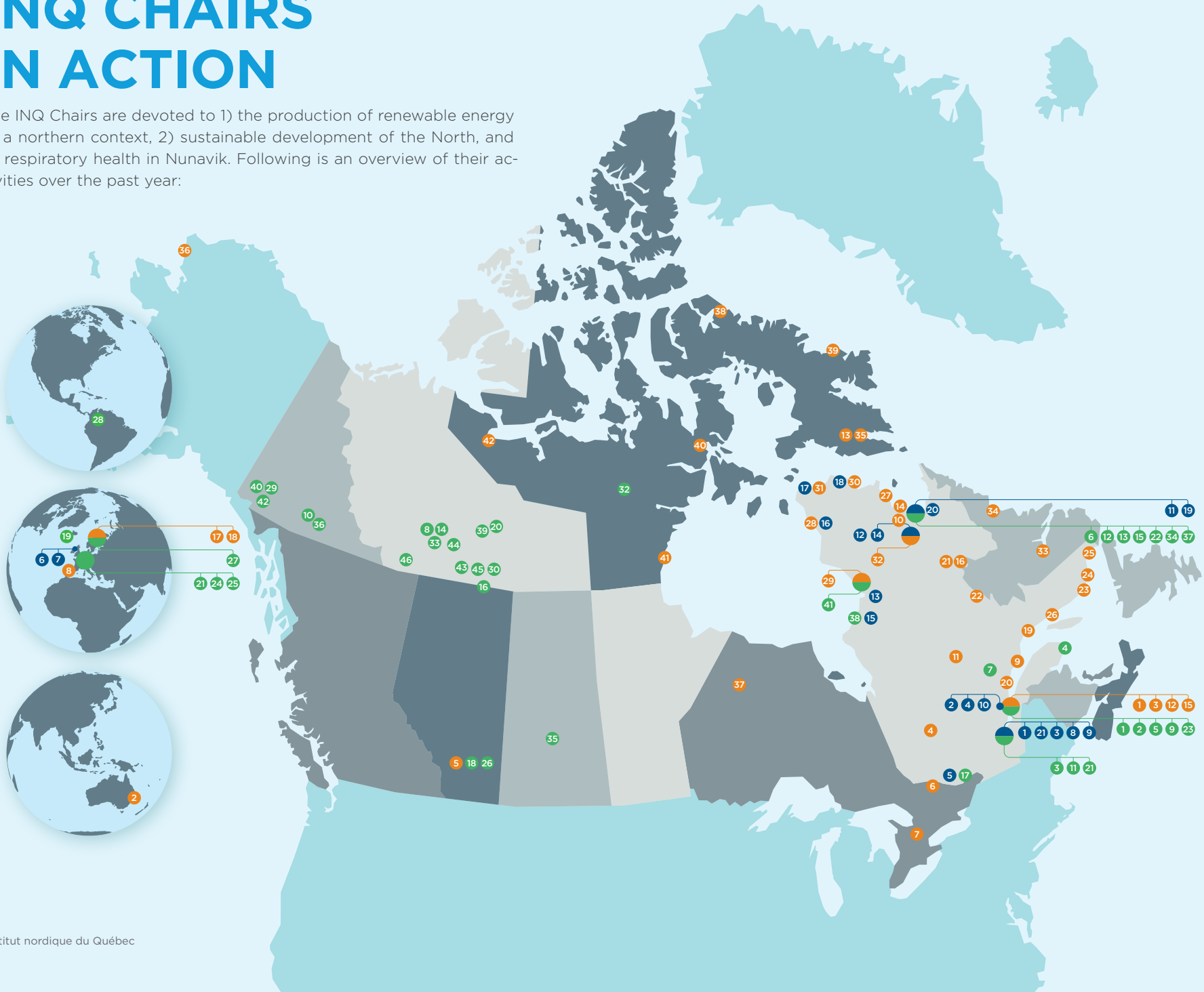
CO-DIRECTORS

René Therrien
Professor
Department of Geology and Geological Engineering
Université Laval

Jasmin Raymond
Professor
Centre Eau, Terre, Environnement
INRS

INQ CHAIRS IN ACTION

The INQ Chairs are devoted to 1) the production of renewable energy in a northern context, 2) sustainable development of the North, and 3) respiratory health in Nunavik. Following is an overview of their activities over the past year:



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

1	McGill University
2	Université Laval
3	Université de Montréal
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 Technologies
11	Nunavik Regional Board of Health and Social Services (NRBHSS)
12	Ungava Tulattavik Health Centre
13	Inuulitsivik Health Centre
14	Kativik Municipal Housing Bureau
15	Kuujjuarapik
16	Akulivik
17	Salluit
18	Kangiqsujuaq
19	Kuujjuaq
20	Kangiqsualujjuaq
21	Montréal

INQ Northern Sustainable Development Research Chair

1	Université Laval
2	Griffith University
3	Institut national de la recherche scientifique (INRS)
4	Université du Québec en Abitibi-Témiscamingue, Val-d'Or Campus
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	Makivvik Corporation
11	Comité condition féminine Baie-James
12	Crown–Indigenous Relations and Northern Affairs Canada
13	Qaujigiartiit Health Research Centre
14	Kativik Regional Government
15	Société du Plan Nord
16	Matimekush-Lac John Innu Nation Council
17	Luleå University of Technology
18	The Arctic University of Tromsø (UiT)
19	Sept-Îles
20	Sacré-Cœur
21	Schefferville and Matimekush-Lac John
22	Fermont
23	Chevery
24	La Tabatière
25	Rivière-Saint-Paul
26	Havre-Saint-Pierre
27	Kangirsuk
28	Akulivik
29	Umiujaq
30	Kangiqsujuaq
31	Salluit
32	Kuujjuaq
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

INQ Northern Geothermal Potential Research Chair

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	Fort Simpson First Nations
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	Dehcho First Nations
15	Nunavik Mineral Exploration Fund
16	Northwest Territory Métis Nation
17	CanmetÉNERGIE
18	Geological Survey of Canada
19	University of Reykjavik
20	Northwest Territories Geological Survey
21	Tarquti Energy
22	Société Kuujjuamiut
23	Induktion Géothermie
24	Bureau de recherches géologiques et minières (French geological survey)
25	Université de Rennes
26	Eavor, Yukon
27	Baker Lake
28	University of Medellín
29	Kluane First Nation
30	Northern Loco
31	Canmet ENERGY
32	Qulliq Energy Corporation
33	Fort Simpson
34	Avataa
35	RESPEC Consulting Inc.
36	Takhini Hot Pools
37	Kuujjuaq
38	Whapmagoostui-Kuujjuarapik
39	Con Mine
40	Lac Kluane
41	Umiujaq
42	Burwash Landing
43	Hay River
44	Fort Providence
45	Enterprise
46	Fort Liard

LEGEND Principal investigator's institutional affiliation | ★ Co-investigators' institutional affiliation | Partner | Research site

The INQ Chairs are devoted to 1) the production of renewable energy in a northern context, 2) sustainable development of the North, and 3) respiratory health in Nunavik. Following is an overview of their activities over the past year:

THE THREE INQ CHAIRS

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 Quebec. 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 Quebec.

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.

In 2023-2024, Professor Raymond's team worked on the following demonstration projects:

> Hybrid geothermal-biomass heating system for Centre TERRE in Jonquière with Cégep de Jonquière;

> Geothermal thermosiphons for the CEN research station in Umiujaq;

> Pilot heat exchanger for the Forum building in Kuujjuaq with Société Kuujjuamiut.

Professor Raymond and his team have begun the process of helping the communities of Burwash Landing, Fort Simpson, and Baker Lake identify their geothermal resources for pilot projects. Since these projects are still at the pre-feasibility stage, no installation is envisaged in the short term.

Research Chair highlights for 2023-2024:

> Heat injection test in a Kluane First Nation well at Burwash Landing in the Yukon to evaluate the flow of terrestrial heat;

> Rock sampling and assessment of thermal properties south of Great Slave Lake, Northwest Territories;

> Social acceptability studies on geothermal energy and isolated northern communities in Burwash Landing, YT, and Fort Simpson, NWT;

> Presentation of research findings to Indigenous communities in the Yukon and to the GEM-GeoNorth Steering Committee at two workshops in Whitehorse (May and October 2023);

> Publication of a review article on geothermal research in Northern Canada in the journal European Geologist.

INQ RESEARCH CHAIR ON NORTHERN SUSTAINABLE DEVELOPMENT

Chairholder Thierry Rodon, 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 to respond to the imperatives of sustainable development in a northern context.

Over the past year, the Chairholder and his team have focused their efforts on promoting and transferring research results within the *Knowledge network on Mining encounters and Indigenous sustainable livelihood (MinErAL)*, which has been extended until March 31, 2025. A collective book entitled *Mining and Indigenous Livelihoods Rights, Revenues, and resistance* will be published by Routledge and available for pre-order as of July 31, 2024.

Chair's highlights for 2023-2024:

> Field missions in Morocco: The *Laboratoire international associé Science, environnements, sociétés et activités minières* (LIA SESAM) carried out a field mission from June 5 to 23, 2023 in Mibladen and Ahouli, Morocco. The aim of the mission was to study the environmental, social and natural characteristics of local communities. The study explored how a community can adapt to the cessation of mining activities and develop economic solutions for the revitalization or reconversion of mining towns. Data processing was carried out by the Université Laval team, and the preliminary results were presented on November 1, 2023 to Midelt province's political and technical partners during a second mission from October 29 to November 4, 2023 in Rabat and Midelt.

> Book: A collective work on free, prior and informed consent, edited by the Chairholder and Martin Papillon, published on December 28, 2023 by Editions l'Harmattan.

> Published article: *Inuit autonomy in the Canadian Arctic: comparing treaty federalism in Nunavut and Nunatsiavut* by Martin Papillon and Thierry Rodon, in *The Polar Journal* (Volume 14(1); April 2024. This work contributed to the Chair's objective by providing a comparative analysis of Inuit autonomy in the Canadian Arctic.

> LIA SESAM summer school: A summer school focusing on the environmental and social restoration of mining areas was organized in the framework of the LIA SESAM program at Université Laval in Quebec City from February 25 to March 4, 2024.

> *Les Voix du Nord* database: The Chair's team updated the *Les Voix du Nord* database, which centralizes transcripts of public hearings as part of impact studies for Canadian northern projects. A new interface was recently launched, enabling more efficient text searches, and new transcripts have been added.

> Arctic Circle Assembly: The Chairholder participated in the Arctic Circle Assembly from October 19 to 21, 2023, where he co-organized the session *Greenland in the international system: relations with Canada and the U.S.* with Rasmus Gjedssø Bertelsen (University of Tromsø) and Frederica Scarpa (University of Akureyri).

> SSHRC project: Co-direction of the axis on measuring the well-being of communities and individuals after implementation of a treaty, with a study on treaty-related disputes.

> Published chapter: *Inuit Engagement in Resource Development Approval Process: The Cases of Voisey's Bay and Mary River in Protest and Partnership,* edited by Jennifer Winter and Brendan Boyd, University of Calgary Press.

> Updating "Polar Values" (VAPO): Project in collaboration with Université Laval's Centre Géostat to create an interactive VAPO map, funded by INQ.

Photo : Rachel Hussherr

INQ-MCGILL NORTHERN RESEARCH CHAIR IN RESPIRATORY HEALTH & HEALTH SERVICES

Chairholder Faiz Ahmad Khan, Associate Professor
Department of Medicine, McGill University

The Chair's work in Nunavik allows us to gain a better understanding of the challenges Nunavimmiut face when seeking medical care, as well as the structural barriers that undermine the healthcare system's capacity to meet patients' needs. This clinical and policy work in Nunavik has given rise to a health research program focused on patient and community priorities and based on partnerships with community members and Inuit health officials. The research program strives to support and be consistent with the assertion of the rights, identities, lands, and autonomy of the Indigenous Peoples of Canada and Quebec.

Puvaqatsianirmut — The Committee for Healthy Lungs

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

The Chair's core objectives:

1. Strengthen and protect lung health in Nunavik by enhancing the capacity and effectiveness of Nunavik's health and housing services thanks to evidence-based, multidisciplinary interventions that address the biomedical and social determinants of lung health.

2. Partner with the Indigenous health research community, Quebec'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.

Highlights of the Chair for the year 2023-2024 are:

The main research program consists of interdisciplinary projects that share common themes: working with partners in Nunavik to identify or eliminate gaps in lung health and strengthen related health services.

Tuberculosis-related work

Numerous projects are underway to strengthen tuberculosis initiatives in Nunavik:

> A research team led by Glenda Sandy, Nurse Consultant for the Nunavik Regional Board of Health and Social Services (NRBHSS), is helping the NRBHSS define the roles and training of community members to participate in TB care services.

> Inuit and First Nations researchers interviewed 160 Nunavimmiut about tuberculosis and health services. In parallel, post-doctoral fellow Stephanie Law interviewed 20 health care providers to gain their perspective.

> The results of this research were presented to Nunavik mayors in November 2023, in Inuktitut, and are being used to inform the community health worker program.

> Anna Dunn-Suen is developing a training manual for public health workers based on the study results.

> A research project, led by Natasha MacDonald, Glenda Sandy and Faiz Ahmad Khan, was submitted to the Canadian Institutes of Health Research (CIHR) in spring 2024.

Other work on tuberculosis, led by doctoral student Coralie Geric, aims to create a clinical-radiological database and a model of tuberculosis transmission specific to Nunavik, with the support of the CIHR.

General work related to respiratory care:

> A study of lung cancer treatment in Nunavik revealed disparities in survival compared with Montreal, prompting increased screening following extensive media coverage.

> The *Resilient Responses to Protect Lung Health in Nunavik* project, funded by the *Canada-Inuit Nunangat-United Kingdom Arctic Research programme (CINUK)*, is a three-part study responding to community interests and the needs of health and housing authorities. Partners include the Nunavik Housing Bureau and the Tulattavik Health Centers of Ungava and Inuulitsivik. The project focuses on the evaluation of predictors of mould in government housing, respiratory health and microbiology.

Educational initiatives:

> Within McGill University's Faculty of Medicine and Health Sciences, the Chair gave lectures on tuberculosis in Nunavik. With Natasha MacDonald, a new lecture for medical students was developed, integrating reconciliation, cultural security, socio-political issues and epidemiology.

A more detailed report on the activities of the INQ-McGill Northern Research Chair on Optimizing Respiratory Health Services is available on the Institut nordique du Québec website.

Photo : Geneviève Vachon

FOR A SUSTAINABLE NORTH PROGRAM

PROJECT 1 | 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 – Main Campus
4 Société d'habitation du Québec
5 Transition énergétique Québec
6 Quaqtaq
7 George River
8 Rivière à la Baleine

PROJECT 2 | The 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 Makivvik Corporation
5 Qikiqtani Inuit Association
6 Lac Tantaré
7 Bylot Island
8 Lac Tasirjuarusik
9 Aupaluk
10 Kangirsuk
11 Kangiqsualujjuaq

PROJECT 3 | 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
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 4 | Dynamics of the Innu ancestral territory (Nitassinan) through the morpho-sedimentary and sociocultural study of Lake Manicouagan (reservoir)

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

PROJECT 5 | 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 Geological Survey of Canada
6 Trent University
7 Nain

PROJECT 6 | Modeling the coupling of terrestrial-aquatic carbon fluxes in the regional forest landscape in a changing climate

1 Université du Québec à Chicoutimi
2 Université du Québec à Chicoutimi
3 Université Laval
4 La Boîte Rouge vif
5 Lac Dechêne
6 Lac Simoncouche
7 Manicouagan-Uapishka World Biosphere Reserve (MUWBR)

PROJECT 7 | Inhabiting the Saint-Augustin-Pakua Shipu Sand River: Biogeomorphological and social transformations

1 Université du Québec à Montréal
2 Université Laval
3 Pakua Shipu cultural agent
4 École Saint-Augustin
5 Université Rennes 2
6 Pakua Shipu

PROJECT 8 | *Back on traces:* Detection of contaminants and nanoparticles as markers of the Anthropocene in the Arctic

1 Université Laval
2 Université Laval
3 Université du Québec à Rimouski
4 Cabinet conseil Érébia
5 Bylot Island

PROJECT 9 | COMIRCHAN Project: Co-construction of an intersectoral model of heat networks in Nunavik

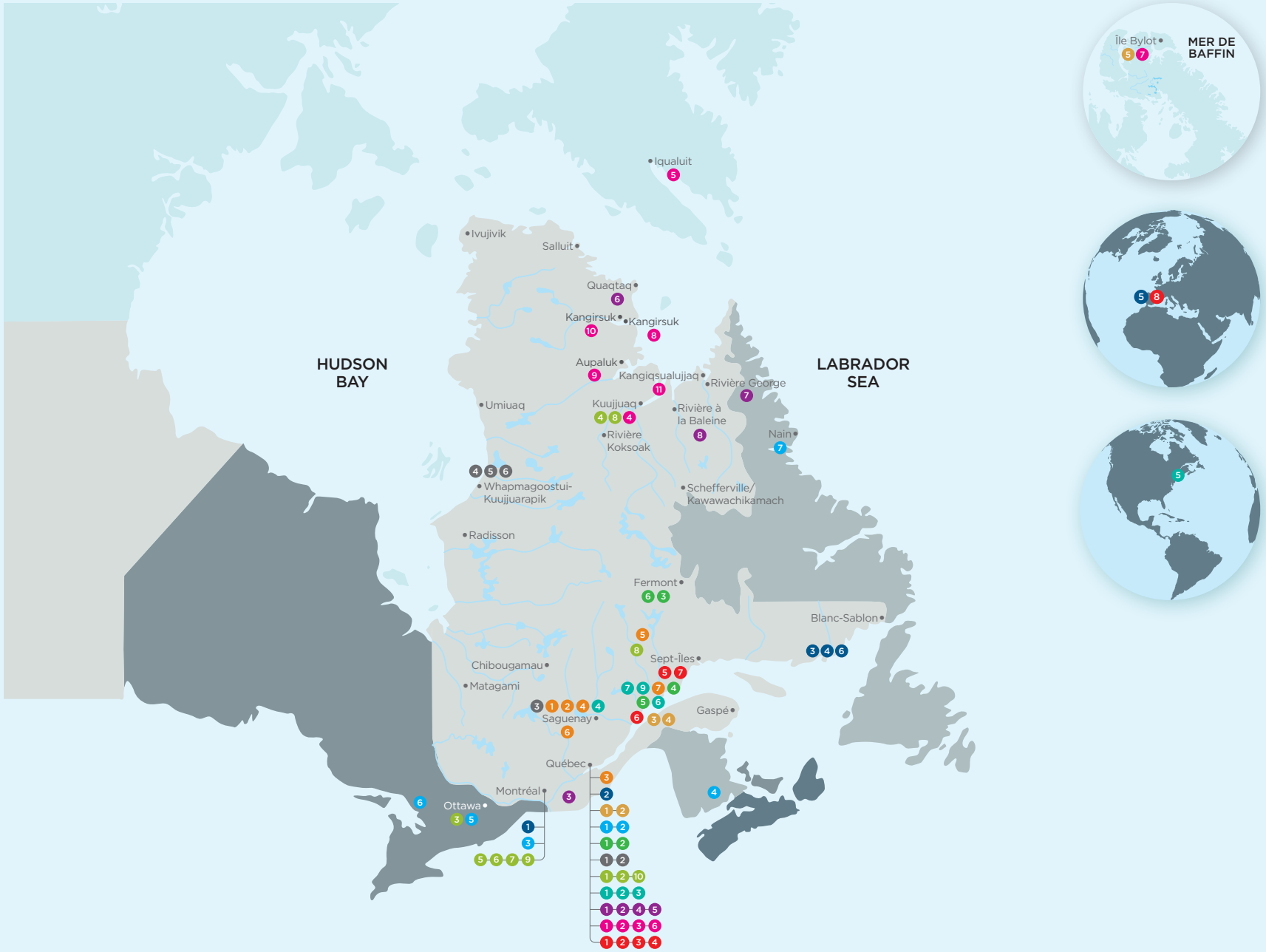
1 Université Laval
2 Université Laval
3 Université Laval du Québec en Outaouais
4 Kativik Regional Government
5 CanmetÉNERGIE
6 Énergies Tarquti
7 Hydro-Québec
8 Kuujjuamiut Corporation
9 Société d'habitation du Québec
10 Société du Plan Nord

PROJECT 10 | Manicouagan-Uapishka imaging through aquatic and cultural territory prospection (IMPACT)

1 Université Laval
2 Université Laval
3 Institut national de la recherche scientifique
4 Université du Québec à Chicoutimi
5 Northeastern University
6 Pessamit Innu Council
7 Manicouagan-Uapishka World Biosphere Reserve (MUWBR)
8 Uapishka Station
9 Lake Manicouagan

PROJECT 11 | Study on the preparation, use, and chemical composition of Northern Labrador Tea (Rhododendron subarticum) decoctions as consumed by the communities of Nunavik

1 Université Laval
2 Université Laval
3 Université du Québec à Chicoutimi
4 Whapmagoostui First Nation
5 Northern Village of Kuujjuarapik
6 Whapmagoostui-Kuujjuaraapik



LEGEND Principal investigator's institutional affiliation | Co-investigators' institutional affiliation | Partner | Research site

The *For a Sustainable North* program launched in 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 Quebec, from a perspective of sustainable development and the well-being of local communities.

FOR A SUSTAINABLE NORTH PROGRAM

1

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, Professor, Department of Mechanical Engineering, Université Laval (ULaval)

Co-investigators
Mourad Ben Amor, Professor, Département de génie civil et de génie du bâtiment, Université de Sherbrooke (UdeS)

Myriam Blais, Professor, School of Architecture, ULaval

Geneviève Cloutier, Professor, Graduate School of Land Management and Regional Planning, ULaval

André Potvin, Professor, School of Architecture, ULaval

Geneviève Vachon, Professor, School of Architecture, ULaval

Students involved
Alice Cavalerie, master's student, ULaval

Paméla Corriveau-Peev, master's student, ULaval

David Dumas, master's student, ULaval

Edgar Sergues, PhD candidate, UdeS

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. The current energy supply is dependent on fossil fuels. This project focuses on the role of housing from a perspective of the energy transition. The project has three main components: 1) to understand how Nunavimmiut are envisaging and taking part in the energy transition, specifically with regard to their housing, from a social acceptability perspective (Component 1); develop and integrate innovative fenestration solutions for more energy-efficient housing in Nunavik, given that this is the weakest link in today's building envelopes (Component 2); and adapt energy and housing life-cycle analyses to the specific characteristics of Nunavik, including end-of-life and land use (Component 3).

Ultimately, the project will provide data, tools, and guidelines for more energy-efficient housing design, operation, and end-of-life management in Nunavik.

2023-2024 project highlights

In April 2023, three students travelled to Quaqtaq to conduct semi-structured interviews with the local population (Component 1). The aim of the interviews was to obtain their perception of energy and comfort in the home. In the months following the trip, the interviews were analyzed. An article was subsequently published on the project.

Alice Cavalerie completed her master's thesis over the course of the year. It focused on the study of window opening behavior in northern dwellings, as well as the development of a model for predicting window openings and closings that can be used in building simulations (Component 2). Her primary focus over the past year was the development of this model.

With regard to Component 3, PhD student Edgard Sergues developed a strategy for parameterizing existing methods in the literature so they align with Nunavik's environmental conditions. He is currently exploring the potential of refining LCA methodology by using monthly granularity rather than the yearly scale typically used.

In addition, three students took part in the Mon projet nordique / My Northern Project competition held during INQ Northern Days. The international competition was won by one of these students, who was partially funded by INQ. Congratulations to master's student David Dumas!

Lastly, another trip to Nunavik is scheduled for June 2024, to gather information to characterize northern regional energy ecosystems.

2

THE 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, Professor, Centre Eau, Terre, Environnement at Institut national de la recherche scientifique (INRS)

Co-Investigators
Normand Bergeron, Professor, Centre Eau Terre Environnement, INRS

Raoul-Marie Couture, Professor, Department of Chemistry, ULaval

André St-Hilaire, Professor, Centre Eau Terre Environnement, INRS

Students involved
Véronique Dubos, postdoctoral fellow, INRS

Simon Joly-Naud, master's student, INRS

Kim Motevalli, PhD candidate, ULaval

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 habitat preference 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.

2023-2024 project highlights

In November 2023, the team visited Kangiqsualujjuaq and Aupaluk to discuss the project and possibilities for collaboration. This visit was an opportunity for the team to gain a better understanding of the interests and concerns of fishers, whose views are now taken into consideration.

In addition, during the first year, PhD candidate Kim Motevalli continued to analyze the high-frequency data from four lakes along a latitudinal gradient on temperature, light, and the concentration of dissolved oxygen, and drafted the first article. The results show highly variable patterns between lakes and a marked influence caused by weather conditions. It will be possible to use this high-frequency lake data in the future as a basis for developing conservation and sustainable management strategies for these ecosystems.

With this project, the research team is seeking to promote synergy between scientific and Indigenous knowledge in order to improve our understanding of the impact of climate change on salmonid habitat in the North, which is directly linked to Inuit food security. A trip to Kangiqsualujjuaq is planned for August-September 2024, to remove a mooring at Lake Ujarasujjulik and relocate it to Lake Tasikallak. Samples of water, soil, and rock will be taken at the same time, to substantiate certain hypotheses about the massive fish mortality that has occurred in this lake.

3

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

PROJECT STARTED IN JULY 2020

Lead investigator
Yves St-Pierre, Professor, Centre Armand-Frappier Santé Biotechnologie, INRS

Co-Investigators
Philippe Archambault, Professor, Department of Biology, ULaval

Jacques Corbeil, Professor, Department of Molecular Medicine, ULaval

Students involved
Jérémie Boucher-Fontaine, master's student, ULaval

Claudia Carpentier, postdoctoral fellow, ULaval

France Casa, postdoctoral fellow, INRS

Marianne Falardeau-Côté, postdoctoral fellow, ULaval

Sophia Ferchiou, PhD candidate, INRS

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, where 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. Given 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 makes it possible to assess the effects of natural and environmental disasters, such as the 1989 Exxon Valdez oil spill or the 2010 Deepwater Horizon accident. In this project, we propose a new, blue mussel sampling and analysis platform based on the concept of liquid biopsy combined with multiomics approaches.

2023-2024 project highlights

The last year of the project was devoted to: 1) completing sample analyses by high-throughput sequencing; 2) developing and improving bioinformatics protocols; 3) writing articles; and 4) exploring funding opportunities to ensure the continuation of this research program.

The team completed its analysis of the microbiomes circulating in all the samples collected in Nunavik and on the North Shore. These analyses were carried out by sequencing the variable regions of the gene coding for ribosomal RNA16S. The team also finished its transcriptome analyses of blue mussel hemocytes from the Marine Park, with a special focus on the mussels from two very distinct sites in terms of proximity to human activities. In addition, the research team completed analyses of blue mussel ccfDNA by shotgun sequencing using the Illumina platform.

The scientists also developed a liquid biopsy analysis using a nanopore platform. One of the main advantages of a nanopore platform is that it has the ability to sequence DNA in real time. Unlike other sequencing technologies, which require preparation and post-analysis steps, nanopore sequencing enables DNA reads to be visualized as they are generated. This allows for real-time feedback and facilitates rapid detection of sequences of interest or specific events. It also enables the direct detection of DNA modifications, creating opportunities for research into epigenetics and the understanding of gene regulation mechanisms.

Overall, the research team demonstrated that the multiomics approach based on the liquid biopsy concept in mussels has the potential to improve the effectiveness and efficacy of conservation efforts, leading to more informed decision-making and better outcomes in biodiversity and ecosystem conservation. However, interpreting the complex and often intertwined information from multiple omics datasets can be challenging, requiring specialized expertise and careful consideration of potential confounding factors. Clearly, this approach will be able to leverage the power of machine learning to

3

analyze data. Pattern recognition and predictive modeling in the near future will help us to understand cellular responses and potentially identify early warning signals.

Project benefits

- Basic knowledge: Overall, the project demonstrates the effectiveness of multiomic analyses of liquid biopsies collected from mussels as a powerful tool for gaining a better understanding of biological responses to environmental stress. From a basic research and conservation standpoint, this holistic approach offers a more in-depth understanding of the underlying mechanisms of these impacts.
- Conservation efforts: The project also has significant implications for efforts to conserve coastal marine ecosystems, the introduction of environmental monitoring strategies, and the development of sustainable practices. For example, the findings on the microbiome support the hypothesis that interrupting or reducing human activities for a very short period of time is sufficient to prevent fluctuations in the mussel microbiome. This hypothesis is also consistent with the observations made in other marine ecosystems during the COVID-19 pandemic.
- Kits: The project also provided an opportunity to improve the sampling kits and tailor them to the needs of research teams. This flexibility will be essential for their future use by biologists from different government agencies or other marine ecosystem monitoring programs and networks.
- Food security, education, and participatory research: Since mussels are part of the traditional diet of Nunavik communities, the results obtained over the course of the project suggest it would be possible to set up a logistically simple and inexpensive pathogen monitoring program. Such a program could involve participatory research within the communities, which would have a two-fold effect, i.e., promoting food security and attuning young people to the importance of scientific research that addresses their local needs. Using the nanopore platform, it could also be possible to establish a fully autonomous local and regional analysis infrastructure for this type of monitoring. In fact, the team worked on this aspect during its research phase in Antarctica. Alternatively, the platform has excellent potential for technology transfer to private or government reference laboratories.
- Biobank: The research project gave rise to the creation of a unique biobank of liquid biopsy samples from various northern ecosystems. This biobank will be extremely useful for retrospective studies, including on viruses. The data, along with the liquid biopsy biobank facilitated by FTA card storage, could be reviewed in the future as progress is made in the development of bioinformatics tools and databases to ensure accurate identification of all potential viral pathogens.

4

DYNAMICS OF THE INNU ANCESTRAL TERRITORY (NITASSINAN) THROUGH THE MORPHOSEDIMENTARY AND SOCIOCULTURAL STUDY OF LAKE MANICOUAGAN RESERVOIR

PROJECT STARTED IN JULY 2020

Lead investigator
Patrick Lajeunesse, Professor, Department of Geography, ULaval

Co-Investigators
Caroline Desbiens, Professor, Department of Geography, ULaval

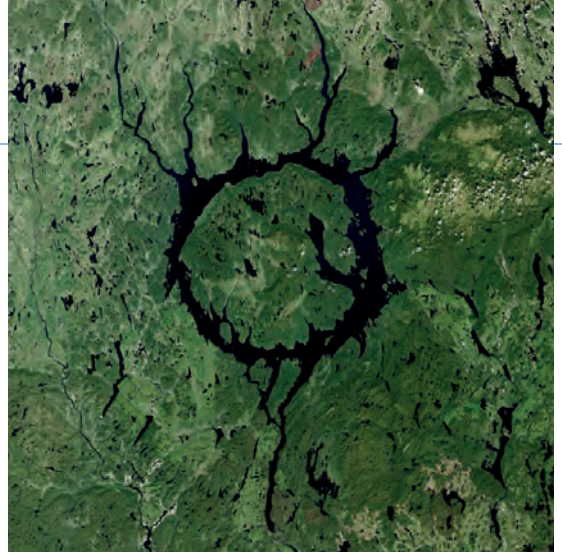
Justine Gagnon, Assistant Professor, Department of Geography, ULaval

Pierre Francus, Professor, Centre Eau Terre Environnement, INRS

Researcher
Léo Chassiot, ULaval

Students involved
Ariane Frigon, master's student, ULaval

Milena Souza Kury, PhD candidate, INRS



Description

The research project aims to acquire knowledge about the ancestral Innu territory (Nitassinan) through a transdisciplinary study of an emblematic ecosystem in Northern Quebec: the Manicouagan Reservoir, which is now part of a territory designated as a UNESCO Biosphere Reserve. This project combines new morphogeological knowledge and the mobilization of Innu ancestral knowledge, with several objectives in mind: 1) to gain a better understanding of the limnological and hydrosedimentary characteristics of a large reservoir in a boreal environment; 2) to assess the consequences of flooding in both morphosedimentary and sociocultural terms; and 3) to reconstruct the landscapes of the ancestral territory. The project also aims to train members of the Pessamit community in aquatic environment research and to develop a participatory approach, so as to promote the transfer of knowledge and skills, both academic and ancestral. Uapishka Station will be used as a platform for the dissemination of results to support the mobilization of knowledge by all project partners to promote Indigenous tourism.

The Station will coordinate the installation of interpretive viewpoints near archeological sites of interest. The study of the Manicouagan Lake/Reservoir addresses several of INQ's research objectives in relation to anthropogenic impacts on the way aquatic ecosystems work and on the living environments of Indigenous Peoples, in this case, specifically, on the disturbance of an ancestral Innu territory by a hydroelectric project.

2023-2024 project highlights

The project wrapped up in June 2023. The team proceeded to analyze and promote the data, and to map the ancestral Innu territory and analyze the morphosedimentary impacts caused by the creation of the reservoir. A number of outreach activities were also completed. In 2023, an article was published in the journal Geomorphology and a media release was broadcast on Radio-Canada. The same year, a knowledge-sharing workshop was held in Pessamit. Then, in March 2024, a scientific seminar was organized as part of the Northeastern Section of the Geological Society of America.

5

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

PROJECT STARTED IN JULY 2020

Lead investigator
James Woollett, Professor, Department of Historical Sciences, ULaval

Co-Investigators
Najat Bhiry, Professor, Department of Geography, ULaval

Anne de Vernal, Professor, Department of Earth and Atmospheric Sciences, UQAM

Philippe Gachon, Professor, Department of Geography, UQAM

Audrey Limoges, Associate Professor, Earth Sciences Department, University of New Brunswick (UNB)

Reinhard Pienitz, Professor, Department of Geography, ULaval

Researcher
Nicolas Van Nieuwenhove, UNB

Students involved
Héloïg Barbel, PhD candidate, ULaval

Alex Derian, PhD candidate, Trent University

Rachel Labrie, master's student, ULaval

Mariah Miller, master's student, Trent University

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. Specifically, the project seeks to integrate paleo-environmental, climatic, and productivity information recorded in coastal marine and lake sediments; information on cultural practices and food chain interactions from archaeological records; Inuit knowledge; historical climate records; and satellite data. The aim of the project is to assess the vulnerability and resilience of the coastal ecosystem of 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 the 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.

2023-2024 project highlights

In July 2023, a data collection expedition was headed by Nicolas Van Niuewenhove aboard the R/V William Kennedy. The field team consisted of Inuit members of the community of Nain, and was supported by an NSERC Complementary Research Grant obtained by professors Audrey Limoges and Anne de Vernal, and collaborator Alexandre Normandeau. During the expedition, a final set of ocean floor sediments was collected in the study zone, and the chemical, physical, and biological properties of the water column were tested. In addition, anchored moorings with sediment traps were deployed.

The team consisting of Professor Audrey Limoges, her students, and Alexandre Normandeau worked with samples collected in 2021-2023. These analyses include dating, granulometry, and geochemistry of bottom sediment samples; the paleontology and geochemistry of foraminifera and dinoflagellate cysts; and biochemical analyses of biomarkers of ocean ice conditions (IP25, triene).

Professor James Woollett and PhD candidate Héloïg Barbel analyzed archeological collections of animal bones and selected archeological organic remains for radiocarbon dating at Université Laval. Archaeological seal and fox bone samples were

analyzed by Mariah Miller (master's student, Trent University) and Alex Derian (PhD student, Trent University) for isotopic analysis at the Trent Environmental Archaeology Laboratory. Analyses of these specimens are underway and, in conjunction with parallel isotope studies of marine invertebrates, will characterize the past dynamics of the food chain. Meriah Miller completed her master's thesis in 2023. Three articles in relation to this research, including two with students as the principal authors, are in the works.

Soil and geophysical field data collected in July and August 2022 were analyzed by Rachel Labrie for her master's thesis project. The analysis was facilitated by a research internship undertaken by Rachel Labrie at Université de Rouen in 2023. The initial results of this research were published in an article in a peer-reviewed journal and a second article is currently being drafted. Rachel Labrie has completed her master's thesis examination and will submit her thesis in May 2024.

6

MODELING THE COUPLING OF TERRESTRIAL-AQUATIC CARBON FLUXES IN THE REGIONAL FOREST LANDSCAPE IN A CHANGING CLIMATE

PROJECT STARTED IN JULY 2023

Lead investigator

Jean-François Boucher, Professor, Département des Sciences fondamentales, Université du Québec à Chicoutimi (UQAC)

Co-applicants

Maxime Boivin, Professor, Département des sciences humaines et sociales, UQAC

Patrick Faubert, Associate Professor, Département des Sciences fondamentales, UQAC

Paul George, Assistant Professor, Département of Biochemistry, Microbiology, and Bio-Informatics, ULaval

Catherine Girard, Professor, Département des Sciences fondamentales, UQAC

Milla Rautio, Professor, Département of Basic Sciences, UQAC

Olivier Riffon, Professor, Département des Sciences fondamentales, UQAC

Description

Climate change is having profound impacts on the boreal forest, including shorter, warmer winters, which are transforming the ice and snow regime, altering the carbon cycle in this biome that dominates Quebec. This is an important issue, as the majority of terrestrial carbon sequestration occurs in forest ecosystems, and little is known about the role of winters in this biogeochemical cycle.

Recent studies have shown that the carbon assimilated during photosynthesis in summer can be lost the following winter through respiration, and that winter losses can account for up to 50% of fixed carbon in the form of greenhouse gases

(GHGs) such as carbon dioxide and methane. Shorter winters will therefore have major repercussions on GHG and forest carbon balances, affecting the forest's role as a carbon sink. This is in addition to the consequences of other disturbances the region is experiencing, such as forestry, which itself affects the snowpack and winter respiration. Moreover, shorter, warmer winters are affecting Indigenous and non-Indigenous communities who live in the boreal forest, including the Innu First Nation, whose ancestral territory is Nitassinan. The ecosystem services provided by this biome are being transformed by warming, including through reduced ice and snow cover (access to remote regions, ice roads, and ice fishing). The aim of this project is to produce a GHG emissions model for the boreal forest in winter, one that incorporates terrestrial and aquatic environments as well as forest management practices.

Lac Simoncouche in Saguenay-Lac-Saint-Jean (SLSJ) and Lac Dechêne on the North Shore have been identified as study sites. More specifically, the work aims to 1) determine the functional links between the forest and boreal lakes, to which part of the carbon is leached when the snow melts; 2) model carbon fluxes between the forest and lakes over the winter, integrating silvicultural exploitation; 3) apply this model across the SLSJ and North Shore regions; and 4) create a network of Indigenous and non-Indigenous knowledge on the ties between the boreal forest and lakes, as well as on land use.

2023-2024 project highlights

The project is advancing with the imminent arrival of a Ph.D. student and a Master's student for the 2024-2025 academic year. Their integration will enable the implementation of both research components—forestry and aquatic—right from the start of this period. These new contributions will further strengthen the ongoing efforts to achieve the project's objectives.

Photo : Rachel Hussherr

7

INHABITING THE SAINT-AUGUSTIN-PAKUA SHIPU SAND RIVER: BIOGEOMORPHOLOGICAL AND SOCIAL TRANSFORMATIONS

PROJECT STARTED IN JULY 2023

Lead investigators
Daniel Germain, Professor, Department of Geography, UQAM

Laurie Guimond, Professor, Department of Geography, UQAM

Co-Investigators
Caroline Desbiens, Professor, Department of Geography, ULaval

Justine Gagnon, Assistant Professor, Department of Geography, ULaval

Researcher
Yoan Jérôme, Innu Geographer

Students involved
Étienne Gariépy-Girouard, PhD candidate, UQAM

Mehrnoosh Heidary, PhD candidate, UQAM

Valérie Potvin, master's student, UQAM

Photo : Sarah Galloway

Description

Today, northern biogeosystems are being particularly hard hit by the effects of global warming and, to date, there has been little documentation on the synergistic effects between biotic and abiotic environments and the communities living on these lands. On the Lower North Shore, the banks of the St. Augustin River are experiencing accelerated erosion and more frequent landslides. This leads to the emergence of sandbanks and shoals in the river, as well as the buildup of numerous dead trees. These environmental changes, in turn, create i) impacts on wildlife, due to erosion destabilizing beaver lodges in some places, and the abundance of dead wood raising concerns about the migratory ability of trout and salmon; and ii) navigation constraints and difficulties for local populations due to sandy shoals and their intra- and inter-annual mobility. The need for knowledge co-constructed with local communities is immediate and crucial, firstly, to better anticipate future changes in the Saint-Augustin River, and second, to better equip communities to ensure the long-term survival of the Innu and Lower North Shore cultures. These cultures depend largely on river access to the land and its wildlife, fish, and forestry resources. For thousands of years, the river has been a vital route for the Pakua Shipu Innu into the nutshimit (inland) to hunt, trap, fish, gather, and to practice innu-aitun (Innu culture). Villagers from the Municipality of Saint-Augustin have been using it for similar purposes since the 1870s. In other words, the river has strong cultural and social importance, and the changes currently affecting it have left no one indifferent

2023-2024 project highlights

A number of activities were carried out over this period. Among other things, the team approached partners in Pakua Shipu and Saint-Augustin, and obtained approval for the research from the Pakua Shipu Band Council. In addition, meetings were held with school staff on November 1 and 9, 2024.

Professor Germain's team also prepared a workshop on erosion and a field trip to be held in late May 2024.

Research data on natural environments, including aerial photographs and satellite images, as well as various types of field samples (sediment, vegetation, etc.) will be collected during the upcoming stages of the project.

8

BACK ON TRACES: DETECTION OF CONTAMINANTS AND NANOPARTICLES AS MARKERS OF THE ANTHROPOCENE IN THE ARCTIC

PROJECT STARTED IN JULY 2023

Lead investigator
Julien Gigault, Adjunct Professor, Department of Biology, ULaval

Co-Investigators
Philippe Archambault, Professor, Department of Biology, ULaval

Catherine-Alexandra Gagnon, Érébia Consulting Firm, Université du Québec à Rimouski

Pierre Legagneux, Assistant Professor, Department of Biology, ULaval

Mélanie Lemire, Professor, Department of Social and Preventive Medicine, ULaval

Description

The anthropogenic impact on ecosystems has been building rapidly over the past 20 years, and the effects are far more pronounced in the polar zones than anywhere else on the planet. Human-generated materials (plastics, ores, soot, etc.) now exceed all the biomass created on Earth by all living organisms. This flow of materials has already reached the Arctic ecosystems, including chemical contaminants, plastics, and titanium dioxide.

But behind these man-made materials hides an enormous fraction—nanoparticles—that have been largely ignored until now, but that could cause far greater damage than their micrometric or millimetric counterparts. Due to their tiny size and high diffusivity and specific surface area, even in an ultra-trace state, these nanometric particles are highly reactive with biota and can be transported over long distances, increasing the bioavailability of a wide range of chemical contaminants within organisms.

The goal of this project is to explore and document the presence of nanoparticles and associated contaminants in Arctic terrestrial and marine ecosystems, drawing from available biological archives, including a long time-series for snow goose feathers dating back to 1886. Professor Gigault and his team will be examining the extent to which concentrations of these nanoparticles and contaminants could affect the exceptional quality of traditional foods that are central to Inuit culture and health.

Communications on sensitive issues relating to ecosystem health and food security will take the form of artistic co-creation, using visual art, interactive art and, in particular, animation, which is very popular with Inuit youth and holds great potential for dissemination at festivals and on social media. Discussions between the community of Pond Inlet and communities in Nunavut and Nunavik will focus on local waste management and mining practices, as well as potential international actions to ban the use of these toxic products.

2023-2024 project highlights

The first year was devoted to the development of analytical methods to characterize the presence of anthropogenic nanoparticles and their associated contaminants in the various biological archives of the designed to extract all metals while optimizing ICP-MS characterization parameters to distinguish the presence of contaminants from natural background elements. On the matter of nanoplastics in eggs, the team is finalizing a potassium hydroxide and dichloromethane-based extraction method combined with detection by field-flow fractionation and pyrolysis coupled with high-resolution mass spectrometry to identify polystyrene, polyethylene, and polypropylene markers in eggs.

During this first year, the research focused primarily on developing an internal calibration method using deuterated polystyrene to quantify nanoplastics and overcome interference from natural macro-molecules present in samples, which was interfering with their detection and quantification. A second stage consisted of examining the other biological archives available to the team, e.g., snow goose feathers collected on Bylot Island and others held in museums, as well as vegetation on Bylot Island. Initial extraction tests were conducted on the feathers to characterize nanoparticles (plastics and metals), as well as organic pollutants (PFAS, PCB, etc.) and trace metals (Hg, Pb, etc.).

9

COMIRCHAN: CO-CONSTRUCTION OF AN INTERSECTORAL MODEL OF HEAT NETWORKS IN NUNAVIK

PROJECT STARTED IN JULY 2023

Lead investigator
Christophe Krolik, Professor, Faculty of Law, ULaval

Co-Investigators
Alice Friser, Professor, Département des sciences administratives, Université du Québec en Outaouais (UQO)

Louis Gosselin, Professor, Department of Mechanical Engineering, ULaval

Ali Hakkaki-Fard, Associate Professor, Department of Mechanical Engineering, ULaval

Jasmin Raymond, Professor, Centre Eau Terre Environnement, INRS

Researcher
Jean Rouleau, Researcher, ULaval

Wiliam Baudon, master's student, Université Laval

Students involved
Wiliam Baudon, master's student, ULaval

Emna Barki, PhD candidate, ULaval

Mafalda Miranda, postdoctoral fellow, INRS

Description

Most of the buildings in Nunavik are heated with diesel from the south, creating risks of spills, air pollution, greenhouse gases, and energy dependency. Yet there are locally available heat sources. The objective of COMIRCHAN is to gather the knowledge needed to co-construct, with the community of Kuujjuaq, a guide to recovering, distributing, and connecting buildings to local heat sources. The guide will feature technical and economic knowledge, best practices for community engagement, as well as requirements, constraints, and possible legal solutions for recovering, distributing, and connecting buildings to local heat sources. This local heat will come from existing facilities (such as electricity generators), future facilities to be built (such as waste incineration), and from available renewable energies (such as geothermal sources). In addition to meeting the needs of communities using a co-construction approach, this project will spur the development of new knowledge in several areas.

A unique team has joined together to tackle this significant challenge. It is made up of researchers with experience in Indigenous contexts, from the natural sciences (engineering and earth sciences) and social sciences (sociology, management, and law). Seven partners are also playing a role in this collaboration, including community representatives; federal, provincial, regional, and local institutions; as well as provincial and Inuit energy companies. This collaboration will bring to light the community's ideas and proposals, as well as the experience of the key people involved in this field, and make these results, desirable, credible, and operational. COMIRCHAN was designed with the community members in mind, and will be built with and for them. The team's activities will contribute significantly to the development of the North, by publicizing new knowledge on local heat potential and on the preferences expressed by the community of Kuujjuaq, the proposed work, and potential legal solutions. This model could subsequently be deployed in other parts of the North. It will need to be adapted to each context, enabling the emergence of new economic, social, and environmental spin-offs.

2023-2024 project highlights

The research project is well underway. Three teams have been involved in the data collection phase. The infrastructure team carried out in-depth research to define the technical and logistical framework required for the efficient design and implementation of heat networks in Nunavik. The social acceptability team took the necessary steps to acquire the ethics certificate that is the cornerstone of its research. Lastly, the legal team defined the scope and structure of its research, establishing a rigorous methodology and identifying relevant doctrinal, legislative, and regulatory sources, which enabled it to gather key legal information on geothermal heat recovery in Nunavik. They are continuing their work to draw up an exhaustive inventory of the legal framework applicable to heat networks in this region, while exploring possible solutions for adapting the law to the specific characteristics of Nunavik.

Every stage of the data collection phase was guided by the principle of collaboration with our partners. Work meetings were held on September 21, 2023, and March 11, 2024, in addition to meetings with team members.

The knowledge acquired through this project will inform action based on the specific characteristics and realities of the North. The proposed solutions will build on the region's strengths, including the capacity of its communities. In addition, new energy opportunities will foster the development of training to ensure spin-offs for the entire northern region.

In 2024-2025, a crucial phase will be implemented. The goal will be to present the preliminary results from the analyses, evaluate them in depth, and set out the precise outlines of the guide currently under development.

Photo : Geneviève Vachon

10

MANICOUAGAN-UAPISHKA IMAGING THROUGH AQUATIC AND CULTURAL TERRITORY PROSPECTION (IMPACT)

PROJECT STARTED IN JULY 2023

Lead investigator
Patrick Lajeunesse, Professor, Department of Geography, ULaval

Co-Investigators
Dermot Antoniades, Professor, Department of Geography, ULaval

Caroline Desbiens, Professor, Department of Geography, ULaval

Pierre Francus, Professor, Centre Eau Terre Environnement, INRS

Justine Gagnon, Assistant Professor, Department of Geography, ULaval

Catherine Girard, Professor, Département des sciences fondamentales, UQAC

Mark Patterson, Professor, College of Science, Northeastern University

Researcher
Léo Chassiot, Department of Geography, ULaval

Students involved
Marilène Blain-Sabourin, PhD candidate, ULaval

Description

The flooding of Lake Manicouagan (Tshishe Manikuakan) by the construction of the Manic-5 dam has led to profound disturbances of the natural ecosystem, formed around a meteorite impact crater, and on its occupants, the Innu of Pessamit. Hydroelectric development came in the wake of the logging and mining that marked the second half of the 20th century on their ancestral territory. The IMPACT research project aims to document the territory's socio-environmental trajectories using a multidisciplinary (natural sciences and humanities), co-constructive approach in partnership with local stakeholders, including the community of Pessamit.

IMPACT was developed as a follow-up to a project that studied the sociocultural and morphosedimentary impacts of the Manic-5 dam. It aims to document the traces of ancestral occupation by the Innu and quantify the impacts caused by human intervention on the human and physical environments of Lake Manicouagan reservoir and Lake Dechêne (Papukuashun), an adjacent lake located at the foot of the Uapishka Mountains. The project consists of a university team from five research institutes as well as partners from the Pessamit Innu Council's Land and Resources Office, the Manicouagan-Uapishka World Biosphere Reserve, and Uapishka Station.

The data that is collected, which highlights a boreal territory designated as a UNESCO World Biosphere Reserve, will offer first-hand results regarding: 1) the overlapping territorialities between Indigenous and non-Indigenous peoples on a territory; 2) the cumulative impacts of resource extraction; 3) the historical trajectory and functioning of a large lake turned reservoir; 4) natural hazards; and 5) the restoration of a flooded cultural heritage. This data will bolster the promotion of cultural landscapes through outreach and awareness tools developed with the support of Uapishka Station, tools that will help boost the development of sustainable, Indigenous tourism, to protect the territory's biodiversity and honour the cultural heritage of the Pessamit Innu. A field school program will ensure the transfer of skills and knowledge (ancestral and academic) to project participants.

2023-2024 project highlights

The start of the project was delayed due to the challenges in recruiting doctoral and master's candidates. Given the uncertain situation, it was decided to postpone the AUV-ROV mapping mission until summer 2025. During the period covered by this report, the research team focused on promoting and publishing the work resulting from the previous project. Bathymetry and subsurface geophysics data from the former Lake Manicouagan were published by Léo Chassiot and his project collaborators.

For the "cultural geography" component, Marilène Blain-Sabourin began her doctoral research project with a review of the existing scientific literature and a discussion with research partners to target their specific needs.

The premise of this research is based on the fact that Innu heritage is alive and evolving, despite Pessamiulnuat territoriality having been greatly affected by successive and cumulative land grabs. Despite the loss of access to many sites, a number of avenues can be explored to revitalize their meaning and raise their profile. We believe that sustainable Indigenous tourism is an essential element of this approach.

The project aims to document Innu cultural heritage, understand its contribution to the region's desired tourism development, and test activities and structures to raise awareness of this heritage. Ultimately, it seeks to plan shared learning and dissemination activities to support the Biosphere Reserve, a showcase for responsible and sustainable tourism.

11

STUDY ON THE PREPARATION, USE, AND CHEMICAL COMPOSITION OF NORTHERN LABRADOR TEA (RHODODENDRON SUBARTICUM) DECOCTIONS AS CONSUMED BY THE NUNAVIK COMMUNITIES

PROJECT STARTED IN JULY 2023

Lead investigator
Normand Voyer, Professor, Department of Chemistry, ULaval

Co-Investigators
Stéphane Boudreau, Professor, Department of Biology, ULaval

Caroline Hervé, Associate Professor, Department of Anthropology, ULaval

Jean Legault, Professor, Département des sciences fondamentales, UQAC

Researcher
Jean-Christophe Séguin, ULaval

Students involved
Mehdi-Benjamin Quittelier, PhD candidate, ULaval


Photo : Normand Voyer

Description

Northern Labrador Tea, also known as Dwarf Labrador Tea or *Rhododendron subarcticum* (tiirluk in Inuktitut, wiisichipikuush in Cree), is a shrub that is commonly found in Nunavik. It is widely consumed among the Cree and Inuit communities in Northern Quebec, primarily as a decoction. In recent years, the popularity of this tea has greatly increased, especially in Cree communities further south. However, there has been very little scientific research done on Northern Labrador Tea decoctions.

The aim of this project is to study Northern Labrador Tea decoctions through an interdisciplinary project in partnership with the Indigenous communities of Whapmagoostui and Kuujjuarapik (W-K). The joint work of chemists specializing in natural products, anthropologists studying Inuit societies, biologists specializing in plant ecology, and experts in molecular pharmacology will result in an in-depth and valuable characterization of this beverage.

In addition, an anthropological component aimed at documenting Indigenous knowledge and the practices of gathering, preserving, preparing, and consuming decoctions of this shrub will help conserve, promote, and disseminate this knowledge within the communities.

With the help of Cree and Inuit harvesters and partners, samples will be collected every month during the growing season, as well as once during the winter, over a three-year period. The samples will be taken at three sites with different ecological characteristics, in order to study the impact of harvest timing and sites, preservation methods, and decoction preparation on the drink's chemical composition, medicinal properties, and toxicity. This information will enable communities to back up their traditional knowledge, and to better define the best practices for deriving maximum health benefits and avoiding negative side effects.

2023-2024 project highlights

In the summer of 2023, a sampling trip was made to Whapmagoostui-Kuujjuaraapik to harvest Northern Labrador Tea samples at three sites with different morphological characteristics. Meetings were also held with local community partners and with elders and key players in the communities, to discuss the anthropological aspect of the project.
In Fall 2023, Professor Voyer's team began work on the development of various herbal tea preparation methods. Various parameters were explored and a number of technical issues were resolved. Preliminary work also got underway to identify the compounds (volatile and non-volatile) present in the herbal teas.
In the winter of 2024, the research team prepared samples for preliminary biological activity testing (infusion samples, decoction samples, chromatographic fractionation of samples for targeted testing of fractions, etc.). Summer 2024 will be the first summer devoted to monthly sampling at three separate sites, in collaboration with gatherers from Whapmagoostui and Kuujjuarapik, marking the start of the analysis of the chemical composition of the herbal teas and the evaluation of the impact of various parameters on this composition.

INQ INFRASTRUCTURES

INQ SCIENTIFIC COMPLEX

The past year also saw a number of crucial steps toward the building of INQ's scientific complex. In August 2023, thanks to additional funding from the provincial and federal governments, a call for tenders was launched for the construction of the complex, which began in late September 2023, with delivery slated for 2026.

The multipurpose complex, which will be located on the Université Laval campus, will act as a knowledge and research hub for the sustainable development of the North.

The only one of its kind in Canada, the pavilion will promote northern innovation, interdisciplinarity, and teamwork. It will help consolidate the partnerships developed with northern communities, the First Peoples of the North, the 16 member universities, the college network, as well as public and private-sector actors.

The multipurpose complex will be 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 hub for multidisciplinary and intersectoral training;

> An educational showcase on the changing North;

> A space for gathering and exchange for the scientific community, First Peoples, partners, and the general public.

INQ FIELD FACILITIES

CEN-INQ 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 alternative energy systems, will also include a training space available for use by members of the Umiujaq community. CEN has secured additional funding to optimize the thermal performance of the building envelope and to incorporate experimental thermosiphons and air exchangers with a view to improving the Station's energy balance. The functional and technical program (FTP) was drawn up in collaboration with architectural and engineering firms. The new station is expected to be up and running in 2026.

Uapishka Station

Uapishka Station is an ecotourism joint venture between the Pessamit Innu Council and the Manicouagan-Uapishka World Biosphere Reserve (MUWBR). 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. The Station also provides accommodations, food services, and a range of outdoor activities.

Uapishka Station plays a crucial role in promoting scientific research on the North Shore, with a steadily increasing number of research projects on the territory and the availability of state-of-the-art equipment for researchers. During the 2023-2024 period, MUWBR deployed a comprehensive fleet of climate monitoring, meteorological, and telecommunications instruments in the Uapishka (Groulx) mountains to observe climate change in the Manicouagan backcountry. It comprises six stations located at varying altitudes in the massif and in various ecosystems, enabling the data collected by scientific and governmental partners to be consolidated. The data will be accessible to all researchers, land users, and decision-makers via open access (OA) on various platforms.

STRATEGIC OUTREACH AND POSITIONING

SCIENTIFIC NEWS

To celebrate the excellence of Quebec's northern research and highlight the various challenges and issues related to the North, INQ launched a series of scientific articles written by science journalist Valérie Levée. She interviews research teams and presents a fascinating and reader-friendly snapshot of the research being conducted north of the 49th parallel. A total of six articles were published in 2023-2024. The Scientific News articles are available in English and French on the INQ website.

- **The territory as a link between nations**
  Laurie Guimond, Professor, Department of Geography, UQAM
- **Detecting ice layers**
  Michel Baraër, Professor, Department of Building Engineering, École de technologie supérieure
- **The Canadian Arctic: carbon sink or source?**
  Oliver Sonnentag, Professor, Department of Geography, Université de Montréal
- **Participatory mapping of the Kuujjuaq River**
  David Didier, Professor, Department of Biology, Chemistry, and Geography, Université du Québec à Rimouski; and Justine Gagnon, Assistant Professor, Department of Geography, Université Laval
- **Doing business in the North**
  Emilie Fortin-Lefebvre, Professor, Department of Management, Université du Québec à Montréal
- **From human medicine to Nunavik mussels**
  Yves St-Pierre, Cancer Researcher at Centre Armand-Frappier Santé Biotechnologie, INRS

STRATEGIC PLANNING 2025-2030

In winter 2024, INQ launched the strategic planning process for the 2025-2030 period, in collaboration with a specialized firm. Numerous hours of interviews have already been conducted with a wide range of stakeholders. This work will wrap up at the end of 2024.

APRIL 13, 2023 | NEW MEMORANDUM OF UNDERSTANDING FOR INQ

Institut nordique du Québec, the Swiss Polar Institute, and Université Laval signed a memorandum of understanding designed to strengthen collaboration between the Swiss and Canadian scientific communities in the fields of polar and high-altitude science. This strategic agreement facilitates the sharing of research infrastructures, as well as the exchange of human resources, data, and other elements essential to research.

STAY IN TOUCH!

There are several ways to stay abreast of the activities of INQ and its partners.

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Photo : Genevieve Vachon

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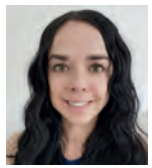

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