COLLÉGIAL INTERNATIONAL
SAINTE-ANNE

JOURNAL DU CiSA 2022

JOURNAL

FORE-WORD

Can CEGEP students carry out relevant, university-level research?
Our journal is annual, open-access, multi-disciplinary and bilingual.
It is based at Collégial international Sainte-Anne in Montréal. Its main aim is to encourage research at CEGEP level.

Our focus is on research papers presented as part of the Integrative Project, a compulsory end-of-CEGEP course, which involves a deeper research process as well as a multi-disciplinary approach. Unlike the majority of the other CEGEPs, at CiSA the Integrative Project consists of a five-week internship in an institution of the student's choosing, at the end of which the students have to write a research project. It is our view that some of those projects are definitely worth a 'second life' through publication in an academic journal.

For the first year, 2018, we prioritized papers presented by our current students but, for the coming years, the publication will be open to all CEGEP students.

We accept research submissions until the end of June. The decision about what should be accepted for publication belongs to the editors. Once accepted for publication, the paper is reviewed by the editor in charge. The review process takes around two weeks (yes, we all want to enjoy the summer…). The authors then have two months to complete their articles and resubmit. During September, the articles are reviewed again and then professionally edited for publication. Our aim is to keep the publication process within four months.

Our editors are paid through a grant gracefully offered by Sainte-Anne, which also provides the technical support required in order to publish the journal. We invite all CEGEP students to submit full-length research articles for the 2019 issue.

HOW WE WORK

BOARD OF EDITORS

Marcel Mitrasca, PhD

Professor of Political Science

The papers are judged based on:

- originality, relevance, and a clear theoretical framework
- quality of content: literature review, research statement, research methodology, findings, and discussion of findings
- high quality and relevant sources
- proper use of the academic apparatus: in-text citations, reference list, appendixes
- originality, thoroughness, and quality of the arguments provided throughout the paper
- language use – grammar, vocabulary, mechanics
- overall organization and style of the paper

For general guidance

mje.mcgill.ca/about/editorialPolicies#focusAndScope

SUB-MISSION POLICY

SUB-MISSION GUIDE-LINES

- it should include an abstract in both, English and French (100-150 words)
- the referencing style is the APA (7th edition), for social science papers, or CSE, for natural science papers
- wherever possible, the URLs for the references should be provided
- the submission file should be in Microsoft Word or Word-compatible format
- the author should use Arial font, single spaced
- the tables, pictures, graphs and other visual elements should be placed within the text and clearly labeled
- if any endnotes are used, they should be manually inserted in the text

Isn’t it strange that the word “Law” has been imprisoned in the word “Flaw”? A flaw, I am told, is thus Justice in its most deceptive form: Law having been in bed with Fear’s shadow for so long that it has assimilated its insidious “F”.

Julius Antonio Grippo

BIO GRA PHY

Isn't it strange that the word "Law" has been imprisoned in the word "Flaw"? A flaw, I am told, is thus Justice in its most deceptive form: Law having been in bed with Fear's shadow for so long that it has assimilated its insidious "F". Law was once the harbinger of progress, the epitome of morality, liberty's mirror. Today, any who dare glance into the shattered mirror of Law are met with a darkness so profound that they may confuse it with an abyss. However, those who stare into the darkness long enough can quickly feel their pupils dilate: an entire world, once grim and invisible, now revealed to them. It is by confronting the realities of this world, by uncovering its hidden structures, that we can begin to understand how far it has plummeted and how deeply flawed it truly is. Therefore, whoever begins to pick up the pieces of liberty's mirror to build it anew must see to it that Fear has relinquished its grasp on Law and its surrounding spheres. In fact, a rule by Fear has nothing to do with Law or Justice and everything to do with greed and despotism.

Julius Antonio Grippo is a first-year Law student attending McGill's Law Faculty. He received a DEC in May of 2022 after completing a two-year Honours Social Science program at Collégial International Sainte-Anne with a concentration in Individual, Law and Society. His main interests revolve around Law, Philosophy & Politics. Julius would like to later pursue a career in prosecution, where he hopes to aid survivors of sexual violence.

The Politics of Law in Quebec

The Separation of Powers and the Independence of the Judiciary

"To be a monster is to be a hybrid signal, a lighthouse: both shelter and warning at once"

Ocean Vuong, "On Earth We're Briefly Gorgeous"

Abstract

Under the Coalition Avenir Québec (CAQ) government, the notwithstanding clause has been repeatedly invoked to bypass the judiciary power's capacity for legal review. Functions belonging to the judiciary, such as the determining of qualifications for judges, are also now being reclaimed by Justice Minister Simon Jolin-Barrette, as an already fusional executive and legislative power permits him to pass legislation that goes against the recommendations placed on the executive branch by the courts. The present research finds that it seems that Government is consummating power to increase the reach of the executive, as it is progressively holding Quebec's three-headed beast on an increasingly short leash. As time progresses, it seems that the government will domesticate the beast, as it becomes its play toy that bends to its caprice. Even though this might not be M. Jolin-Barrette's intention, there is no denying that his actions can subject Quebec society to a Hobbesian organization of State.

Keywords: Separation of Powers, Hobbes, Philosophy, Law, Quebec.

Sous le gouvernement de la CAQ (Coalition Avenir Québec), la clause dérogatoire a été invoquée à plusieurs reprises pour contourner la capacité de révision du pouvoir judiciaire. Des fonctions appartenant au pouvoir judiciaire, telles que la détermination des qualifications des juges, sont aussi maintenant réclamées par le ministre de la Justice Simon Jolin-Barrette. En effet, un pouvoir exécutif et législatif déjà fusionnel lui permet d'adopter des lois qui vont à l'encontre des recommandations imposées au pouvoir exécutif par les tribunaux. Ainsi, la présente recherche constate qu'il semble que le gouvernement consomme du pouvoir dans le but d'accroître la portée du pouvoir exécutif, tout en tenant progressivement la bête à trois têtes du Québec en laisse de plus en plus courte. Au fur et à mesure que le temps passe, il semble que le gouvernement va domestiquer la bête, en la transformant en son jouet qui se plie à ses caprices. Même si ce n'est pas l'intention de M. Jolin-Barrette, on ne peut nier que ses actions peuvent soumettre la société québécoise à une organisation hobbesienne de l'État.

The Separation of Powers: Liberty's Mirror

In The Spirit of the Laws, Montesquieu (1748) argues that freedom finds its vitality exclusively when present within a moderate State, which he suggests consists of a government where "power must check power by the arrangement of things" so that power cannot be abused by the caprice of a despot (p.155). In fact, he proposes that when the executive, legislative and judiciary powers are distinctly separate within the State, "liberty will appear there as in a mirror"; the State thus being the very reflection, or embodiment, of what freedom both represents and promotes (p.157). For a principle so fundamental to the core of human nature, it is worrying that, to this day, in many western democracies, there is dispute within the three-body system, where none of the distinguished entities can agree on what this principle requires, and how its objectives can be met (Magill, 2000, p.1129).

Moreover, there is a distinction to be made between the "separation of functions" and the "balance of power." In fact, function separation relates directly to the art of distinctly separating the three main governmental powers, whilst the idea of balance of power rather relates to the need to accord sufficient power to the three branches to assure that they can mutually check themselves (Brookes & Wheare, 2017, p.54). The attribution of competencies to the diverse branches thus composes this equilibrium, where consummation, or reclamation of a branch's competencies by any of the two other powers consequently destabilizes the distribution of power within a State (Steytler, 2005, p.277).

The idea of the consignment of diverse powers within a same body of government finds its origins in Greek philosophical thought. When referring to Socrates, however, one can look no further than the Socrates presented to us through the dialogues of Plato. Socrates never explicitly stresses the importance of the judiciary's independence, though he does lay an important philosophical base for Plato to later develop on. In fact, Kraut (1987) offers a different perspective from what the majority of scholars first understand in Crito & The Apology. He argues that Socrates does not promote blind obedience to laws, as the latter rather claims that the interaction between legislators that make the laws and a judge's duty to uphold them can create an environment propitious to the reinforcement of immorality and muddled justice (p.11). However, in Crito, Socrates also introduces the Rule of Law, a concept that echoes in tune with the very ideas that motivate the separation of powers. In fact, such a concept asserts that politicians and citizens alike are all subject to the same laws and that, in consequence, Law itself becomes inescapable even from the very people that create it (Stephens, 1985, p.5). Thus, Socrates exemplifies the power held by Law as well as how governments can pollute such justice, though they cannot escape it so long as the Rule of Law governs the State and its courts.

Based on Socrates' conception of the Rule of Law, Plato (1859) further argues that "where the law is subject to some other authority and has none of its own, the collapse of the state [...] is not far off; but if law is the master of

the government and the government is its slave, then the situation is full of promise" (p.60).

Plato thus begins to introduce the idea that the judiciary's independence is fundamental to the maintaining of democracy, as he also proposes a model of the balance of powers where the Law is custodian of freedom and a guard against tyranny. Moreover,

Domanski (2003) further argues that the theoretical foundation of the separation of powers that govern western constitutions is often mistakenly attributed to Montesquieu and Locke, as it is rather Plato that proposes that all spheres of government must operate within their own functions so that they do not endanger the integrity of other spheres (p.76).

As Plato was the student of Socrates, Aristotle became the student of Plato. As Socrates' ideologies echo through the ensuing generations, it is undeniable that, although their philosophies are perceptively different, they inherently share certain commonalities in the subjects they discuss. In fact, Aristotle also greatly studied the Rule of Law, in addition to the creation of a system free of tyranny. He develops on the idea of demagoguery proposed by Plato, as he further couples such an idea with the independence of the magistrature. He argues that "in democracies where the laws are not sovereign, demagogues spring up [...], for where the laws do not govern, there is no constitution" (Aristotle, 350 B.C.E, p.305). And so, a new concept now becomes fundamental to one's understanding of the judiciary's independence: the use of one's oratory to rule in an undemocratic way, where the demagogue deceptively consummates power, all whilst continuing to rally popular support. Today, this new-age despotism is attained through the wielding of populism's exponential rise and the mobilization of democracy's rhetoric (Keane, 2020, p.14). Aristotle is also one of the first philosophers to name the specific powers that were to be separated, beyond simply resorting to the idea of a moderate State. He separated the functions between "deliberative", "magisterial' and "judicial", which relates to the contemporary conception of legislative, executive and judicial roles of government (Glassman, 2016, p.3). Gilchrist (2018) however notes that the Greek conception of the moderate State is a direct reflection of the democracy of the time. In fact, despite this promotion of the powers' separation, these distinguished powers were still held by the same assembly in Athens, where Archons, for example, were both executive officers and judges (p.290). Thus, although the Greeks preached a separation of powers, this separation clearly lacked any conception of autonomy, and by extension, the very idea of a balance of power. As the feudal system then rose in the Middle Ages, power knew an important era of concentration (Astarita, 2021, p.99). Aquinas witnessed first-hand the dangers that ensued when the organization of government enabled an abuse of power. In consequence, he reintroduced the idea of limited government, which he inherited from Aristotle. However, they diverge as to the purpose of this limitation of the government's power. In fact, Aristotle rather argued that a mixed, or limited government, will balance out the variety of classes in Athens to produce political stability,

while Aquinas rather argued that this limitation would assure that the governed is ruled by Law and thus regulated by an “ordinance of reason” (Rhonheimer, 2019, p.446).

However, it is important to note that Aquinas still believes in the ruling by a single authority, a monarch that he says should resemble God as much as humanly possible (p.449). Aquinas thus does not advocate a Rule of Law, but rather a rule by law.

During the era of enlightenment, Locke and Montesquieu dominated the philosophical space, as they introduced a modern conception of power separation. In fact, in Locke’s Second Treatise of Government, he argues that Lockean constitutions must have substantive goals that “check” and “balance” unitary executive power especially, as well as the other separate branches of government (Jenkins, 2011, p.545). Locke’s approach to the separation of powers is characterized as dualistic, as he focuses specifically on the consequences of the executive power’s undermining of the legislative branch, which he judges is tantamount to an attempt to wield absolute power, further voiding the common good since too much faith is placed in the hands of arbitrary power. Another fundamental part of Locke’s theory is his conception of the King’s prerogative, where the executive power can be vested, under exceptional circumstances, with the powers to reintroduce political stability. These acts must however be legitimate within their own contextual settings, as any illegitimate use of extraneous power that ultimately undermines the legal regime is not a use of the constitutional prerogative, but rather directly of tyranny (Casson, 2008, p.948).

However, although Montesquieu and Locke’s theories both undermine the influence of the judiciary in balancing the powers, under John Adams, the judiciary lost its inferior role and officially became perceived as a power in itself, capable of regulating both the executive and legislative branches all whilst remaining autonomous (Kurland, 1986, p.595). Adams laid the groundwork for the American Constitution’s article concerning the independence of the judiciary, which implicitly accords a capacity for judicial review. In fact, judicial review is the ultimate demonstration of the judiciary’s independence, as it enables the courts with a constitutional veto of legislative and executive acts that are in violation of the constitution (Gerber, 2007, p.29). It is important to note that many of the aforementioned thinkers suggest that human nature is inherently political or social, which contrasts directly with Machiavelli’s conception of humanity that rather relates to aggression, power and acquisition (Berridge, 2001, p.544). Machiavelli still however argued that mixed regimes were to be sought out, as such regimes, when observing their historical success, delay Polybius’ cycle of constitutional decline (Calabresi, Berghausen & Albertson, 2012, p.531). Despite this separation of powers however, Machiavelli does not advocate a balance of power, and rather argues that order is best found when power is concentrated.

Homo Homini Lupus

Hobbes further diverges from the shared conception of human nature by the latter philosophers, as he rather argues that humans that are not subject to an absolutist government will eventually degenerate into a natural state of anarchy. In fact, he claims that the various powers of the State are “indivisible”, “incommunicable”, and “inseparable” (Waldron, 2020, p.449). In Hobbes’ Leviathan, he thus proposes that peace imposed through the will of a supreme power is the only way one can free humanity from their innate curse of anarchy and perpetual war (Zuckert, 2001, p.232). Hobbes then believes that “a kingdom divided in itself cannot stand”, thus directly opposing any proposition of balance or division of powers (Hobbes, 1651, p.112). And so, from a Hobbesian perspective, the judiciary’s role is to simply interpret the Law imposed by the supreme power, as Judges, for example, must conform to the intentions of the sovereign when interpreting the Law (Campagna, 2000, p.500). The Leviathan has thus murdered the three-headed beast, as the former triad of powers becomes subservient to both his rule and caprice.

Liberty is in the Eye of the Beholder

Any debate around a need for a separation of powers and judicial review through power balance is underpinned by a need to protect freedom. However, freedom in itself has been widely contested amongst philosophers and judicial members alike. Although this paper will not delve into the individual conceptions of freedom promoted by diverse thinkers, it will draw a general outline as to what scholars understand of freedom and its link to the balance of power and Law. Allan (2013) argues that Law is the people’s armour against arbitrary power (p.2). It is thus important to not perceive the Rule of Law as simply “the law applies to everyone”, but rather to perceive it as a system that guarantees each person’s autonomy and independence without yield. In an 1864 speech in Baltimore, Abraham Lincoln claimed that, when speaking of freedom, “in using the same word, we do not mean the same thing” (Leoni, 2012, p.26). And so, if freedom dissociates itself from a universal definition, and individuals begin to perceive it through the lens of their own experiences, we lose the very essence of freedom. In this respect, freedom belongs to the common good, and no one person should be able to mould it to serve them solely. This paper will thus characterize freedom as freedom promised within a State’s constitution that usually enables citizens with inalienable rights that protect them from oppression from others and guarantee their security. In the Western World, one can quickly forget the value of freedom, and by extension, the importance of safeguarding what protects the very structure upon which our freedom is built on. As Nietzsche (1889) would claim in regard to freedom, “the worth of a thing lies sometimes not in what one attains with it, but in what one pays for it, what it costs [them]” (p.64).

The Beast with Three Heads

Waldron (2020) separates the three powers and their functions. In fact, although each State and their constitutions warrant a specific type of function separation, general roles can be attributed to the different branches of State that encompass a large set of constitutions. The Legislative branch's competencies relate to law-making and representation, while the executive branch carries out and enforces laws introduced by the legislature. The Judiciary rather finds its power in its own independence and autonomy, as its capacity for legal review makes them custodians of democracy (pp.448-449). Their powers also include the interpretation and application of the Law, although the latter power is what the current paper is more so interested in. In fact, it is these specific "task" separations that ensure that no one person or entity can subject a people to tyranny. Thus, a perceptively banal, or convenient assumption of a role by a branch whose ascribed competencies do not include such role marks a degeneration to Leviathan-like powers. Although Hobbesian politics promote such degeneration through a simple cost-benefit analysis between freedom and security, the constitutions that many western democracies are built on perceive the ascension of an individual with Leviathan-like powers as their ultimate antithesis. Adams et al. (2001), claim that American constitutionalism, for example, is heavily rooted in the history of oppression from the metropole, where Americans, following the revolution, vowed to never mirror the tyrannous monarchial powers found in Europe (p.5). The separation of powers through the adoption of a revolutionary constitution thus became the embodiment of the former North American colony's independence from its British colonizer.

Quebec's Separation of Powers

Quebec's political system is comprised of a soft power separation between executive and legislative powers. In fact, the executive branch is composed of the premier as well as their ministers. These ministers are also members of the national assembly, which thus creates a direct bridge between the two powers. The judiciary power remains independent from the other two powers, as Quebec's court has a capacity for legal recommendation and review and is also charged with the application and interpretation of the Law (Assemblée Nationale du Québec, 2009, par.1-20).

The Exception Becomes the Rule

Over recent years, under the Coalition Avenir Québec Government (CAQ), the separation of powers has come back up for debate, as Simon Jolin-Barrette has progressively inserted himself into the judiciary branch. The present research will discuss the major two instances under which this blurring of power separation took place and will link such incidents back to fundamental Law and Philosophy principles. The current research thus has as objective the in-depth analysis of Quebec's current power separation, as well as the determining of whether

Quebec democracy is currently under attack by its own government. Since M. Jolin-Barrette's initiatives relate to sexual violence courts, the present research also attempts to discuss the need for these courts in Quebec and whether an insertion into the judiciary branch is truly necessary if wanting to promote change efficiently within the Quebec court system.

Research Methodology

Secondary-Source Analysis

In the context of the current research, secondary data will be fundamental to the elaboration of conclusive data. In fact, at first, the research attempted to interpret primary data and use this in junction with secondary data. However, the primary data presented was too scarce to draw any conclusive and recurring patterns. In consequence, the primary data collection tool had to significantly be modified. In fact, the present research reviewed a large number of newspaper articles that followed the progression of both Bill 96 and Bill 92, as the bills were followed through the legislative process as well as through the process of judicial review under the Quebec Superior Court. The large set of news reportings on such subjects thus logically best compliments the intent of the research. Of course, in the articles themselves, some news companies interviewed the actors directly involved in the dispute amongst powers, interviews that were as well used to compliment the findings of secondary data, without being the core of the research itself. The news articles were mainly taken from CBC News, Radio-Canada, LaPresse, CTV News and Le Devoir, thus including both francophone and anglophone accounts of a same event.

A large part of the present study also traces the very idea of the separation of powers through historical philosophical thought. In fact, the research paper finding an important base in political and legal theory permits the current study to cement itself into the reality of social science. Without this, the paper would have no infrastructure to develop on: it is its very core. For the most part, political theory is taken from political philosophers themselves, as the interpretation of their theories is undergone by the researcher and then is contrasted and compared with other scholars' interpretation of such theories.

Interviews

The sampling process for interviewing was mainly through snowball sampling. In fact, once in direct contact with the assistant chief prosecutor at the DPCP emails were sent out to referrals by the latter. These referrals would then also refer the participation email to other prosecutors and defense attorneys. The email and question sample can be found in Appendix A. The sample questions served as a guide throughout the interview process, as they also helped the interviewees prepare themselves for a certain set of questions so that they were not to

be blindsided. Also, two sets of questions were developed, one more objective than the other, thus adapting to the role and permissions of both defense attorneys and prosecutors of the crown. Twenty (20) emails were sent out through snowballing to practitioners of the Law. A total of six (6) answers were received, three (3) of them accepting to participate in the interview process: two (2) crown prosecutors and one (1) defense attorney. The three other answers, although answers to the negative, still decided to provide secondary data concerning the separation of powers and Quebec's new sexual violence courts. Out of the three individuals that accepted the interview, the defense attorney became unavailable, and the assistant prosecutor in chief became a judge. The defense attorney never participated in the interview, though the former assistant chief prosecutor did undergo the interview process and had to later invoke a clause from the consent form to revoke the information they provided due to their new position as judge. One interview, approximately 40 minutes long, was thus conducted with a prosecutor in the domestic violence team at the DPCP at the Palais de Justice office. The interview took place over videoconference and respected all ethical procedures.

Ten (10) emails were sent out to politicians, and only two responded with a negative answer. The present research thus had to be modified to focus more specifically on secondary-source analysis, where it would use the conducted interview as a complement to the secondary data.

Results

Bill 96

Under Bill 96 (2022), "an act respecting French, the official and common language of Quebec", Justice Minister Simon Jolin-Barrette has introduced legislation that would strengthen the Bill 101 language laws already set in place since 1977. It introduced important amendments and changes to every realm of the Quebec citizen's life, from education and the workplace to law. This paper is however axed on the judiciary changes Bill 96 attempts to enact. In fact, in December of 2021, the Justice Minister proposed an amendment to the Bill that would remove bilingual requirements for both the courts and its judges, thus claiming that a purely francophone judge with more qualifications than a bilingual judge should be favoured in the nomination process (The Canadian Press, 2022, par.13). Minister Jolin-Barette maintains that it is within his executive functions to set out the requirements for the Judges of the land, while Chief Justice Lucie Rondeau rather claims that the Minister's executive role is simply to nominate the judges, not decide what is needed for her courts (CBC News, 2022, par.1).

According to Giroux (2022), the bill was thus brought before the Superior Court of Quebec, where it decided, in February, that the justice minister "has no discretionary power as to the content of the selection notice to be published. His role is limited to asking the secretary to launch the competition" (par.6). Justice Immer

describes the minister's attempt to overreach as "ultra vires exceeding his powers and illegal" (par.5). Despite the Superior

Court's deeming of the Justice Minister's action as out of place, Jolin-Barrette felt no need to challenge the judgment, as the powers he currently holds permits him to introduce the removal of bilingualism through other means. Using the legislative route, the minister can amend Bill 96 and modify the regulation that surrounds the selection of the court of Quebec judges. This will thus also amend the Courts of Justice Act, as the Legault government continues to maintain that bilingualism is a systematic barrier for francophones in Quebec that aspire to become judges (The Canadian Press, 2022, par.9).

The bill passed on May 24th, 2022, contains explanatory notes explaining its purpose in relation to the judiciary: "the bill introduces various measures to reinforce French as the language of legislation and justice" (p.2). Clause 12 reinforces the French language in the courts by leaving any requirement of bilingualism to the Justice Minister's own discretion:

"A person to be appointed to the office of judge shall not be required to have knowledge or a specific level of knowledge of a language other than the official language unless the Minister of Justice and the Minister of the French Language consider that the exercise of that office requires such knowledge and that all reasonable means have been taken to avoid imposing such a requirement" (p.9).

Under this clause, Simon Jolin-Barette is the sole individual that can determine the bilingual requirement for judges, stripping this competency from the judiciary power, without the courts being able to defend itself in any shape or form.

Bill 92

In response to claims that sexual assault survivors are systemically silenced by the judiciary system in Quebec, legislators have decided to adopt a new bill that would create a specialized tribunal within the Court of Quebec to treat crimes of a sexual nature (Bill 92, 2021). According to Sioui (2021), the honourable Lucie Rondeau, although cognizant of the need to "rebuild confidence" in the judiciary system, opposes the involvement of the political in the judiciary branch, thus also directly opposing Bill 92 (par.3). She claims that this involvement surpasses simple discomfort, as it rather demonstrates a cataclysmic shift in the perceptions of power balance in the province (par.2). The Chief Justice was, in fact, not even present by the government to the two-day consultation they undertook in October of 2021 due to this intense clash of perspectives on power separations and the role of the fusional powers in Quebec (Jocelyne, 2021, par.3).

However, despite strong opposition from the judiciary branch, in November of 2021, Quebec legislators voted unanimously to pass the bill, and, by extension, officially create the courts and begin the pilot projects (Sabrina, 2021, par. 6). Despite the actions undertaken by the executive and legislative branches to improve the judicial system's handling of sexual assault survivors, the honourable Rondeau decided to undertake reform on her own end of the judiciary branch to enact this change, rather than put her faith in politicians. She thus decided to create a division of "Accusations in a domestic and sexual context", dubbed ACCES in French (Accusations en contexte conjugal et sexuel). ACCES regroups dossiers of domestic and sexual violence together to ensure cohesiveness of handling by prosecutors and creates a better liaison system between the court and its social and judicial workers to better assist victims (Radio-Canada, 2021, par.12).

Interview with Me Crown Prosecutor

In reference to the consent form, the interviewed crown prosecutor accepted that their name be blurred out or altered in the context of the current research paper. Me Crown Prosecutor prefaced many of their statements with a reminder that their views and opinions do not represent those of the entirety of the DPCP, as they also showed reasonable constraint as to the subjective information that they communicated with the researcher due to their quasi-judiciary role.

Me Crown Prosecutor's experience over that past year and a half has been within the teams specialized in domestic violence at Montreal's Palais de Justice. They have been practicing Law for more than a decade and have thus gained immense experience in various domains of the Law. As they now specialize in domestic violence cases, and that domestic violence often can comprise sexual violence as well, according to the interviewee, they are very knowledgeable about the inner workings of the Law, as well as the places where it falls short. In the context of this research, it is vital that the current state of the legal system is understood and evaluated from this perspective, as this would further enable the determination of whether the use of the non-withstanding clause is justifiable, and if the introduced bills remain constitutional once an Oakes test is passed.

Since 2018, the persons included in the legal definition of a "domestic", or intimate couple was widened to include a larger array of cases. In fact, according to the interviewee, two individuals that meet on a dating site and speak for two weeks, for example, are perceived by the Law as an intimate couple, thus falling under the department of prosecutors that treat domestic violence. There has thus been an increased number of cases given to the domestic violence team since 2018, as the interviewee however notes that it works closely with the sexual violence teams, and this, to the best of their ability. Me Crown Prosecutor also explains that although they routinely meet with victims throughout the judiciary process, there are also social services present at the Palais de Justice for victims, such as Coté Cour and the Centres d'aide aux victimes d'actes

criminels (CAVAC), depending on the district. However, the interviewee does note that the services vary drastically between districts. In some cases, prosecutors do not separate into specific teams of specialty but rather are attributed to a large number of cases pertaining to diverse areas of criminal law.

There is thus a lack of harmony, or conformity in the services offered to the victims between districts that requires reconciliation. Me Crown Prosecutor also states that this is where the Law is lacking most, as a uniformization of practices is severely needed. They assert that currently, in the province of Quebec, Montreal can serve as a sufficient role model for what the courts require.

Concerning the court's understanding of the psychological bearings of sexual assault, domestic violence and trauma, Me Crown Prosecutor understands the impact this has on victims, as they routinely cite the cycle of violence throughout the interview. They claim that since their introduction to the legal practices, they have noticed an increased understanding of the psychology of trauma through the court's jurisprudence. They also reference workshops and trainings offered to the prosecutors to increase their knowledge on such subject matters; subject matters that are ever-changing even in the realm of psychology.

On the separation of powers, the interviewee remarked that they may not enter into a political debate, though they do personally believe that there must be distance between both the judiciary power and politics. They argue that currently, in Montreal, the reform proposed by the Minister of Justice regarding sexual assault tribunals is not needed, since what he proposes is already in place in the Montreal district. As for a uniformization of victim treatment among the province and bilingualism, they claim that these are, in fact, important issues, but that it should be the judiciary that undertakes this reform on a district-specific basis. Also, Me Crown Prosecutor claims that since Quebec falls under Common Law, change is most easily noticed and influenceable when found within the jurisprudence. Once more, they place the seeds of change in the judiciary's soil. They thus do not think that change is not needed within the system. They rather acknowledge that things take time, as their own experience with the Law demonstrates that it is, in fact, changing.

Discussion

Interpretation

The aforementioned results demonstrate a trend by the fusional powers of the executive and legislative branches to insert themselves into the judiciary power, under the direction of Justice Minister Simon Jolin-

Barrette. This gambles the very independence of the magistrature, as M. Jolin-Barrette seems to be engaged in a game of tug-of-war with Chief Justice Lucie Rondeau. It is clear that, compared to Quebec's history with the separation of powers, the already fusional power seems to yearn for a consummation of the judiciary that would free the Leviathan from amber, as it has the potential to seriously dismantle, or hold hostage Quebec democracy. As discussed above, Locke has a dualistic approach to the separation of powers. He however warns that any "attempt by the executive to undermine the legislature's independence or oversight" reflect a thirst for absolute power (Jenkins, 2011, p.545). As such, even from the pure standpoint of Quebec's legislative and executive branches' overlapping, the power wielded by the executive branch is already to be requestioned. As presented in the results above, although the judiciary power decided that it is beyond M. Jolin-Barrette's competencies to remove bilingual language requirements for Quebec judges, this, in no way, had any impact on whether or not the Justice Minister would enforce it through the legislature. As such, Quebec seems to place itself in a strange model of power separation. In fact, since the judiciary remains the only power that has a legitimate check on the executive-legislative function fusion, it should follow a model similar to that of John Adams where its capacity for judicial review trumps all. However, due to the notwithstanding clause, much legislation can bypass judicial purview for half a decade, where the clause can then be invoked once more to avoid judicial review (Rousseau & Côté, 2017, p.391). This undermines the influence of the judiciary, rendering it significantly less powerful than the other branches of government. This model is favoured by Locke and Montesquieu. However, the connection of the executive branch to the legislature directly opposes both the latter philosopher's dualism in regard to the separation of powers, as power clearly knows a form of unification. Thus, as demonstrated in the results, M. Jolin-Barette can use his executive power to overreach into the powers of the judiciary. Once the judiciary used its power to deem unwarranted such overreach, M. Jolin-Barette simply used his connection to the legislative branch to introduce it through the legislature.

Through Me Crown Prosecutor's interview, the patience that comes with the democratic process is clearly expressed. They acknowledge that change is needed, but also understand that these changes take time. The intervention of the softly linked powers thus expedites the process, but at the very detriment of the result itself. It is rather important to continue the training of legal professionals and ensure its intersectionality with other sciences, such as psychology, as proposed by the interviewee.

Implications

These findings serve as a warning as to how the current organization of powers within Quebec consigns dangerous amounts of power to the fusional executive-legislative branch in Quebec. In fact, the CAQ government seems to abuse the notwithstanding clause to advance its own agenda, demonstrating a certain

impatience towards the democratic process. The current actions of the CAQ government will forever alter the power structure within Quebec, thus creating a potential for the supplanting of Quebec's democratic tradition by a despotic force. Unfortunately, no extensive research has been conducted concerning Quebec's power separation and its evolution, although the current research does open a discussion surrounding such issues. Resnick (1987) expands on Montesquieu's theory and applies it partly to the province of Quebec. It is however evident that the current political state is far different than the one present in the 1980s, as the researcher seemingly suggests that Quebec society finds influence in Marxism and attempted to mimic an American-type system in the context of their fight for independence (pp.98-113). Richard (2009) also reviews Quebec's democratic tradition and constitutional safeguards, though the current paper more critically assesses the situation in Quebec specifically, whilst the latter researcher rather focuses on Quebec's ability to secede and its relation to Canadian judiciary powers (p.744). The current paper thus pioneers research in the current subject matter, as it defines, analyzes and assesses the state of power separation in Quebec.

Limitations

The present research, unfortunately, only had the opportunity to interview one individual. Despite the fact that Me Crown Prosecutor was extremely qualified and knowledgeable in their area of practice, it is evident that the data they presented is far from conclusive and generalizable, although it does compliment the research, in that it presents a perspective of the Law and its founding principles. Moreover, little to no research seems to have been previously conducted concerning the separation of powers in Quebec, which does not permit the present research to build off of heavily empirical data and peer-reviewed literature.

Conclusion

Under the CAQ government, the notwithstanding clause has been repeatedly invoked to bypass the judiciary power's capacity for legal review. Functions belonging to the judiciary, such as the determining of qualifications for judges, are also now being reclaimed by Justice Minister Simon Jolin-Barrette, as an already fusional executive and legislative branch permits him to pass legislation that goes against the recommendations placed on the executive branch by the courts. Already, the judiciary power, compared to the other two branches of State, seems unable to check an overreaching government. This overreach, although perceptively banal, can set a dangerous precedent as to what the judiciary is willing to waiver and can forever weaken the magistrates.

The CAQ government claims that such intervention is done because the issues it tackles are of utmost

importance, such as in the case of the sexual violence courts in Quebec. However, as demonstrated through this paper and Me Crown Prosecutor's interview, the issue seems rather district-specific, as it was found that Chief Justice Lucie Rondeau already began to undertake actions to ensure the uniformity of victim treatment across the province. Consequently, it can be inferred that the CAQ government has intentions that surpass simply ensuring the common good. In fact, it seems that it is consummating power to increase the reach of the executive, as it is progressively holding Quebec's three-headed beast on an increasingly short leash, where, as time progresses, the beast becomes domesticated by government: a play toy that bends to its caprice. Even though this might not be M. Jolin-Barrette's intention, there is no denying that his actions can subject the Quebec society to a Hobbesian organization of State.

As proposed by the interviewee, jurisprudence remains the Common Law's most powerful tool, as it is both an agent of social change and the reflection of social change itself. Important reforms in domestic violence have been undertaken by the judiciary branch, according to Me Crown Prosecutor, demonstrating the court's ability to enact change. Accelerating, or rather bypassing the democratic process, the CAQ government and the new separation of powers put our very democracy at risk, as power loses all balance in the frame of its separation.

Despite the importance of the current topic and its relationship to the very livelihood of Quebec democracy, literature concerning the separation of powers' evolution in Quebec is currently still a work in progress. Although the current research does spearhead a better understanding of the current political state of Quebec, it is important that scholars continue to study the topic in great detail. The philosophy of Politics and Law has been laid out for millennia. All that is needed is for Quebec society to decide, based on history and morality, what it wishes its government and State to embrace: freedom or tyranny.

References

Adams, W. P., Kimber, R. A. R., & Morris, R. B. (2001). *The First American Constitutions: RepublicanIdeology and the Making of the State Constitutions in the Revolutionary Era* (Expanded ed.). Rowman & Littlefield Publishers.

Allan, T. (2013). *The Sovereignty of Law: Freedom, Constitution and Common Law* (1st ed.). Oxford University Press.

Aristotle. (350 B.C.E.). *Politics*. Cambridge University Press.

Assemblée Nationale du *Québec*. (2009, March 10). *At the Heart of the Québec State*. http://www.assnat.qc.ca/en/abc-assemblee/assemblee-nationale/coeur-etat-quebecois.html

Astarita, C. (2021). *From Feudalism to Capitalism*. Brill.

Berridge, G. R. (2001). Machiavelli: human nature, good faith, and diplomacy. *Review of International Studies, 27(4)*, 539–556. https://doi.org/10.1017/s0260210501005393

Bill 92, *Loi visant la création d'un tribunal spécialisé en matière de violence sexuelle et de violence conjugale et portant sur la formation des juges en ces matières*, 1st Parliament, Quebec, 2021.

Bill 96, *An act respecting French, the official and common language of Quebec*, 1st Parliament, Quebec, 2021.

Blankenberg, C. M. (1997). *Evaluating the Special Sexual Offences Courts in Cape Town and Wynberg Through Professional Perspectives.* (Master's thesis, University of the Western Cape, Cape Town, South Africa). http://etd.uwc.ac.za/xmlui/handle/11394/7352

Brookes, R. H., & Wheare, K. C. (2017). Political Theory: The Separation of Powers. *Political Science, 3(1)*, 53–60. https://doi.org/10.1177/003231875100300105

Calabresi, S., Berghausen, M. E., & Albertson, S. (2012). The Rise and Fall of the Separation of Powers. *Northwestern University Law Review, 106(2)*, 527–550. https://scholarlycommons.law.northwestern.edu/nulr/vol106/iss2/5

Campagna, N. (2000). Leviathan and Its Judges. *Archives for Philosophy of Law and Social Philosophy, 86(4)*, 499–517. http://www.jstor.org/stable/23681490

Casson, D. (2008). Emergency Judgment: Carl Schmitt, John Locke, and the Paradox of Prerogative. *Politics & Policy, 36(6),* 944–971. https://doi.org/10.1111/j.1747-1346.2008.00146.x

CBC News. (2022). *Quebec justice minister has "no power" to say judges don't need English, court finds*. https://www.cbc.ca/news/canada/montreal/quebec-bilingual-judges-court-ruling-1.6338203

Chinnian, K., & Petersen, A. (2020). Gender Construction in Sexual Offences Cases: A Case for Fully Reviving the Sexual Offences Courts. *Acta Jurídica, 2020(1)*, 135–163. https://hdl.handle.net/10520/EJC-1fa671fd58

Cloutier, M. (2020). L'instauration de tribunaux spécialisés en matière de crimes sexuels : un pas de plus vers la reconstruction d'une confiance brisée. *Les Cahiers de Droit, 61(1),* 83–112. https://doi.org/10.7202/1068782ar

Cloutier, M. (2021). *Les tribunaux spécialisés en matière de violence sexuelle : une piste de solution pour l'amélioration de l'accès à la justice des victimes*. (Master's thesis, Université Laval, Québec, Canada). https://corpus.ulaval.ca/jspui/bitstream/20.500.11794/68550/1/37009.pdf

Davids, C. (2001). *Policy and Practice of Sentencing Male Child Sexual Offender at Wynberg Sexual Offences Court*. (Master's thesis, University of Cape Town, Cape Town, South Africa). https://open.uct.ac.za/handle/11427/7709

Domanski, A. (2003). Plato, Justice and the Constitution. *University of the Witwatersrand*. https://journals.co.za/doi/pdf/10.10520/EJC34237

Gerber, S. D. (2007). Unburied Treasure: Governor Thomas Burke and the Origins of Judicial Review. *Historically Speaking, 8(6)*, 29–30. https://doi.org/10.1353/hsp.2007.0059

Gilchrist, R. N. (2018). *Principles of Political Science (Classic Reprint)*. Forgotten Books.

Giroux, S. (2022, February 4). *Court strikes down attempt by Quebec justice minister not to require judges to be bilingual*. Montreal. https://montreal.ctvnews.ca/court-strikes-down-attempt-by-quebec-justiceministernot-to-require-judges-to-be-bilingual-1.5765352

Hobbes, T. (1651). *Leviathan*. Cambridge University Press.

Jenkins, D. (2011). The Lockean Constitution: Separation of Powers and the Limits of Prerogative. *McGill Law Journal, 56(3)*, 543–589. https://doi.org/10.7202/1005132ar

Jocelyne, R. (2021, October 24). *Consultation sur le projet de loi 92 | L'absence de la juge Rondeau suscite le malaise*. La Presse. https://www.lapresse.ca/actualites/politique/2021-10-24/consultation-sur-le-projet-de-loi-92/l-absence-de-la-juge-rondeau-suscite-le-malaise.php

Keane, J. (2020). *The New Despotism*. Harvard University Press.

Kraut, R. (1987). *Socrates and the State* (Reprint ed.). Princeton University Press.

Kruger, H. B., & Reyneke, J. M. (2008). Sexual Offences Courts in South Africa: Quo Vadis? *Journal for Juridical Science, 33(2)*, 32–75. https://journals.ufs.ac.za/index.php/jjs/article/view/2959/2871

Kurland, P. B. (1986). The Rise and Fall of the "Doctrine" of Separation of Powers. *Michigan Law Review, 85*(3). https://repository.law.umich.edu/cgi/viewcontent.cgi?article=2969&context=mlr

Leoni, B. (2012). Freedom and the Law (3rd ed.). Liberty Fund.

Magill, M. E. (2000). The Real Separation in Separation of Powers Law. *Virginia Law Review, 86(6)*, 1127. https://doi.org/10.2307/1073943

Montesquieu, C. D. (1748). *The Spirit of the Laws*. Cambridge University Press.

Nietzsche, F. (1889). *Twilight of the Idols*. Van Haren Publishing.

Plato. (1859). *Laws* (First Edition). Cambridge University Press.

Radio-Canada. (2021, October 27). *Violences sexuelles : la juge en chef de la Cour du Québec démolit le projet de loi 92*. https://ici.radio-canada.ca/nouvelle/1834768/projet-loi-92-tribunal-specialise-violences-sexuelles-cour-quebec-juge-rondeau

Resnick, P. (1987). Montesquieu Revisited, or the Mixed Constitution and the Separation of Powers in Canada. *Canadian Journal of Political Science, 20(1)*, 97–115. https://doi.org/10.1017/s0008423900048964

Rhonheimer, M. (2019). St. Thomas Aquinas and the Idea of Limited Government. *Journal of Markets & Morality, 22*(2), 439–455. https://www.marketsandmorality.com/index.php/mandm/article/viewFile/1443/1174

Richards, J. D. (2009). Separation of Powers: The Canadian Experience. *Duquesne Law Review, 47*(731), 731–762. https://dsc.duq.edu/dlr/vol47/iss4/5/

Rousseau, G., & Côté, F. (2018). A Distinctive Quebec Theory and Practice of the Notwithstanding Clause: When Collective Interests Outweigh Individual Rights. *Revue Générale de Droit, 47*(2), 343–431. https://doi.org/10.7202/1042928ar

Sabrina, J. (2021, November 25). *Quebec legislators vote unanimously to create special court for victims of domestic, sexual violence*. CBC News. https://www.cbc.ca/news/canada/montreal/specialized-court-victims-domestic-sexual-violence-1.6262414

Sadan, M., Cassiem, S., & Dikweni, L. (2001). *Pilot Assessment: The Sexual Offences Court in Wynberg & Cape Town and related services*. Idasa.

Sioui, M. (2021, October 7). *Tribunal spécialisé: la Cour du Québec n'exclut pas une poursuite*. Le Devoir. https://www.ledevoir.com/politique/quebec/638700/agressions-sexuelles-la-cour-du-quebec-n-exclut-pas-une-poursuite

Stephens, J. (1985). Socrates on the Rule of Law. *History of Philosophy Quarterly, 2*(1), 3–10. http://www.jstor.org/stable/27743706

Steytler, N. (2005). The Powers of Local Government in Decentralised Systems of Government: Managing the 'Curse of Common Competencies. *The Comparative and International Law Journal of Southern Africa, 38*(2), 271–284. http://www.jstor.org/stable/23252297

The Canadian Press. (2022, March 21). *Battle continues between justice ministry and Quebec court over bilingual judges*. Montreal. https://montreal.ctvnews.ca/battle-continues-between-justice-ministry-and-quebec-court-over-bilingual-judges-1.5827786

Tutty, L. M., & Koshan, J. (2013). Calgary's Specialized Domestic Violence Court: An Evaluation of a Unique Model. *Alberta Law Review, 50*(4), 731. https://doi.org/10.29173/alr74

Waldron, J. (2020). Separation of powers in thought and practice? *Revista de Direito Administrativo, 279*(3), 17–53. https://doi.org/10.12660/rda.v279.2020.82914

Walker, S. P., & Louw, D. (2007). The Court for Sexual Offences: Perceptions of the victims of sexual offences. *International Journal of Law and Psychiatry, 28*(3), 231–245. https://doi.org/10.1016/j.ijlp.2007.04.001

Zuckert, M. (2001). Natural Law, Natural Rights, and Classical Liberalism: On Montesquieu's Critique of Hobbes. *Social Philosophy and Policy, 18*(1), 227–251. https://doi.org/10.1017/s026505250000285536

Appendix A

Interview Questions

DPCP

1. Please tell me about your role within the DPCP
2. Can you define “beyond a reasonable doubt”?
3. How are sexual assault victims treated in the judiciary system?
4. How does one usually lose criminal cases?
5. How does one usually win criminal cases?
6. Can you detail the process a victim of sexual violence goes through at the DPCP?
7. How does the defence plant a reasonable doubt?
8. Does the court take into account psychological theories and principles when rendering a verdict?
9. How does bilingualism play a role in the judiciary system?
10. How would you define the role of the judiciary in Quebec?
11. How does the DPCP proceed once a defendant is convicted?
12. How does the DPCP proceed once a defendant is not convicted?
13. From your experience, what delays are, on average, associated with different judiciary proceedings?

How are we so attracted to the idea of buying clothing?

Alexandra Morin

BIO GRA PHY

My name is Alexandra Morin. I recently graduated from the Collégial International Sainte-Anne, where I obtained a DEC in Social Science with a focus in administration. I am currently pursuing a Bachelor of Science in computer science at the University of Montreal. While I have many different interests from books to sports, I wish to merge both fields (business and computer science) in the future as a career. This study has helped me get a little closer to my goal, while looking at the marketing side and the growing technologies. Building a ‘’code’’ and analyzing the data used in my research helped me reveal the interest I have in computer science.

What are the most popular digital marketing methods used to attract young women from Quebec in the fashion field?

Abstract

In western societies, consumerism is a crucial problem. This impacts numerous areas like fashion, technology, food, and many others. In recent years, what is called as “fast fashion” has been recalled for its impactful environment and labour challenges. We can ask ourselves, how are we so attracted to the idea of buying clothing? In other words, how are clothing compagnies influencing buyers? In this specific research, we look at 25 different corporations or stores located in the province of Quebec. More particularly, we focus on the target population of young women from the ages of 15 to 25 years old. A lengthy content analysis was produced, which matched the marketing campaigns from the compagnies mentioned above to more than 30 different marketing techniques. Which then yielded a ranking of the most used techniques in the Quebec fashion field for young woman. The most popular marketing method was found to be the association with feeling (19 out of the 25 marketing campaigns used this technique), followed closely by colour psychology that reflects brand/clothing (16), colour psychology that reflects relevant emotion (13), interesting medium – social media (12) and the fifth place was a tie between words that reflect brand/clothing and symbolism (11). With these results, we have important knowledge that can help many different individuals, from young women who can understand how they are being “manipulated” all the way to professionals that can see how their competitors work.

Keywords: fast fashion, young women, colour psychology, digital marketing

Introduction

“The Internet is becoming the town square for the global village of tomorrow – Bill Gates” (Ganassini, 2016, para.2). In the recent decade, technologies have appeared and evolved, changing the world all around us. While many see this change as something revolutionary in their everyday lives, everything around us has changed. While sectors had to adapt to keep up, new technologies appeared. For some professionals, their jobs are disappearing, now being automated; some are profiting from it, creating new and more advanced ways to pursue their careers. Marketing is a part of the latter; digital marketing has appeared, growing more influential every day. The globalization of marketing campaigns could spread around the world and affect more individuals, being profitable for smaller companies' growth and also helping large companies get wealthier. Looking at different studies, most of them agree on the power of social media. Ananda et al. (2015)

values social media in the Italian luxury clothing area, while also looking at the traditional and modern approach. On a different financial area, McQuitty et al. (2019) looks at how social media give economic benefits to small businesses using the DIY model, as the following quote notes: “The results from a structural equation model and the hypothesis tests suggest that our sample of small business owners and managers is motivated to undertake digital marketing themselves because of the economic benefits, but not due to a perceived lack of quality” (p.192). Similarly, Putranto et al. (2019) who mainly uses social media due to lack of funds, analyses it’s benefits in the tourism industry. Both research by Suleiman et al. (2020) and Shamsudeen & Ganeshbabu (2018), looked at the impact of social media. However, Suleiman et al. (2020) went more in depth by researching the benefits and challenges of social media and various strategies. Peric et al. (2020) brought something new to the table by pointing out the importance and presence of videos, while also exploring future trends, new technologies and effectiveness. Another relevant research article, Tiago & Verissiomo (2014) explored the pressure to use social media and the benefits of “relationship-based” communication. As many can expect, the fashion industry has been revolutionized by new technologies. In Quebec, we differentiate ourselves from the provinces around us and often portray ourselves as the opposite of our neighbours, the United States, in terms of language, culture, and plenty other aspects. Yet, are we really all that different when it comes to marketing fast fashion to young women (15 to 25 years old)? How do clothing boutiques, stores and corporations attract our attention? What methods do they use? This is what the study attempts to find. First, 25 marketing campaigns from clothing stores found in Quebec will be observed, then coded to find which marketing techniques were applied by each. With the previous results, they will all be compiled and ranked per frequency. Finally, the most popular marketing techniques used in Quebec clothing stores targeted at young women will be identified.

Methodology

A pre-test is a small-scale research to make sure the code functions properly (make sure the questions are suitable and work, or if another category needs to be added/removed) before starting the "real" research. The first step was to find all the coding categories and copy them into an Excel spreadsheet to facilitate the process. At first, five marketing campaigns were identified (Garage Clothing, Womance, GirlCrush Gang, Yoga Jean Denim and Urban Outfitters) – focused on the Quebec fashion field and how it applies to women between 15 to 25 years old (refer to Appendix 1). Then, each definite category was checked and the marketing techniques that were applied to each specific case were written down. While coding, any changes that needed to be addressed were noted in a different document; this lead to the addition of 9 new categories. Additionally, it was decided to create sub-categories, such as colour psychology, use of specific words, sounds, music and data, the medium of the campaign, the composition, typography, and association (see Table 1). With these changes, the pre-test was carried out on the same marketing campaigns. (refer to Appendix 1). The coding system worked and the results provided insightful data, so the research was expanded to 25 marketing campaigns.

Table 1

Techniques / Campaigns	Garage	Womance	GirlCrush Gar	YogaJean Der	Urban Outffiters
Colour psychology					
Reflects brand/clothing	0	1	1	0	0
Reflects emotion	0	0	1	0	1
Words					
Reflects brand/clothing	0	0	1	1	0
Reflects emotion	0	0	0	0	1
Narration	1	0	0	0	1
Sounds					
Reflects brand/clothing	0	0	0	0	0
Reflects emotion	0	0	0	0	0
Music					
Reflects brand/clothing	0	1	0	0	0
Reflects emotion	0	0	0	0	0
Popular trends	0	0	1	0	0
Celebrities					
Catch our attention	0	0	0	0	0
Related to the clothing	0	1	1	0	0
Social media influencers	0	0	0	1	0
Data					
Presents a need	0	0	0	0	0
Presents the advantages	0	0	0	0	0
Interesting location					
Social media	0	0	1	1	0
Television	0	1	0	0	0
Others	0	0	0	0	0
Composition					
Focal point	1	1	0	1	0
Rule of thirds	1	0	0	0	0
The golden mean	0	0	0	0	0
Visual path	0	0	0	0	0
Typography					
Resemble shapes/objects	0	0	0	0	0
Deeper meaning	0	0	0	0	0
Body language	1	0	0	0	1
Association					
Feelings	1	0	1	1	1
Ideas	0	0	0	0	0
Places	1	0	0	0	1
Nostalgia	0	0	0	0	0
Symbolism	1	0	0	1	0
Call of emotions	0	0	0	0	0
Pressure to buy	0	0	0	1	0
Client case study	0	0	0	1	0

Twenty-five various marketing campaigns were compiled for the study. The selected data are taken from multiple platforms such as Instagram, Tik Tok and the web and varies from small boutiques to large corporations. All the data are from fashion stores found in the province of Quebec. Additionally, they target women between the ages of 15 and 25 years old. The list of marketing campaigns and samples from some of them can be found in Appendix 2. All the data relating to the study was manually coded. The process is elaborated using various steps. First, the same Excel spreadsheet was reused and incorporated every company name associated with the campaigns at the top (Appendix 3). Second, each campaign were individually analyzed related to a specific technique. For example, if a campaign "A" used colour psychology to attract viewers to the emotion, then the number one was written in its appropriate cell (Appendix 3). On the other hand, if campaign "A" did not have any music or sound, a zero was written in its appropriate cell. This was a lengthy process, but very rewarding and impressive in the end.

Results

The frequency of the marketing techniques was calculated overall by adding the results for each campaign (see Appendix 4). In each row, I added the results (Appendix 4). An example of the formula for the fourth row (colour psychology that reflects brand/clothing): = SUM(C4:AA4). After completing this task for all the rows, another column dedicated to the ranking was added (Appendix 4). Then, they were manually ranked from the highest frequency to the lowest (Appendix 4). This step was very rewarding as it showed a concrete answer for the analysis. To illustrate the results in the most optimal way, two different graphics were created. The first one presented below the excel spreadsheet is a bar chart which accurately and efficiently highlights the results (Table 2). The second one is a colour-coded pie chart to show proportions and comparisons between categories (Table 3). Furthermore, analyzing in more details the top five criteria (the most important and powerful results) is crucial to understand the research and its impact on digital marketing.

Table 2

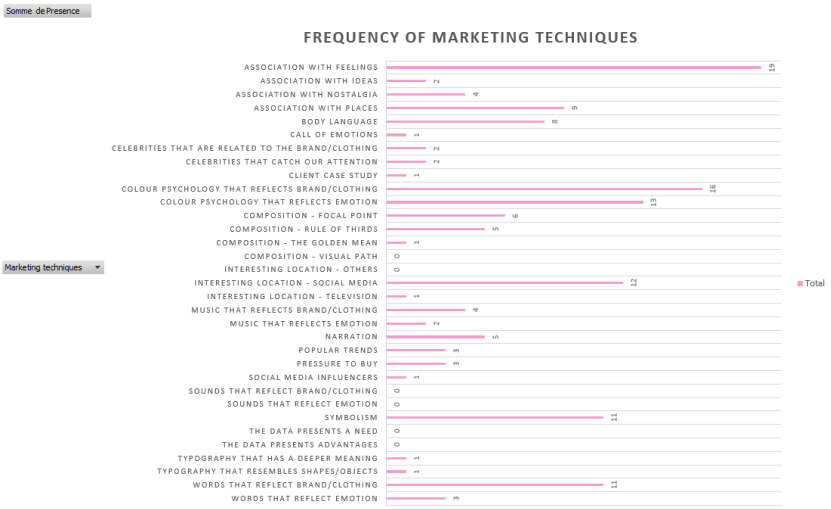
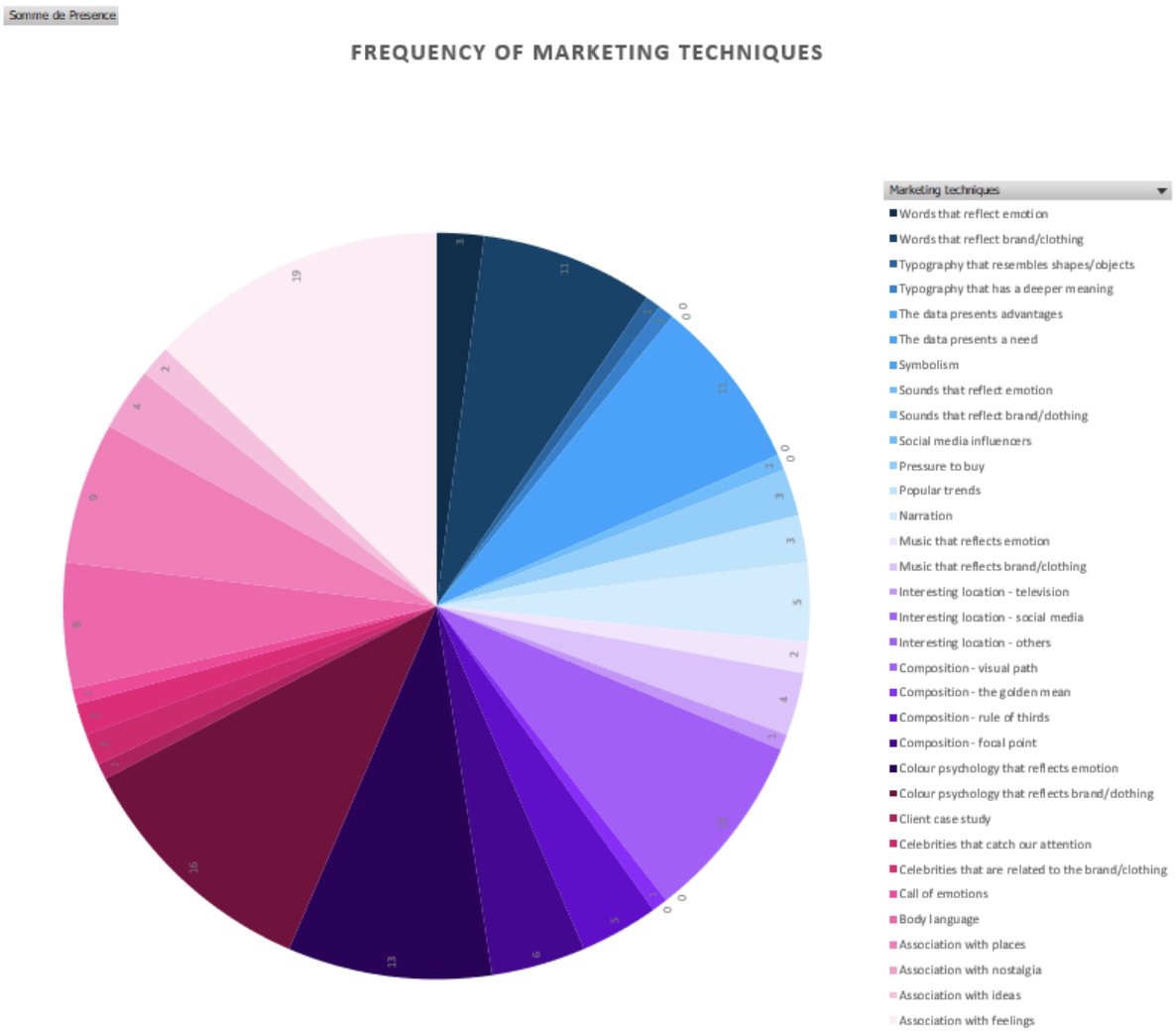


Table 3



Ranking:

1. Association with feelings (19)
2. Colour psychology that reflects brand/clothing (16)
3. Colour psychology that reflects relevant emotions (13)
4. Interesting medium – social media (12)
5. Words that reflect brand/clothing & Symbolism (11)
6. Association with places (9)
7. Body language (8)
8. Composition – Focal Point (6)
9. Narration & composition – rule of thirds (5 each)
10. Music that reflects brand/clothing & association with nostalgia (4 each)
11. Words that reflect emotion, popular trends & pressure to buy (3 each)
12. Music that reflects relevant emotion, celebrities that catch our attention, celebrities related to the clothing/brand & association with ideas (2 each)

13. Social media influencers, interesting medium – television, composition – the golden mean, typography that resembles shapes/objects, typography with deeper meaning, call of emotions & client case study (1 each)
14. Sounds that reflect brand/clothing, sounds that reflect emotion, data that presents a need, data that presents the advantages, interesting medium – other & composition – visual path (0)

1. Association with feelings (19)

Association is the cognitive phenomenon where an object, image, thoughts or other is connected to something related. For example, I associate the beach with summer and vacation, as there are no “real” beaches in Montreal, so it is only accessible while on vacation elsewhere, most of the time during the warm season (summer). In the research, one of the most important marketing techniques is the association with feelings. While the concept of feelings is much more abstract, it is defined as an emotional and physical experience (The Difference Between Feelings and Emotions, n.d, para 4). The association with feelings represents a state of mind that we can relate to a specified feeling, either visually or by sound. For example, a thick and soft textile could be associated with warmth and comfort like we can see in Girl Crush Gang.

2. Colour psychology that reflects brand/clothing (16)

Colour psychology is “the study of colors in relation to human behavior” (Ferreira, 2019, para. 2). An example of this phenomenon would be associating green with nature, “harmony, tranquility [and] peace” (Green: Color Psychology, Symbolism and Meaning, n.d, para 2). A colour that reflects the brand and/or the clothing was the second most used marketing technique in the research. Another example would be if a company used neutral colours to highlight the modern and fresh aspects which the brand identifies with, like we can see in Simons’ campaign.

3. Colour psychology that reflects relevant emotions (13)

Similarly to the previous marketing techniques, the concept of colour psychology is used again but its purpose is to highlight relevant emotions. Emotion is defined as a state with three elements: “a subjective experience, a physiological response, and a behavioural or expressive response” (Emotions and Types of Emotional Response, 2022, para. 2). Together, they result in colour psychology that reflects relevant emotion. For example, orange in a marketing campaign could mean that the clothing brings joy and enthusiasm (Colour Psychology, n,d, para. 5), like we can see on H&M’s campaign. It differentiates from the second category by not directly hinting at the company or the clothing (ex: how it looks or how it’s made).

4. Interesting medium – social media (12)

As technology has evolved, social media has taken more and more space in our daily lives. Companies have also realized the power of social media to achieve their entrepreneurial goals. Compared to the traditional web with websites, social media implements itself easily in our lifestyles. It can increase profit through refined algorithms, the new accessibility social media offers, and interactions with comments and direct messages while increasing viewing potential by a large number of users on social media (The Power of Social Media Marketing, 2020, para. 7). As the fourth most used marketing technique in this study, social media clearly has a large impact and presence, especially on popular platforms like Instagram, Facebook, Tik Tok and several more. Additionally, social media has a large impact on young individuals as 97% of teens are on social media (Mayo Clinic Staff, 2022, para. 1). Social media is an interesting medium as it has a lot of profit monetarily and can easily reach the right individuals.

5. Words that reflect brand/clothing & Symbolism (11)

Whether a word is written or spoken, they have power. Also referred to as a "power word", they can be defined as words to generate "psychological or emotional response" (Brayfield, 2019, para. 2). Words (or power words) reflect the brand and /or the clothing when they allude to something, whether it is material to the value of the company. For example, the words "prenez l'air" or "get fresh air" alludes to the act of going outside during the summer, when the temperature is comfortable, leading to the idea that the clothing are not heavy and meant to be worn outside in the warm weather Symbolism can be defined as "the representation of one thing for another using a person, object, or idea" (What is Symbolism? Definition, Examples of Literary Symbolism, n.d, para 1). While symbolism is everywhere, we can most definitely observe it in marketing campaigns to increase accessibility and to pass a deeper message to the viewers, especially to be unique (Symbolism in Marketing, 2011, para 1). For example, if a marketing campaign included a fireplace, it would lead us to believe that the clothing is warm and made to be worn in winter, like in the Yoga Jean Denim campaign.

Discussion of results

In a study targeting Italian luxury brands Gucci and The Bridge, the authors focused on the social media activities of the two brands, analyzing their content individually on their respective Facebook and Twitter pages (Ananda et al., 2015, p.1). They emphasized more the context or purpose of the social media activity rather than the content of the advertising campaign itself. While I looked at the content itself, we both found that companies (or The Bridge in their research's context) wanted to regularly showcase their brand and values on social media, which is why colour psychology and words that reflect brand/clothing are top in my ranking (p.8). We both saw a

trend with The Bridge and my study with narration (especially holidays or vacations) (Ananda et al, 2015, p.9). While they did notice the pressure to buy the clothing with links, I did not observe as much abundance of this technique. They observed many celebrities and influencers, which I surprisingly did not observe much of, and they separated the two social media platforms they used (Facebook and Twitter). Similarly, Putranto et al. (2019) also analyzed a specific medium; while they do not study the fashion industry, they take a closer look at the tourism activity in the Atlantis Land Surabaya, in the Indonesia island of Java. They found that social media was the main marketing pathway to attract tourists, especially younger individuals who constitute most users. They particularly like to showcase their "brand-identity" with artistic pictures of the park, use "hashtags" and connect with visitors' posts on Instagram (Putranto et al., 2019, p.3-4). I also observed a similar effect in the study with the words that reflected the brand, association with places and the medium (social media, mostly Instagram) which are all in my top 6 results (Yoga Jean Denim, Urban Outfitters, Twik and American Eagle), but I did not observe much connection between brand and consumers in my research. Another study that explored social media is Shamsudeen Ibrahim & Ganeshbabu (2018) who found that 80% of "business executives" highlighted the importance of social media in their marketing plans resulting in increasing profits (p.112). They also included the importance of images and email marketing (Shamsudeen Ibrahim & Ganeshbabu, 2018, p.124). Compared to my study, 12 out of 25 marketing campaigns used social media like Instagram and Tik Tok (48%) but most companies are present on the internet (top 4 in my study). In my research, all marketing campaigns include images/pictures which represent their importance but without any email. Instead of pictures, Peric, Radojevic & Slijepcevic (2020) highlight the importance of videos with statistics that indicate that 87% of professionals use YouTube as a marketing platform and other social media/medium (p.36). While it is not specified in my coding criteria, there is the music, sound, and medium component, which are found in videos. Additionally, there are some videos used in my data listing, which shows a certain similarity with their findings (Womance, Zara, H&M, Ardène, Roots, Noize and La Petite Garçonne).

Instead of highlighting a medium to visualize the marketing campaigns like other scholars above, Suleiman et al. (2020) highlights techniques similar to the study I conducted. They found that the "5 W's" (who, what, where, why and when) was the best approach for digital marketing (Suleiman et al.,2020, p.175). Lastly, two independent research studies have resulted in a ranking of digital manifestation. McQuitty, Ritz, & Wolf (2019) have concluded that the most used platform for digital marketing goes as follows: Facebook, personal website, email, other social media, Twitter, SEC, blog, review analytics, e-commerce site, mobile website, and YouTube (p.189). Similarly, Tiago & Verissiomo (2014) have determined that the most popular ways to have a marketing presence on the web are: social media/apps, email, digital ads, viral campaigns, digital brand experiences, mobile, blogs and games (p.706). Both studies have similarities with the research I conducted, as both recognized the importance of social media for companies and look for a ranking (see above at page 5). However, the most important differences with most of the studies evaluated above are the variety of criteria,

they mostly looked at the medium or the purpose; while I individually evaluated campaigns and how they captured our attention, which leads to a difference in results.

Conclusion

As technology has changed our world, marketing can heavily impact your perception and lifestyle. From the increase of accessibility to the increase of presence in our everyday lives with the web, social media and other online platforms affect us more and more. While discussing about social media, young individuals constitute most users. In the same realm, most young individuals have at least one account on social media. An additional criterion for this research was the medium, as seen later in the discussion section, several studies specify a medium. The study determined that association with feelings (19), colour psychology that reflects brand/clothing (16), colour psychology that reflects relevant emotions (13), interesting medium – social media (12), words that reflect brand/clothing & Symbolism (11) were respectively the five most used marketing techniques in the Quebec fashion field addressed to the youth. While this study determines the most popular or most used marketing techniques, it would be highly relevant to study the effectiveness of those same tools to see if companies are making the wrong decision by choosing these popular tools or if these tools are frequently used because they are the easiest to access. To conclude, the most popular marketing techniques used by Quebec clothing stores targeted to young women is to associate their products with a specific feeling.

References

Ananda, A.S., Hernandez-Garcia, A., & Lamberti, L. (2015). *Social media marketing in Italian luxury fashion. Conference Presentation*. https://core.ac.uk/download/pdf/148681971.pdf

Brayfield, A. (2019, June 27th). The Most Powerful Marketing Words Your Small Business Should Be Using. *Crowdspring*.

Ferreira, N. (2019, May 31st). *Color Psychology: How Color Meanings Affect Your Brand*. Oberlo. https://www.oberlo.com/blog/color-psychology-color-meanings

Ganassini, M.G. (2016, December 28th). *60 (+1) Digital Marketing Quotes to Inspire Your Strategies*. MailUp. https://blog.mailup.com/2016/12/digital-marketing-quotes/

Mayo Clinic Staff. (2022, February 26th). *Teens and social media us: What's the impact?* Mayo Clinic. https://www.mayoclinic.org

McQuitty, S., Ritz, W., & Wolf, M. (2019). Digital marketing adoption and success for small businesses: The application of the do-it-yourself and technology acceptance models. *Journal of Research in Interactive Marketing, 13*(2), 179-203.

Peric, N., Radojevic, I., & Slijepcevic, M. (2020). Considering Modern Trends in Digital Marketing. *Marketing, 51*(1), 34-42.

Putranto, T.D., Susilo, D., Riyadi, S., & Arnawati Sufa, S. (2019). Digital Marketing Strategies to Boost Tourism Economy: A Case Study of Atlantis Land Surabaya. *Humanities & Social Sciences Reviews, 7*(5), 468-473. https://doi.org/10.18510/hssr.2019.7553

Shamsudeen Ibrahim, S.A., & Ganeshbabu, P. (2018). A Study on the Impact of Social Media Marketing Trends on Digital Marketing. *Shanlax International Journal of Management, 6*(S1), 120-125. https://doi.org/10.5281/ zenodo.1461321

Suleiman, M.I.Y., Bin Muhammad, N., Yahaya, I.S., Adamu, M.A., & Sabo, A.U. (2020). Benefits and Challenges: For Marketing Strategies On-Line. *European Journal of Molecular & Clinical Medicine, 07*(03),164-179. https://ejmcm.com/article_1505_57afb6807136e8f18c9a30f183a73179.pdf

Symbolism in Marketing (2011, February 28th). McCauley Marketing Services. Retrieved May 16th, 2022, from https://www.mccauleyadvertising.com.

The Difference Between Feelings and Emotions. (n.d) Wake Forest University. Retrieved May 15th, 2022, from https://counseling.online.wfu.edu/blog/difference-feelings-emotions/

The Power of Social Media Marketing. (2020, July 17th). St. Thomas University. Retrieved May 15th, 2022, from https://online.stu.edu/articles/business/the-power-of-social-media-marketing.aspx#:~:text=Social%20media%20can%20be%20used,Social%20media%20marketing%20strengthens%20sales.

Tiago, M.T.P.M.B. & Verissiomo, J.M.C. (2014) Digital marketing and social media: Why bother? *Business Horizons, 57*(6), 703-708. http://dx.doi.org/10.1016/j.bushor.2014.07.002

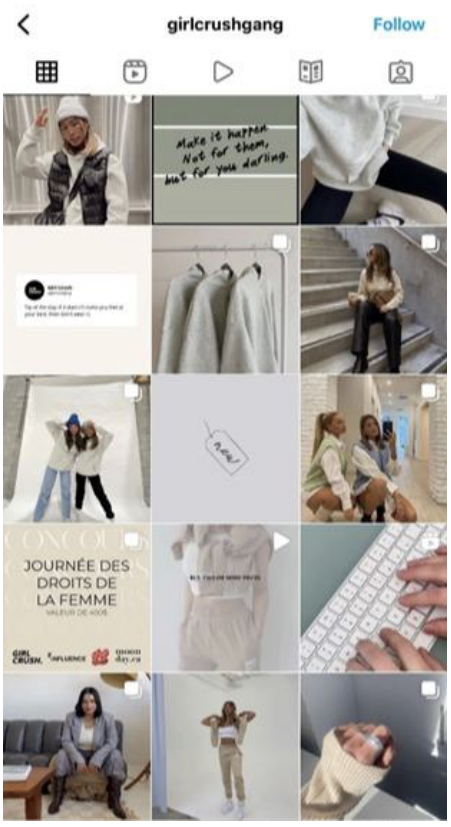
Appendix

Appendix 1 – Pre-test samples

Garage Clothing (Summer 2018)

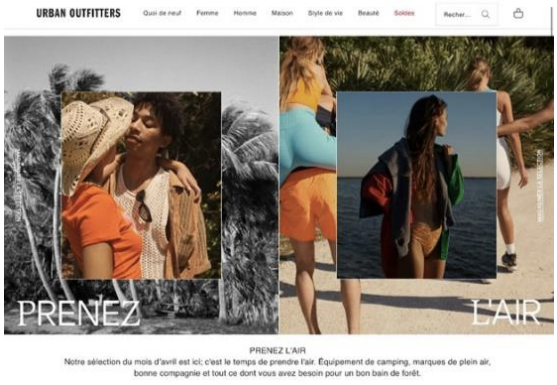
Womance (2017) - https://drive.google.com/file/d/1fXQC0uozx7SL0GJHnXdPdtfEnBtGVnCK/view?usp=sharing

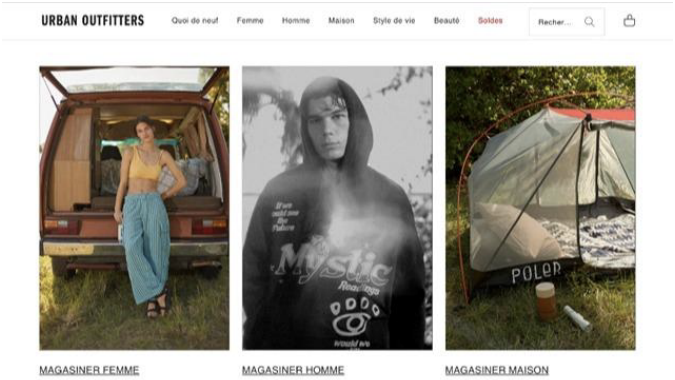
Girl Crush Gang (March 2022)



Yoga Jean Denim (December 2021)

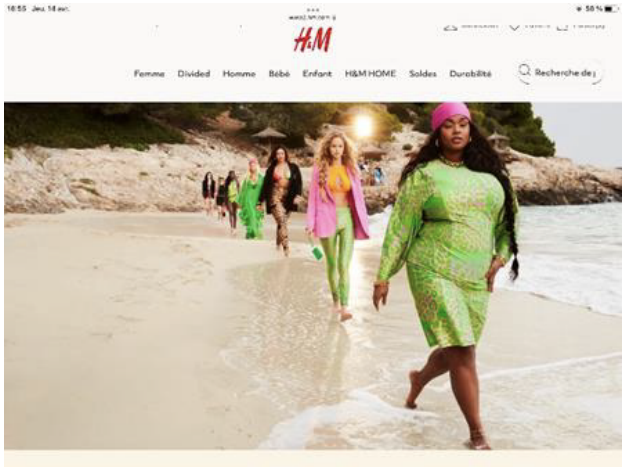
Urban Outfitters (Spring 2022)





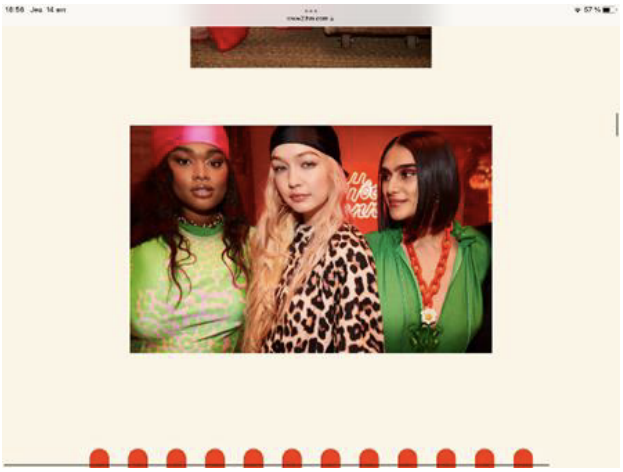
Appendix 2 – List of marketing campaigns and samples

H&M – sample campaigns



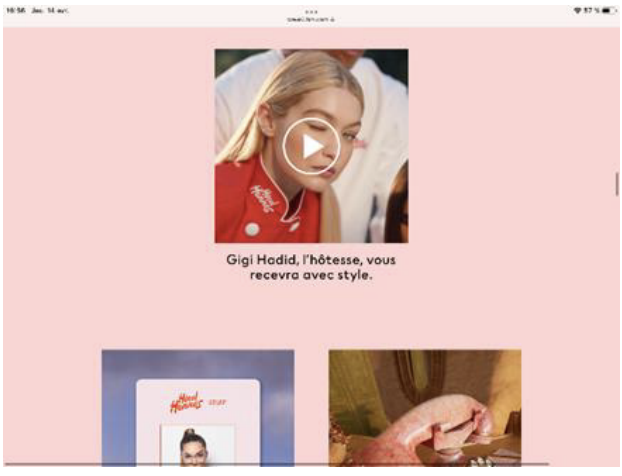

BIENVENUE À
L'HÔTEL
HENNES

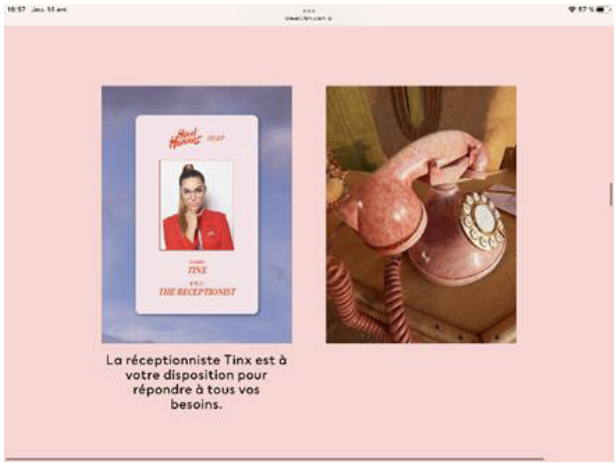

L'hôtel Hennes est une destination de rêve où tout est possible. Les personnages les plus intéressants rendront votre séjour mémorable : imaginez Gigi Hadid à la réception, Donté Colley vous offrant le soin parfait et les filles les plus branchées qui vous invitent à un karaoké.

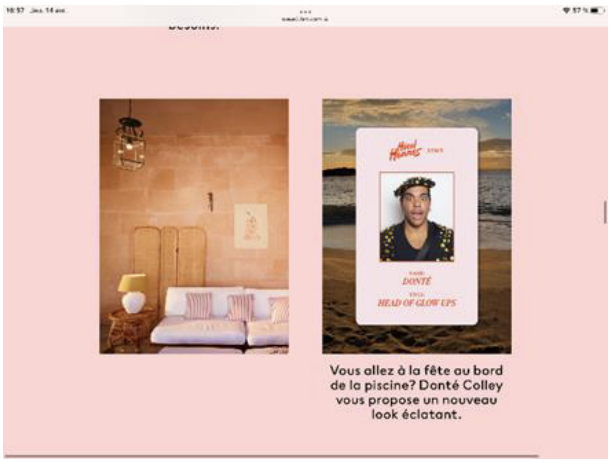


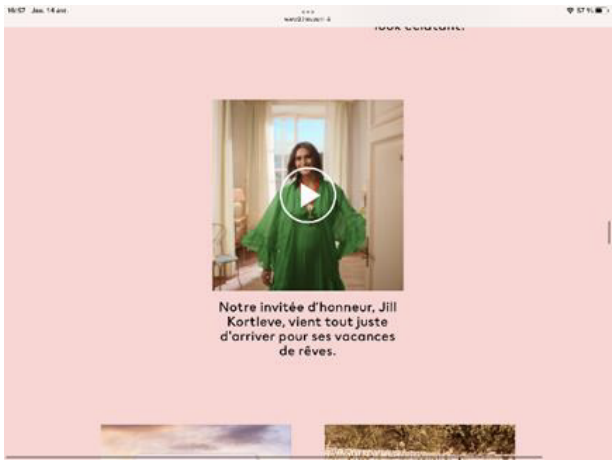

CINEMA
Regardez le film réalisé par Bardia Zeinali et suivez le parcours de notre personnage principal alors qu'elle accueille les invités à l'Hôtel Hennes.

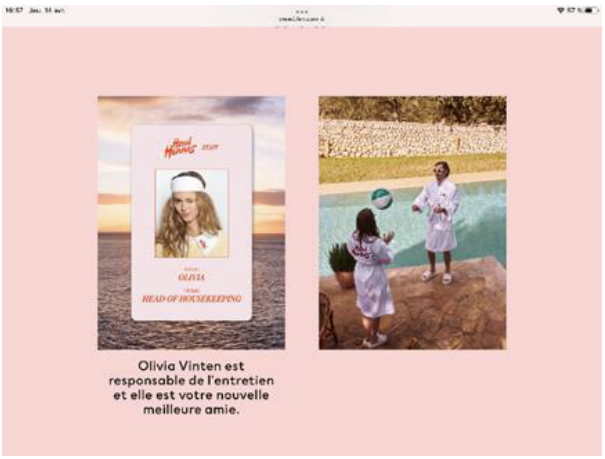

RENCONTREZ
L'ÉQUIPE
L'équipe de rêve qui fera en sorte que votre séjour à l'Hôtel Hennes soit digne des réseaux sociaux.


Gigi Hadid, l'hôtesse, vous recevra avec style.









List of marketing campaigns

1. H&M

2. Atelier New Regime

3. Aritzia

4. Dynamite 5. Zara - https://vm.tiktok.com/ZMLVdCD8W/

6. Twik

7. Simons

8. Noble

9. Reckless Minds

10. American Eagle

11. Winners

12. Guess 13. Noize: https://drive.google.com/file/d/1XXRQutBh7pslpUbXHqBOjdQuCP0fLY1d/view?usp=sharing

14. Gap

15. Reformation 16. Ardène - https://www.youtube.com/watch?v=elBnjPqmO-U 17. Roots - https://vm.tiktok.com/ZMLbDAbhL/

18. The Bay

19. Mélanie Boutique 20. La Petite Garçonne - https://vm.tiktok.com/ZMLbDKrWN/

Appendix 3 – The Use of Marketing Techniques

Techniques / Campaings	Garage	Womance	GirlCrush (	YogaJean	Urban Outf	H&M	Atelier	Aritzia	Dynamite	Zara	Twik	Simons	Noble	Reckless	AE	Winners	Guess	Noize	Gap	Reformatio	Ardène	Roots	The Bay	Mélanie	LPG
Colour psychology																									
Reflects brand/clothing	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	1	1	1	1
Reflects emotion	0	0	1	0	1	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1
Words																									
Reflects brand/clothing	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	0
Reflects emotion	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Narration	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Sounds																									
Reflects brand/clothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reflects emotion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Music																									
Reflects brand/clothing	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Reflects emotion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Popular trends	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Celebrities																									
Catch our attention	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Related to the clothing	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Social media influencers	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Data																									
Presents a need	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Presents the advantages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interesting location																									
Social media	0	0	1	1	0	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	0	1	1
Television	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Composition																									
Focal point	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Rule of thirds	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
The golden mean	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Visual path	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Typography																									
Resemble shapes/objects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Deeper meaning	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Body language	1	0	0	0	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1
Association																									
Feelings	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	0
Ideas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Places	1	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	1	0
Nostalgia	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Symbolism	1	0	0	1	0	0	0	1	0	0	1	0	1	0	1	1	1	0	0	0	0	1	1	1	0
Call of emotions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Pressure to buy	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Client case study	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 4 – The Frequency of Marketing Techniques

Techniques / Campaings	Garage	Womance	GirlCrush	YogaJean	Urban Out	H&M	Atelier	Aritzia	Dynamite	Zara	Twik	Simons	Noble	Reckless	AE	Winners	Guess	Noize	Gap	Reformatic	Ardène	Roots	The Bay	Mélanie	LPG	Results	Rank
Colour psychology																											
Reflects brand/clothing	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	1	1	1	1	16	2
Reflects emotion	0	0	1	0	1	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1	13	3
Words																											
Reflects brand/clothing	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	0	11	5
Reflects emotion	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	3	11
Narration	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	5	9
Sounds																											
Reflects brand/clothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Reflects emotion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Music																											
Reflects brand/clothing	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4	10
Reflects emotion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	12
Popular trends	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	11
Celebrities																											
Catch our attention	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	12
Related to the clothing	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12
Social media influencers	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13
Data																											
Presents a need	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Presents the advantages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Interesting location																											
Social media	0	0	1	1	0	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	0	1	1	10	4
Television	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Composition																											
Focal point	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	6	8
Rule of thirds	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5	9
The golden mean	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13
Visual path	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Typography																											
Resemble shapes/objects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	13
Deeper meaning	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	13
Body language	1	0	0	0	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	8	7
Association																											
Feelings	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	1	1	0	19	1
Ideas	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2	12
Places	1	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	1	0	9	6
Nostalgia	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	4	10
Symbolism	1	0	0	1	0	0	0	1	0	0	1	0	1	0	1	1	1	0	0	0	0	1	1	1	0	11	5
Call of emotions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	13
Pressure to buy	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	11
Client case study	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13

Climate change adaptation plan: Observed and foreseen impacts of climate change on Kawawachikamach Naskapi territory

Étienne Sigouin

BIO GRA PHY

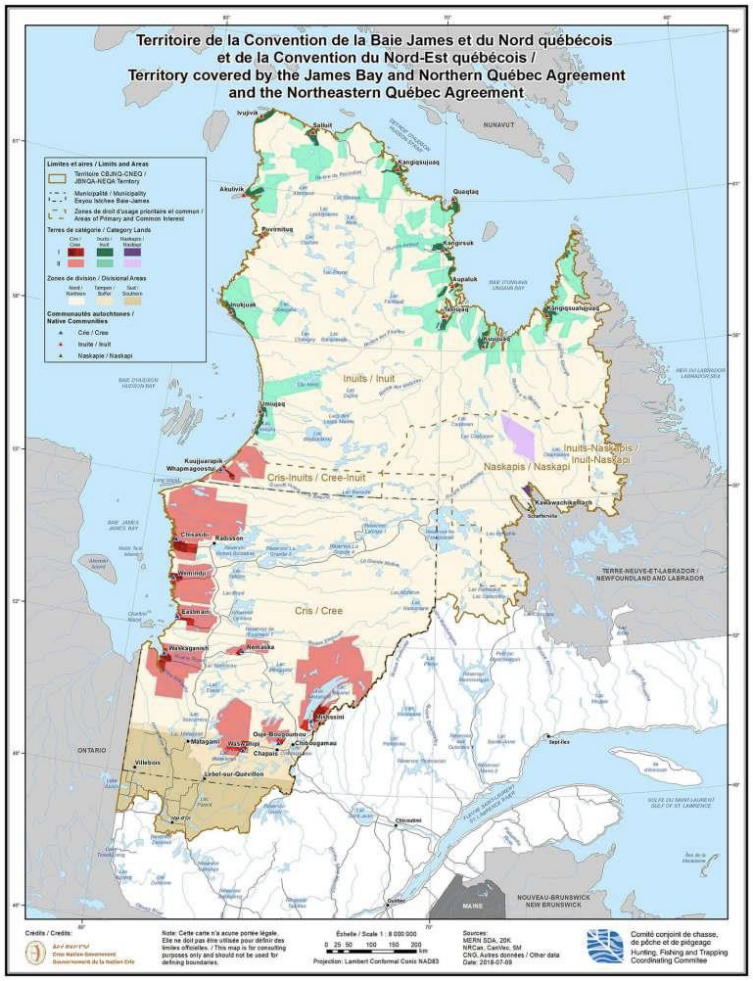
While studying international administration at Collège International Sainte-Anne, Étienne kept himself involved in various ecological projects with research and conservation objectives, as part of his functions as a conservation officer for Héritage Laurentien. Having noticed first hand the changes in the local ecology of the Saint-Lawrence riverside, he grew increasingly curious about the ecological ramifications of climate change, something which he knew to pose a serious threat to much of the biodiversity he stood alongside regularly. With the collaboration of the business management consultant firm Atmacinta Inc., he had the perfect opportunity to further develop his knowledge of this important issue and contribute meaningfully, working as an intern on the layout of a climate action plan, with a focus on the effects of climate change on both the ecology and humans themselves. Now a student of HEC Montréal in business administration, Étienne hopes to one day contribute to the fields of commerce and ecology in tandem, having seen how their respective interests can align rather than clash.

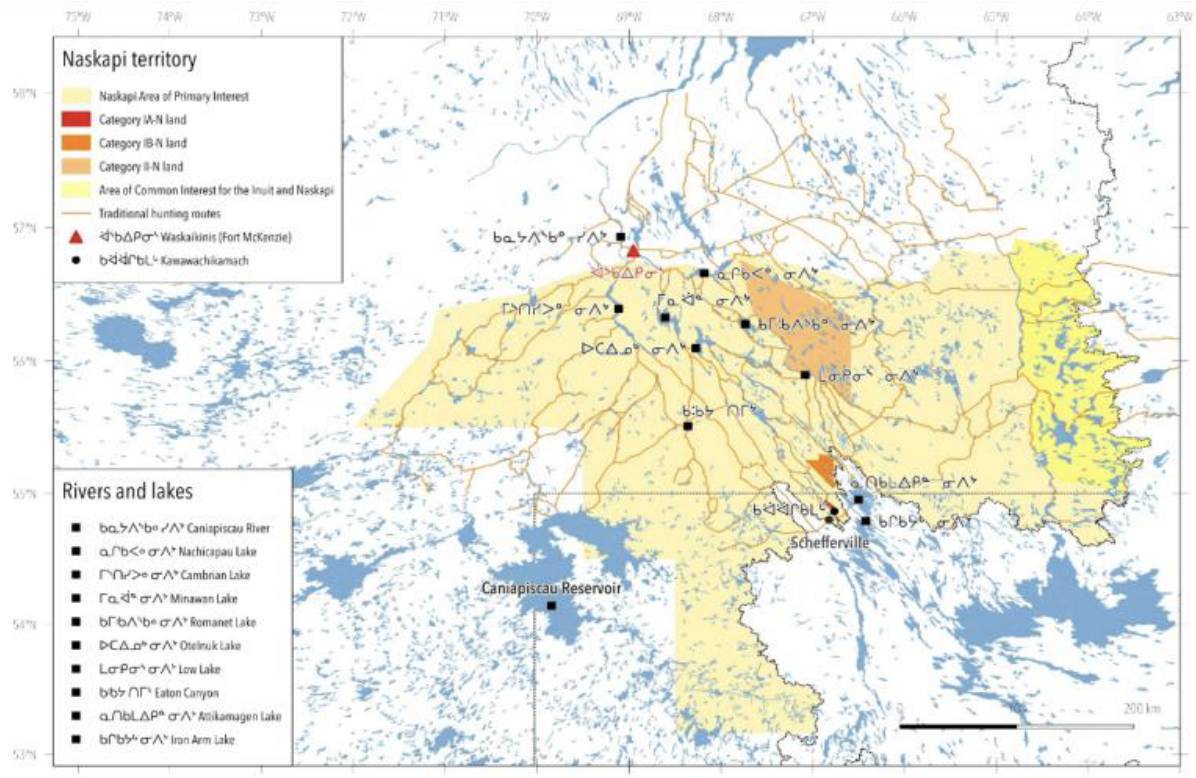
Climate change adaptation plan: Observed and foreseen impacts of climate change on Kawawachikamach Naskapi territory

With the collaboration of Atmacinta Inc. and the Naskapi Nation of Kawawachikamach

Climate change is suspected to have greatly altered the territory and land use of the Naskapi Nation of Kawawachikamach (NNK), which saw great variations in game animal populations, notably migratory caribou (90%+ decrease in 30 years), which it has historically hunted for subsistence. Given that climate change is accentuated the closer you get to the poles, its impact is drastic in the region. What could a change in climate entail for a small population of 1400, living nearby the forest tundra, where winters are known for their colds? While such a question might draw more questions than answers, a clear response comes through the drawing of baseline observed and foreseen effects of climate change, a stepping stone to the implementation of a Naskapi Climate Action Plan, the first of its kind in Quebec. Dressing a past and future climatic portrait for a location for which very limited data exists is challenging. Analysis of past climate trends for 2 reference points central to Naskapi history: Schefferville and Kuujjuaq for the time period (1948-2022) and examination of literature on projected climate change shows climate trends to have been stable from the late 1940s to the early 1990s, before a surge in climate trend severity, which is projected to hold steady in at the very least our near and medium future, with effects most pronounced in summer and winter. Pairing this with the examination of environmental changes for comparable time periods allows to assert the effect of the former on the latter. Results disproportionately point towards a specific direction: steady loss of known ecological conditions point in Naskapi are occurring at a significant pace, one that plants, mammals and birds cannot follow; in other words, in the Far North, climate moves faster than living organisms can, thus we need to move faster than climate can.

Keywords: Naskapi, climate change, First Nations





Retrieved from: https://native-land.ca/maps/territories/naskapi/

Introduction

The Naskapi nation of Kawawachikamach (NNK), with its approximately 1400 members, inhabits a vast territory located in northeastern, subarctic and arctic Quebec, stretching from the 50th to the 58th parallel (although population numbers are most concentrated near the village of Kawawachikawach, 15th km north east of Schefferville near the 55th parallel). By their own accounts, the community experiences the effects of climate change on a regular basis, phenomena which render the practice of traditional food gathering (big game, small game and waterfowl hunting, trapping, fishing, picking) and often consequential land use and travel precarious (Weiler et al, 2009; Mameaskum et al., 2014). Notably, the declining health of the George River caribou herd population is a significant point of concern for the Naskapis, as they have long depended on this caribou herd for their livelihood, something that still reflects today in their cultural identity and way of life (Weiler, 2009; Mameaskum, 2014; Chaumond & Maillhot, 2017b). Effectively, the George River Herd has seen a 99% decrease in population from 1993-2020 (823 000 to 8100) (Rasiulus, 2015; Department of Fisheries, Forestry and Agriculture of Newfoundland and Labrador & Gestion de la Faune du Nord-du-Québec, 2020, 9:30). Its hunting was banned in 2013 (Environment and conservation Newfoundland-Labrador, 2013).

To this date, little has been done at the community level to address climate change (NNK, 2022). Presently, the NNK is seeking to change that, as exemplified by the Development of a Naskapi Climate Action Plan it proposed to the Ministère de l'environnement et des changements climatiques du Québec on January 14th 2022. Still in its initial development phase, the plan includes as objective the identification of observed and foreseen impacts of climate change, an important research need which enables the identification of priority actions in the context of an eventual Climate Change Adaptation Plan (one of the expected outcomes of the development of a Naskapi Climate Change Action Plan).

We here thus aim to lay out the baseline regarding the observed and projected effects of climate change on Naskapi territory. Such effort includes reviewing existing literature and databases, then synthesizing and analyzing such information while providing indications for further research where needed. The chosen paper structure goes as follows: general methodology setting general orientation, followed by distinct categories representing different areas of research; 1. historical and projected development of climate change; 2. the effects of climate change on vegetation, land cover, soil & infrastructure; and 3. its effects on the fauna. Besides the general methodology, each category contains its own literature review, detailed methodology, results and discussion of results, given varying research context and processes.
Given the nature of the Naskapi climate action plan, the noted effects of climate change will be geared towards the land use by Naskapi.

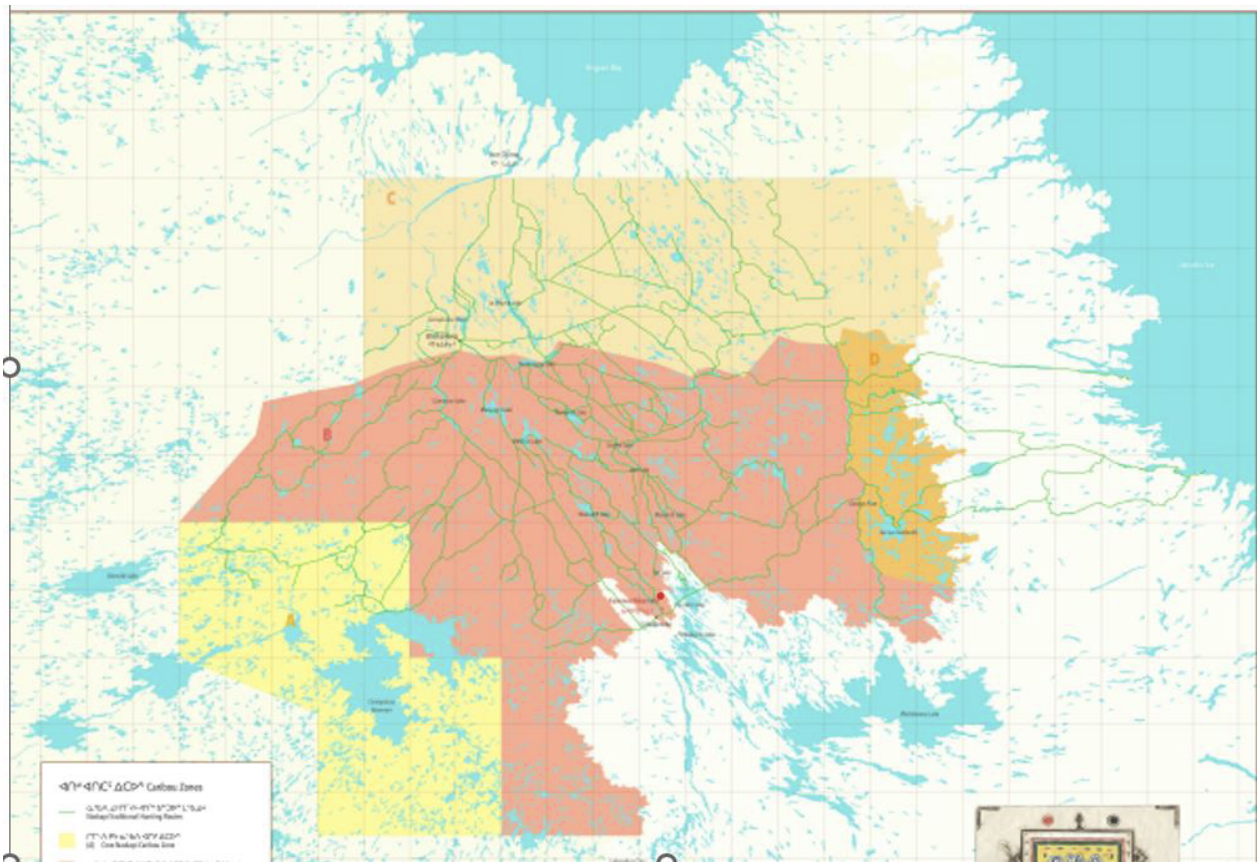
General Methodology

This section summarizes the rationale behind the chosen approaches, further detailed information regarding “research category” specific methodology can be found at their respective sections.

Area of study

The NNK concentrates its activities near the village of Kawawachikamach. However, certain activities, such as caribou hunting and other food gathering related practices, are carried out throughout the traditional Naskapi territory or “Naskapi sector”. Thus, in order to display a complete portrait of the effects of climate change on Naskapi land and its usage, the study area was set to match the area of the “Naskapi sector”, with an increased focus on the Schefferville-Kawawachikamach-Lac John area.

Figure 1: Naskapi sector, caribou zones and hunting routes



Source : Development of a Naskapi Climate Change Action Plan Proposal

General Approach

While significant literature on observed and especially predicted climate change in Northern Quebec exists (Climate Atlas of Canada, 2018; Government of Canada, 2022; Chaumond & Maillhot, 2017b), information specific to the range of Naskapi land use is scarce and rather imprecise. Similarly, literature on the environmental and human effects of climate change is relatively rich (Chaumond & Maillhot, 2017a) yet lacks specificity in regards to its effect on the NNK and its area of primary interest (fig. 1).

Thus, this paper will attempt to bring more information about the Naskapi land in general and the impact of climate change on it in particular by combining existing information with projected climate and environmental trends. Doing so highlights the effects of climate change in terms of environmental change for a specific territory that needs to be thoroughly explored (ex: the existing literature, in a fauna context is caribou-centric and provides limited information in respect to population of other fauna (small mammals, fish and avian species)). Combining climate data with environmental data allows us to draw possible conclusions in terms of the effect of climate on Naskapi territory even though such literature for a specific environment variable does not exist, insofar as there is extensive literature detailing a relation between a climate variable for which data exists on Naskapi sector and a certain effect of climate change/ environmental change (geographical and biotrophic barriers may apply).

Such approach proceeds as follows:

1. Review, report and analyze the existing information concerning the observed and foreseen climate change trends applicable to the Naskapi sector.

a) Collect climate data from the Environment Canada Historical Climate Database (ECHCD) for meteorological variables where data is sufficient to quantify the occurrence or not of change over the available historical data period (1948- March 2022) for the following locations, collected at meteorological stations that geographically correspond to more of less the southern and northern limits of Naskapi land use: Schefferville Airport and Kuujjuaq Airport.

b) Organize results derived from the data retrieved from the ECHCD to show the evolution of 9 climate variables (mean temperature, max temperature, minimum temperature, difference in daily temperature (max-min), precipitation levels (solid, liquid and total), snow cover and average maximum speed of wind gusts) over the 1948-2022 time period. Results are expressed under the form of monthly averages – this allowed to control for seasonality and its influence on climate fluctuations. Such results are exemplified using graphs and tables showing trends over time, produced with the statistical software Stata (see section xx).

c) Collect data from trusted sources in the projection of climate change in Quebec which present projected trends for different climate variables at a local level by downscaling climate projections of reliable predictive climate models using emission scenarios RCP 4.5 and 8.5 (Climate Atlas of Canada, 2018; Chaumond & Maillhot, 2017b). Such information is to be presented under the form of tables showcasing the projected evolution of climate for the Schefferville and Kuujjuaq areas, under 2 emission scenarios (RCP 4.5 and 8.5) as well as different future time periods.

2. Review and report on the existing literature regarding the effects of climate change expressed as environmental changes (fauna, flora, soil) and altered land use prospects. While the reported literature was intended with Naskapi land use in mind, it was designed to be as encompassing as possible due to the time and resource constraints.

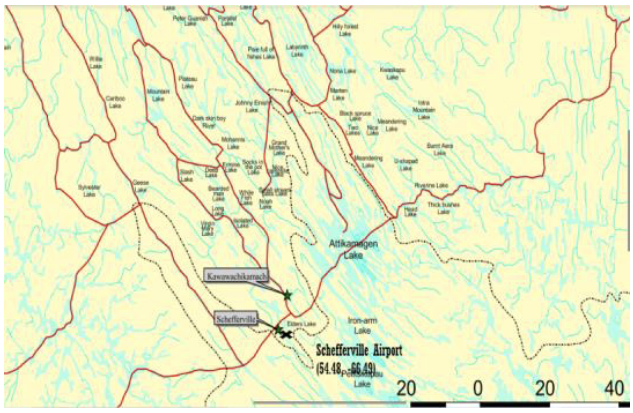
Historical and foreseen climate change on Naskapi territory

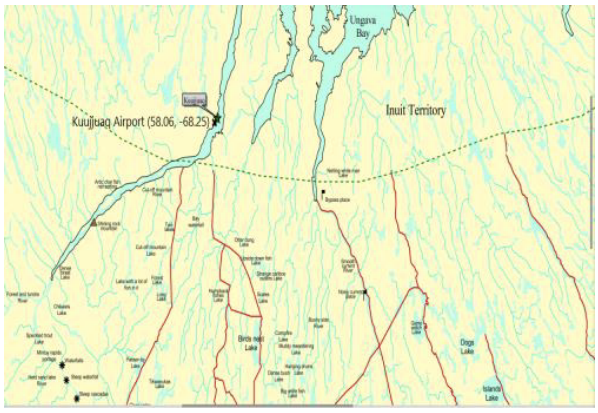
Historical Climate Change overview

By all accounts, climatic variation has been significant in the arctic and subarctic Quebec in the recent past, a trend which is believed to exacerbate within the end of this century (Mameamskum, 2014;Chaudmont and Mailhot, 2017a; Berteaux et al. 2018, Climate Atlas of Canada, 2018). While climate change is global in nature, it is believed that northern regions, due to polar amplifications and the role of ice and snow on earth's albedo, see amplified climate change in comparison to the global average, with meteorological data showing Nunavik experiencing climate change as up to 2x faster than the rest of Quebec (McBean et al. 2005; IPCC, 2014; Berteaux et al. 2017; Chaumond & Maillhot, 2017b). While the northernmost and coastal regions of Nunavik, most subject to such drastic changes are mostly out of the range of Naskapi territory, the "polar effect" on climate amplification still seems to apply. Above all, temperature warming, a growing season, higher levels of total precipitation but lower levels of snow are the changes highlighted by most (Charron, 2017; Chaumont & Mailhot, 2017; Berteaux et al. 2018). While such changes have affected the local ecosystems (Christensen et al. 2013; Gagon et al. 2018), it also invariably affected what humans could draw from such resources (Berteaux et al. 2018).

While sources of information detailing past climate change in Northern Quebec exist, their available forms are hardly precise enough for analysis of variations as they typically only present 30 or 40 year averages, lacking information about more precise trends. Thus, it was deemed appropriate to perform data collection and analysis to obtain detailed information in regards to climate change on Naskapi territory, given that the existing historical meteorological and climate data (Environment Canada, 2022) allows this at 2 locations/meteorological stations meaningful to Naskapi territory; the Schefferville Airport, situated about 15km southwest of Naskapi village Kawawachikamach, which roughly represents the climatic conditions found in the southern range of Naskapi territory; and the Kuujjuaq airport, located on the east coast of Koksoak river, on Inuit grounds, remains near northern Naskapi routes that reach the Koksoak river. Such location roughly corresponds to the northernmost range of Naskapi territory, while also being characteristic of the bioclimatic conditions preferred by the Naskapi's traditional food source, the migratory caribou (Jenny & Krey, 2003) (more details in section 5.1).

Figure 2: Schefferville and Kuujjuaq airport/meteorological stations location on/near Naskapi territory - source: Naskapi Nation of Kawawachikamach





Historical climate change data analysis methodology

In order to present an accurate portrait of the evolution of climate change over time, the time period retained for collection of climate data was maximized (goes as far back as Environment Canada's past weather and climate historical database allows for): January 1949-March 2022 for the Schefferville Airport site and March 1947-March 2022 for the Kuujjuaq airport site (table 1). As mentioned, such data is available publicly, courtesy of Environment Canada. Given that we only attempt to assess the evolution of historical climate trends at both locations, different period ranges for the 2 locations do not pose problems.

Climate and Weather variables (table 2) chosen to perform analysis using the statistical software Stata 17.0 were variables where a change was theorized to affect the environment as well as Naskapi land use. Data under its daily form was converted to monthly averages for all months included in the time period. This allows easy gathering and visualization of monthly results for x variable (ex: Schefferville Airport, Mean Temperature, July 1949-2021) and its trend over the chosen period.

Table 1: data provenance

Note: read as (time period, coordinates, meteorological station climate id)

Kuujjuaq Airport	Schefferville
1947-March 2014, 58.06, -68.25, 7113534	1949-Sept. 1993*, 1995-2006, 54.48, -66.49, 7117825
April 2014-March 2022, 58.0522, -68.2520, 7113535	2007-2017, 54.48, -66.48, 7117827
	2008-March 2022, 54.4819, -66.4819, 7117823

*From Oct 1993-Dec. 1994, data is missing for Schefferville Airport location, dates under this missing range are not taken into account.

All data retrieved from : https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

Table 2: climate variables selected for analysis

Climate variable (monthly data)	Kuujjuaq A. (1947-2022)	Schefferville A. (1949-2022
Avg. Daily Mean Temperature (°C)	Yes	Yes
Avg. Daily Max. Temperature (°C)	Yes	Yes
Avg. Daily Min. Temperature (°C)	Yes	Yes
Avg. Daily Temperature variation (Max. Temp. - Min. Temp.) (°C)	Derived from Min and Max Temp.	Derived from Min and Max Temp.
Total liquid precipitations (mm)	yes*	yes*
Total solid precipitations (cm) Note: 1 cm solid precipitation equivalent to 1 mm liquid precipitations	yes*	yes*
Avg. daily Snow Cover (cm)	Yes	Yes
Avg. daily Max. Wind Gust (km/h)	unavailable	Yes
Growing degree days (at 0 celsius)	Yes	Yes
Warm degree days (21.5 celsius) For heating purposes	No	Yes

*Variables for which the years (2000-2018) Kuujjuaq and (1993-2012) Schefferville were estimated using the total precipitation data adjusted for min. and max. temperature using the occurrence of liquid or solid precipitations depending on temperature for the years where liquid and solid precipitations data existed.

Historical climate change results

Intent here is to obtain results in terms of change in x climate variable, expressed as average year to year change for a given month across the periodic range. For instance, if the coefficient of yearly change is 0.1°C for the month of January for Mean Temperature, this means that over the periodic range (ex: 1947-2022), temperatures on average increased by 0.1°C yearly for the month of January.

To arrive to such means the following formula was estimated by ordinary least square regression, which was used to calculate all monthly trends for all climatic variables:

$$y_{it} - (b_i + a_i t) = r\left(y_{i\,t-1} - (b_{i-1} + a_{i-1} t)\right) + e_{it}$$

The formula was designed as such in order to minimize the effect of prior month values for x climatic variables. $a\ it$ corresponds to the yearly change for x climatic variable where i = month and t = year.

Historical results Kuujjuaq Airport

Note:

- Coefficient = average yearly change for the periodic range (1947-2022).
- Months where the coefficient of average yearly change is statistically significant at p<0.05 arehighlighted in yellow.

Table 3: Mean Temperature

MeanTempC	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
1	0.0262373	0.0212047	1.24	0.216	-0.0153232	0.0677978
2	0.0045425	0.0194065	0.23	0.815	-0.0334936	0.0425785
3	0.0102833	0.0213774	0.48	0.63	-0.0316157	0.0521823
4	0.0240893	0.0188836	1.28	0.202	-0.012922	0.0611006
5	0.0233882	0.0140265	1.67	0.095	-0.0041033	0.0508796
6	0.017345	0.0092953	1.87	0.062	-0.0008735	0.0355634
7	0.0221124	0.006304	3.51	0	0.0097568	0.0344679
8	0.0333365	0.0058	5.75	0	0.0219688	0.0447042
9	0.0219073	0.0059031	3.71	0	0.0103375	0.0334771
10	0.0290708	0.0097814	2.97	0.003	0.0098996	0.0482419
11	0.0154087	0.0111108	1.39	0.165	-0.0063681	0.0371854
12	0.028599	0.0196596	1.45	0.146	-0.0099332	0.0671311

Table 4: Max Temperature

MaxTempC	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	0.0239607	0.0211976	1.13	0.258	-0.0175858	0.0655072
gam2	0.0056277	0.0196381	0.29	0.774	-0.0328624	0.0441177
gam3	0.0182787	0.0202275	0.9	0.366	-2.14E-02	0.0579238
gam4	0.0275652	0.0159475	1.73	0.084	-0.0036913	0.0588217
gam5	0.0342815	0.0162602	2.11	0.035	0.0024121	0.066151
gam6	0.0241616	0.0122177	1.98	0.048	0.0002153	0.0481079
gam7	0.0232749	0.0077987	2.98	0.003	0.0079898	0.03856
gam8	0.0420795	0.0072834	5.78	0	0.0278044	0.0563546
gam9	0.0281186	0.0074622	3.77	0	0.0134929	0.0427443
gam10	0.0312978	0.01063	2.94	0.003	0.0104634	0.0521322
gam11	0.0118698	0.0101334	1.17	0.241	-0.0079913	0.031731
gam12	0.0250425	0.019304	1.3	0.195	-0.0127925	0.0628776

Figure 3: Statistically significant temperature increase for September in Kuujjuaq. (yearly average change = 0.0219073 degrees or +1 celsius degree every 45.64 years. For August, it would be +1 degree every 33 years).

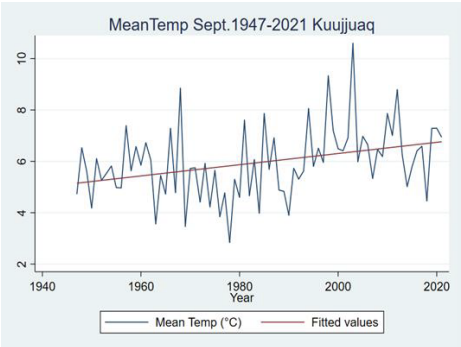


Figure 4: Statistically significant Monthly avg. Max Temp. July 1947-2021 (coefficient = 0.0232749)

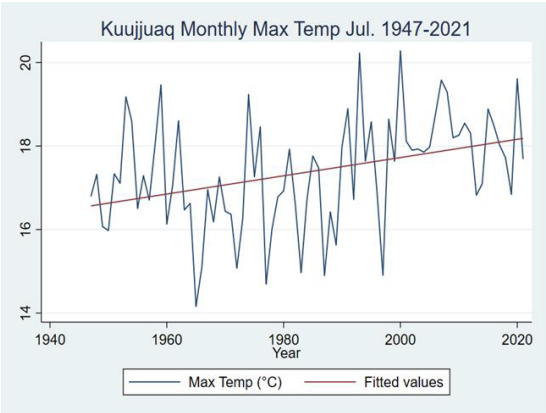


Table 5: Total liquid precipitations

TotalRainmm	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.0038663	0.0054958	-0.7	0.482	-0.0146379	0.0069054
gam2	0.0033286	0.0044652	0.75	0.456	-0.0054231	0.0120802
gam3	-0.0009644	0.0043267	-0.22	0.824	-0.0094445	0.0075157
gam4	0.0403569	0.0227471	1.77	0.076	-0.0042266	0.0849403
gam5	-0.031281	0.06461	-0.48	0.628	-0.1579142	0.0953522
gam6	0.1145378	0.104991	1.09	0.275	-0.0912407	0.3203164
gam7	0.4223669	0.1325612	3.19	0.001	0.1625518	0.6821821
gam8	0.189798	0.1571089	1.21	0.227	-0.1181299	0.4977259
gam9	0.5544239	0.1307023	4.24	0	0.2982522	0.8105956
gam10	0.2264893	0.1033474	2.19	0.028	0.0239321	0.4290465
gam11	0.022111	0.0310814	0.71	0.477	-0.0388074	0.0830293
gam12	0.0126117	0.0215205	0.59	0.558	-0.0295678	0.0547911

Table 6: Total solid precipitations

TotalSnowcm	Coefficient	Std. err.	Z	P>z	[95% conf.	interval]
Month						
gam1	0.0105263	0.1027601	0.1	0.918	-0.1908797	0.2119324
gam2	-0.0838748	0.1167583	-0.72	0.473	-0.3127169	0.1449673
gam3	0.0204637	0.0775768	0.26	0.792	-0.1315839	0.1725114
gam4	0.0713741	0.0603552	1.18	0.237	-0.0469199	0.189668
gam5	0.0591665	0.0627681	0.94	0.346	-0.0638568	0.1821897
gam6	-0.03449	0.0318554	-1.08	0.279	-0.0969254	0.0279455
gam7	-0.0004918	0.0063117	-0.08	0.938	-0.0128625	0.011879
gam8	-0.0043795	0.0037985	-1.15	0.249	-0.0118244	0.0030653
gam9	-0.0890585	0.0420758	-2.12	0.034	-0.1715256	-0.0065914
gam10	-0.1235647	0.0793333	-1.56	0.119	-0.2790552	0.0319257
gam11	0.0963386	0.0867252	1.11	0.267	-0.0736397	0.2663168
gam12	-0.0404637	0.1026974	-0.39	0.694	-0.2417468	0.1608194

Figure 5: Monthly total rain (mm) (coefficient = 0.5544239)

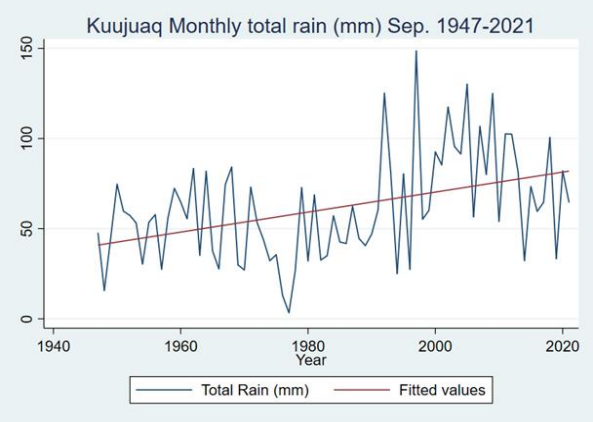


Figure 6: Avg. Monthly snow precipitations (cm), sept. 1947-2021. Coefficient = -0.0890585

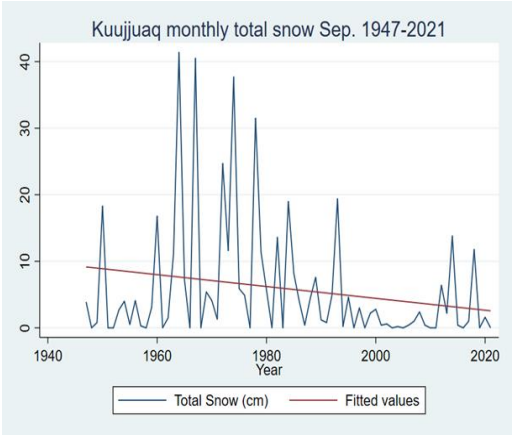


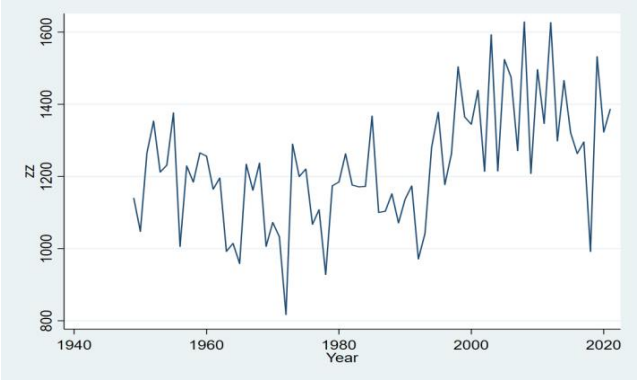
Table 7: Average Snow Cover

SnowonGrndcm	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.6021007	0.0985624	-6.11	0	-0.7952795	-0.4089218
gam2	-0.8486508	0.0984418	-8.62	0	-1.041593	-0.6557083
gam3	-0.8546616	0.1161275	-7.36	0	-1.082267	-0.6270559
gam4	-0.8894646	0.1296284	-6.86	0	-1.143532	-0.6353977
gam5	-0.3204963	0.1169065	-2.74	0.006	-0.5496288	-0.0913638
gam6	-0.021256	0.0915116	-0.23	0.816	-0.2006153	0.1581034
gam7	-0.0049349	0.0641844	-0.08	0.939	-0.1307339	0.1208641
gam8	-0.0034387	0.0449151	-0.08	0.939	-0.0914707	0.0845933
gam9	-0.0041711	0.0314506	-0.13	0.894	-0.0658131	0.0574709
gam10	-0.044719	0.0311612	-1.44	0.151	-0.105794	0.0163559
gam11	-0.116337	0.0510369	-2.28	0.023	-0.2163674	-0.0163066
gam12	-0.3754043	0.0661878	-5.67	0	-0.5051301	-0.2456785

Table 8: Average difference daily temperature (max-min)

D	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
gam1	-0.0049876	0.005736	-0.87	0.385	-0.0162299	0.0062546
gam2	0.0019751	0.0054636	0.36	0.718	-0.0087334	0.0126836
gam3	0.0159082	0.0067266	2.36	0.018	0.0027243	0.0290921
gam4	0.0058069	0.0083463	0.7	0.487	-0.0105516	0.0221654
gam5	0.0221753	0.0079994	2.77	0.006	0.0064967	0.0378539
gam6	0.0136606	0.0072604	1.88	0.06	-0.0005696	0.0278908
gam7	0.0018239	0.0049156	0.37	0.711	-0.0078105	0.0114582
gam8	0.0172784	0.005714	3.02	0.002	0.0060791	0.0284776
gam9	0.0125122	0.0042899	2.92	0.004	0.0041042	0.0209202
gam10	0.004919	0.0047989	1.03	0.305	-0.0044867	0.0143246
gam11	-0.0070726	0.0045113	-1.57	0.117	-0.0159145	0.0017693
gam12	-0.0073247	0.004923	-1.49	0.137	-0.0169737	0.0023243

Figure 7: Yearly Growing degrees at 0 celsius (Kuujjuaq)



Historical results Schefferville Airport

Table 9: Maximum Temperature Schefferville

MaxTempC	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
month						
gam1	0.0142205	0.0195142	0.73	0.466	-0.0240268	0.0524677
gam2	-0.0083541	0.019591	-0.43	0.67	-0.0467518	0.0300436
gam3	0.0000478	0.0164229	0	0.998	-0.0321404	0.032236
gam4	0.0103076	0.0139427	0.74	0.46	-0.0170195	0.0376347
gam5	0.033429	0.0148996	2.24	0.025	0.0042263	0.0626318
gam6	0.0146079	0.0128097	1.14	0.254	-0.0104987	0.0397144
gam7	0.0161909	0.0078254	2.07	0.039	0.0008535	0.0315284
gam8	0.0453429	0.0087729	5.17	0	0.0281484	0.0625374
gam9	0.0384211	0.0091796	4.19	0	0.0204294	0.0564128
gam10	0.0278868	0.0124473	2.24	0.025	0.0034904	0.0522831
gam11	0.0133058	0.0104472	1.27	0.203	-0.0071704	0.033782
gam12	0.0253466	0.0176757	1.43	0.152	-0.0092971	0.0599903

Table 10: Average Mean Temperature

MeanTempC	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
month						
gam1	0.0129599	0.0209444	0.62	0.536	-0.0280904	0.0540101
gam2	-0.0143901	0.0204381	-0.7	0.481	-0.0544481	0.0256679
gam3	-0.01497	0.0186357	-0.8	0.422	-0.0514952	0.0215552
gam4	-0.0002051	0.0181253	-0.01	0.991	-0.03573	0.0353197
gam5	0.02225	0.0136128	1.63	0.102	-0.0044306	0.0489306
gam6	0.0081706	0.0110443	0.74	0.459	-0.0134759	0.029817
gam7	0.0138518	0.0063637	2.18	0.03	0.0013791	0.0263244
gam8	0.0384867	0.0073297	5.25	0	0.0241208	0.0528526
gam9	0.0288346	0.0078304	3.68	0	0.0134872	0.0441819
gam10	0.0284766	0.0111991	2.54	0.011	0.0065267	0.0504264
gam11	0.0150084	0.0111737	1.34	0.179	-0.0068917	0.0369085
gam12	0.0287018	0.0188021	1.53	0.127	-0.0081497	0.0655533

Table 11: Average Minimum Temperature (°C)

MinTempC	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
month						
gam1	0.0117226	0.0228816	0.51	0.608	-0.0331245	0.0565697
gam2	-0.0200187	0.0219904	-0.91	0.363	-0.0631191	0.0230817
gam3	-0.0303472	0.0216763	-1.4	0.162	-0.0728319	0.0121376
gam4	-0.0102324	0.0227456	-0.45	0.653	-0.054813	0.0343481
gam5	0.0111946	0.013347	0.84	0.402	-0.014965	0.0373543
gam6	0.0017034	0.0102971	0.17	0.869	-0.0184786	0.0218854
gam7	0.0107979	0.0057104	1.89	0.059	-0.0003942	0.0219901
gam8	0.0313394	0.0067758	4.63	0	0.0180592	0.0446196
gam9	0.0196682	0.0067141	2.93	0.003	0.0065088	0.0328275
gam10	0.0288841	0.0102179	2.83	0.005	0.0088574	0.0489108
gam11	0.0157436	0.0126209	1.25	0.212	-0.0089929	0.0404801
gam12	0.0326805	0.0204598	1.6	0.11	-0.00742	0.072781

Table 12: Average daily temperature variation

d	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
month						
gam1	0.0024285	0.0076645	0.32	0.751	-0.0125937	0.0174507
gam2	0.0116423	0.0080704	1.44	0.149	-0.0041753	0.02746
gam3	0.0303889	0.0092556	3.28	0.001	0.0122483	0.0485295
gam4	0.0211456	0.0107703	1.96	0.05	0.0000362	0.0422551
gam5	0.0224342	0.0079063	2.84	0.005	0.0069381	0.0379303
gam6	0.0129585	0.0065528	1.98	0.048	0.0001154	0.0258017
gam7	0.0054069	0.0050546	1.07	0.285	-0.0044998	0.0153137
gam8	0.014007	0.005897	2.38	0.018	0.0024492	0.0255649
gam9	0.0187539	0.0045519	4.12	0	0.0098322	0.0276755
gam10	-0.0014614	0.0058714	-0.25	0.803	-0.0129693	0.0100464
gam11	-0.0025906	0.0060036	-0.43	0.666	-0.0143575	0.0091762
gam12	-0.0073752	0.0070405	-1.05	0.295	-0.0211743	0.0064239

Figure 8: Daily variation in temperature Schefferville (September 1949-2021)

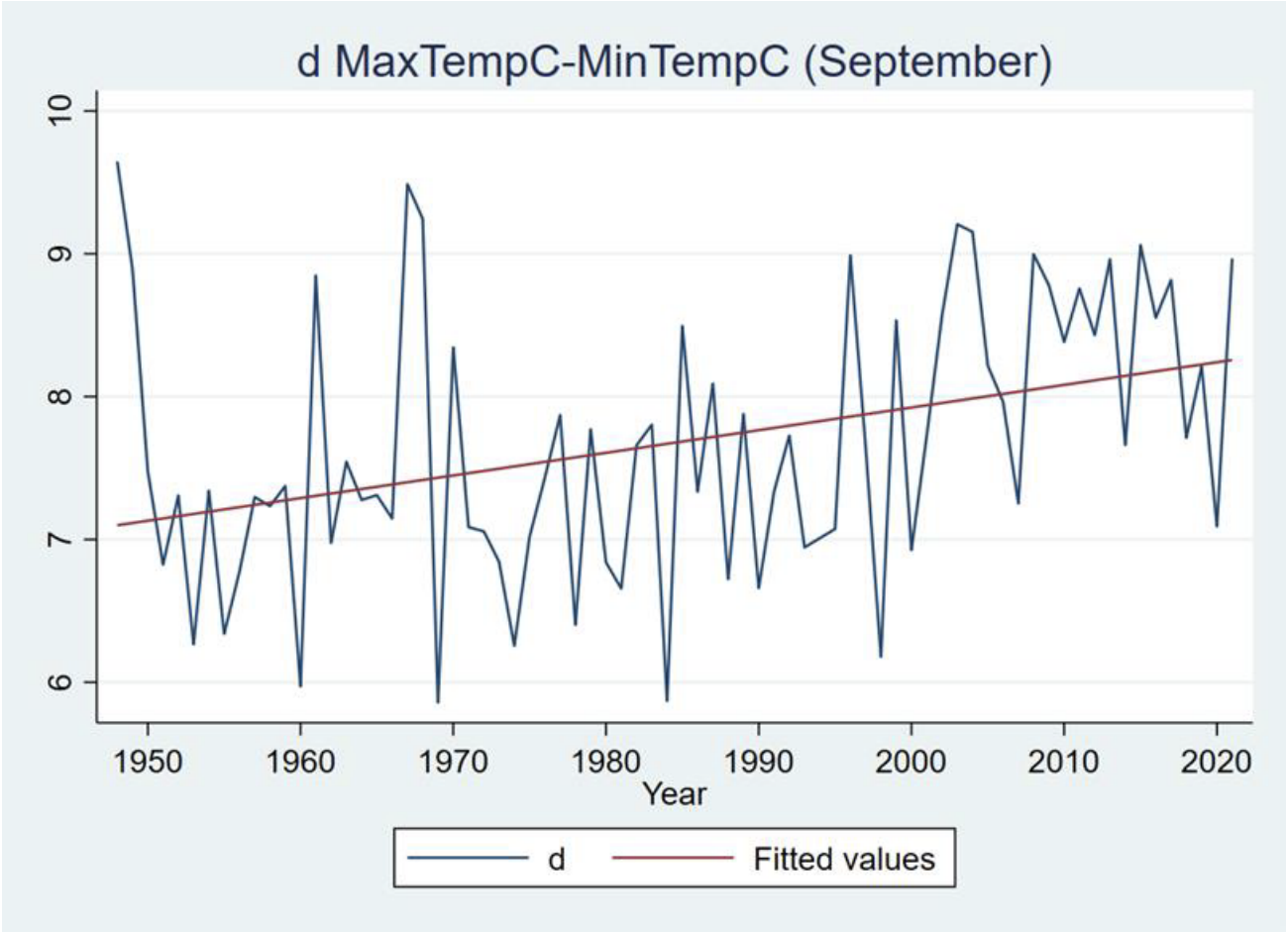


Table 13: Total heat degree days

HeatDegDaysC	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.8266772	0.7119987	-1.16	0.246	-2.222169	0.5688146
gam2	0.1041688	0.6126038	0.17	0.865	-1.096513	1.30485
gam3	0.0845507	0.5762493	0.15	0.883	-1.044877	1.213979
gam4	-0.5313452	0.5895122	-0.9	0.367	-1.686768	0.6240775
gam5	-1.261285	0.5815709	-2.17	0.03	-2.401143	-0.1214269
gam6	-0.5471769	0.3697633	-1.48	0.139	-1.2719	0.1775458
gam7	-0.6263481	0.2179978	-2.87	0.004	-1.053616	-0.1990802
gam8	-1.239217	0.2340474	-5.29	0	-1.697942	-0.7804924
gam9	-1.177666	0.3046039	-3.87	0	-1.774679	-0.5806539
gam10	-1.183899	0.3863441	-3.06	0.002	-1.941119	-0.4266785
gam11	-0.7902822	0.3930892	-2.01	0.044	-1.560723	-0.0198415
gam12	-1.195697	0.7086695	-1.69	0.092	-2.584663	0.1932698

Table 14: Total liquid precipitations (mm)

TotalRainmm	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.0208794	0.028796	-0.73	0.468	-0.0773186	0.0355598
gam2	-0.0020717	0.005986	-0.35	0.729	-0.0138041	0.0096607
gam3	0.0070678	0.0239157	0.3	0.768	-0.0398062	0.0539417
gam4	0.0144083	0.034893	0.41	0.68	-0.0539807	0.0827974
gam5	0.1717203	0.0959327	1.79	0.073	-0.0163043	0.3597449
gam6	-0.2088451	0.1640572	-1.27	0.203	-0.5303912	0.112701
gam7	0.1175283	0.2150004	0.55	0.585	-0.3038648	0.5389214
gam8	0.2303334	0.2304445	1	0.318	-0.2213295	0.6819964
gam9	0.270501	0.1634364	1.66	0.098	-0.0498285	0.5908304
gam10	0.1447236	0.1427009	1.01	0.31	-0.134965	0.4244122
gam11	0.0051247	0.0676739	0.08	0.94	-0.1275138	0.1377631
gam12	0.0526338	0.0512487	1.03	0.304	-0.0478117	0.1530793

Table 15: Total solid precipitations (cm)

TotalSnowcm	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.1837876	0.1395386	-1.32	0.188	-0.4572782	0.0897031
gam2	-0.3160946	0.1260615	-2.51	0.012	-0.5631706	-0.0690186
gam3	-0.2245662	0.1175862	-1.91	0.056	-0.455031	0.0058985
gam4	-0.0032271	0.1256244	-0.03	0.98	-0.2494464	0.2429921
gam5	-0.0569443	0.0796838	-0.71	0.475	-0.2131218	0.0992331
gam6	-0.0633801	0.0547636	-1.16	0.247	-0.1707148	0.0439545
gam7	-0.0011795	0.0163684	-0.07	0.943	-0.0332609	0.030902
gam8	-0.0304157	0.0205054	-1.48	0.138	-0.0706055	0.0097741
gam9	-0.2560898	0.1014507	-2.52	0.012	-0.4549294	-0.0572501
gam10	-0.159955	0.1338252	-1.2	0.232	-0.4222476	0.1023376
gam11	-0.1458279	0.1507322	-0.97	0.333	-0.4412576	0.1496019
gam12	-0.0646136	0.1834485	-0.35	0.725	-0.4241661	0.294939

Figure 9: Total Solid Precipitations February 1949-2022 (Schefferville)

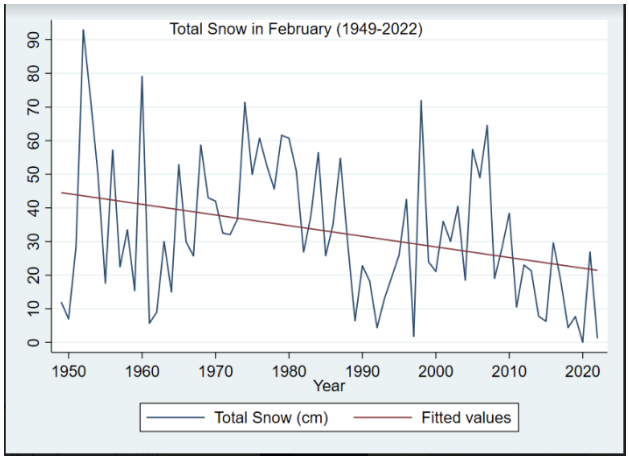


Table 16: Total precipitations (mm)

TotalPreci~m	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.2010543	0.150435	-1.34	0.181	-0.4959015	0.093793
gam2	-0.3174764	0.1242956	-2.55	0.011	-0.5610914	-0.0738614
gam3	-0.2152716	0.1222053	-1.76	0.078	-0.4547895	0.0242463
gam4	0.0126535	0.1379654	0.09	0.927	-0.2577537	0.2830607
gam5	0.1258821	0.1285156	0.98	0.327	-0.1260038	0.377768
gam6	-0.265745	0.1838787	-1.45	0.148	-0.6261405	0.0946506
gam7	0.1612731	0.1983436	0.81	0.416	-0.2274731	0.5500194
gam8	0.2002878	0.2354082	0.85	0.395	-0.2611037	0.6616794
gam9	0.029376	0.1894963	0.16	0.877	-0.3420299	0.4007819
gam10	-0.0026492	0.2063636	-0.01	0.99	-0.4071144	0.401816
gam11	-0.1255184	0.1665257	-0.75	0.451	-0.4519028	0.200866
gam12	-0.008855	0.1808802	-0.05	0.961	-0.3633738	0.3456638

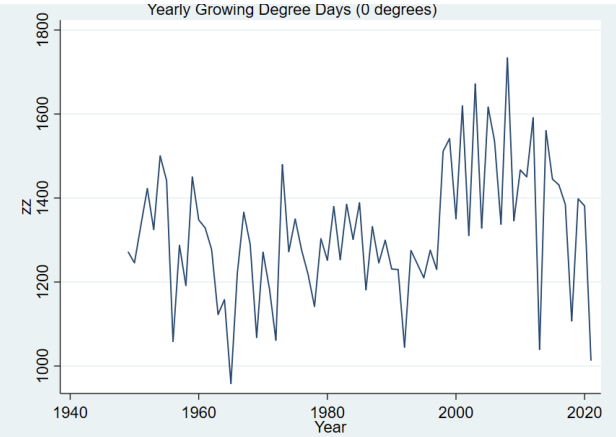
Table 17: Average Snow cover (cm)

SnowonGrndcm	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.4845251	0.1568128	-3.09	0.002	-0.7918726	-0.1771776
gam2	-0.6525293	0.1474231	-4.43	0	-0.9414732	-0.3635854
gam3	-0.6784081	0.1354578	-5.01	0	-0.9439005	-0.4129157
gam4	-0.6111011	0.1508924	-4.05	0	-0.9068448	-0.3153575
gam5	-0.2872539	0.1659102	-1.73	0.083	-0.6124319	0.0379241
gam6	0.0193464	0.1524182	0.13	0.899	-0.2793878	0.3180806
gam7	0.0222009	0.113233	0.2	0.845	-0.1997317	0.2441335
gam8	0.0152798	0.0840884	0.18	0.856	-0.1495304	0.1800899
gam9	0.0105454	0.0627181	0.17	0.866	-0.1123798	0.1334705
gam10	-0.0235506	0.0599424	-0.39	0.694	-0.1410356	0.0939344
gam11	-0.1127046	0.0837611	-1.35	0.178	-0.2768733	0.0514641
gam12	-0.3611197	0.1026739	-3.52	0	-0.5623569	-0.1598825

Table 18: Average speed of max daily wind gust (km/h)

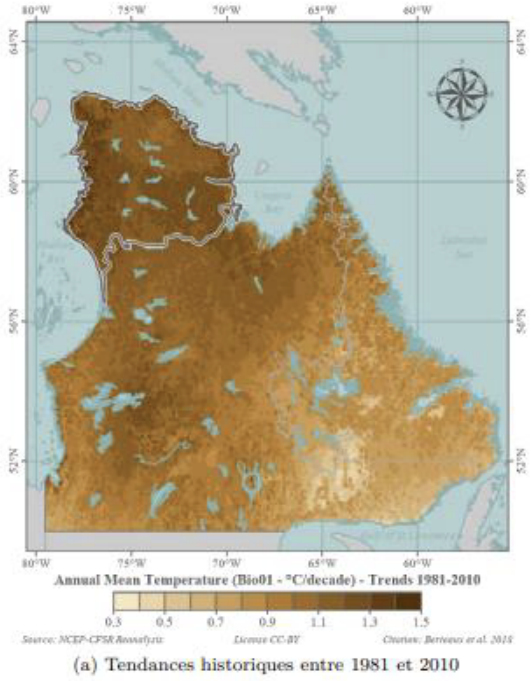
SpdofMaxGust	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Month						
gam1	-0.1773521	0.0392381	-4.52	0	-0.2542574	-0.1004469
gam2	-0.1148416	0.036034	-3.19	0.001	-0.185467	-0.0442163
gam3	-0.1264036	0.0531813	-2.38	0.017	-0.230637	-0.0221702
gam4	-0.111978	0.0390887	-2.86	0.004	-0.1885905	-0.0353655
gam5	-0.1646494	0.037354	-4.41	0	-0.2378619	-0.091437
gam6	-0.134919	0.0351367	-3.84	0	-0.2037858	-0.0660523
gam7	-0.1449405	0.0259765	-5.58	0	-0.1958535	-0.0940275
gam8	-0.1213881	0.0304937	-3.98	0	-0.1811547	-0.0616215
gam9	-0.1196213	0.0332922	-3.59	0	-0.1848729	-0.0543698
gam10	-0.1431897	0.0308038	-4.65	0	-0.2035641	-0.0828153
gam11	-0.158387	0.0351942	-4.5	0	-0.2273663	-0.0894077
gam12	-0.1758715	0.0427126	-4.12	0	-0.2595867	-0.0921563

Figure 10: Yearly Growing degree days at 0 celsius (Schefferville)



Retrieved visualizations

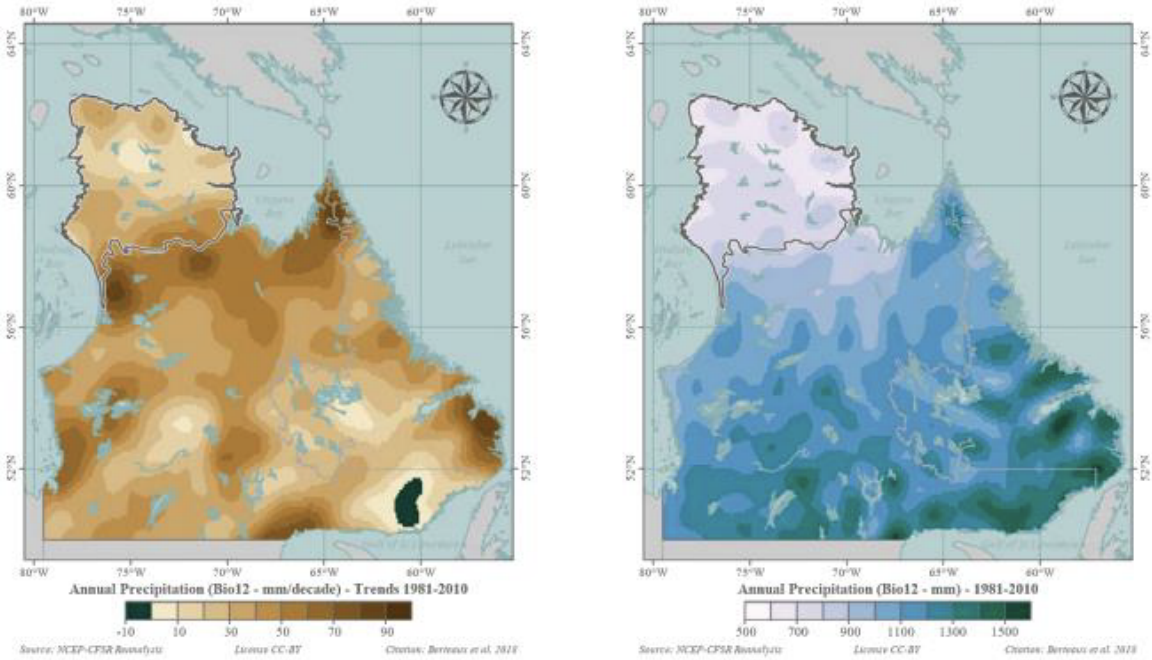
Figure 10.1 Historic climate trend 1981-2010



(a) Tendances historiques entre 1981 et 2010

Source: https://www.ouranos.ca/wp-content/uploads/RapportBerteaux2018.pdf (figure 13)

Figure 10.2 Annual Precipitations (mm)

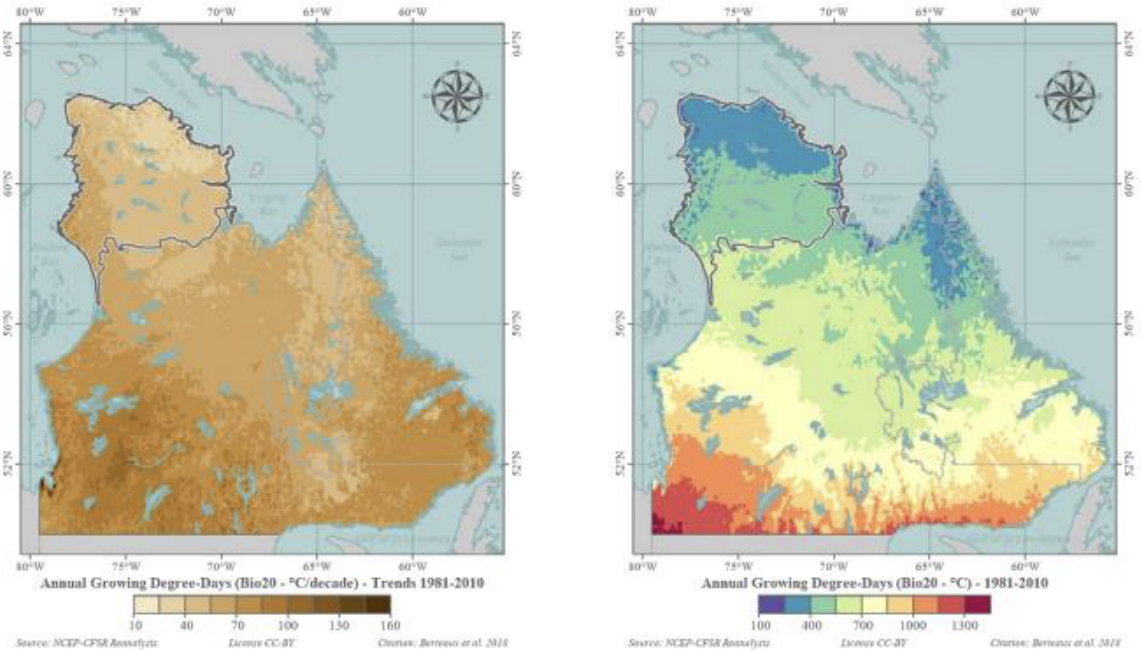


(a) Tendances historiques entre 1981 et 2010 (b) Conditions climatiques pour la période 1981-2010

FIGURE 14 – Précipitations annuelles totales (Bio12)

https://www.ouranos.ca/wp-content/uploads/RapportBerteaux2018.pdf

Figure 10.3: Annual growing degree days



(a) Tendances historiques entre 1981 et 2010 (b) Conditions climatiques pour la période 1981-2010

FIGURE 22 – Degrés-jours de croissance annuel (Bio20)

Source: https://www.ouranos.ca/wp-content/uploads/RapportBerteaux2018.pdf (figure 22)

Discussion of results

Historical data for both Schefferville and Kuujjuaq show changing climate trends, especially pronounced since the 1990s, following a long period (as far back as data availability goes) of relative stability. Such results are consistent with those presented by the scientific consensus regarding climate change in Northern Quebec and Nunavik (or even globally), (Ouranos, 2006; IPCC 5, 2014; Chaudmont & Mailhot, 2017a, p. 8-9) as is the case with most trends shown in our results. However, historical data shows upwards change in temperature to be most significant in summer and early fall, which contrasts the existing literature and local observational surveys which often state winter as "peak climate change, warming season" (Mameamskum, 2014, p.7; Chaudmont & Mailhot 2017a, p.9). The Kuujjuaq location saw on average slightly more statistically significant changes in climate than Schefferville, especially in terms of liquid precipitation increases, which is consistent with the idea that the further north you go, the more pronounced the climate change (Mameamskum, 2014). While liquid precipitation mostly increased in the fall (September, October), it was often at the expense of solid precipitation, due to an uptick in temperature. Overall, the effect remained of an increase in precipitation. Arguably attributable to increased temperatures was the statistically significant loss of average snow cover (November-May Kuuujjuaq, December-April Schefferville, with up to 0.7 cm/year lost over the time period (while solid precipitation levels saw a much smaller decrease). It is possible that such phenomena skews climate change to be seen as a "winter matter" in the 2012 Naskapi survey (Mameamskum, 2014, p. 7) given sensibility of snow conditions (a highly visible meteorological condition) to temperature. Snow cover results were consistent with the 2012 Naskapi survey as well as the Nunavik Climatic Report (Mailhot & Chaumont, 2017a, p. 11) which indicated a lesser period of snow cover (about 30 days later arrival and a 30 day earlier departure).

Other expressed trends in the results include the statistically significant decrease of wind gust speed (between 0.1 and 0.2 average decrease yearly for every month in Schefferville), lesser Heat degree days in the fall indicating warmer temperatures and decreased energy expenditures for heating in Schefferville as well as an increase in growing degree days for both Schefferville and Kuujjuaq. Interestingly enough, figures 9 and 10 show such an increase to have occurred suddenly in the late 90s to early 2000s, with relatively stable plateaus before and after such a period.

Projected climate change on Naskapi Territory

While projecting climate change is far from an exact science, climate models have become increasingly sophisticated and offer insight on how climate might change depending on different greenhouse gas (ghg) emissions scenarios, given that the relation between emission levels and climate change is strong (Crowley & Berner, 2001; Montzka, Dlugokencky & Butler, 2011). Predicting emission levels itself is rather hard, given a panoply of factors to take into consideration (economic development in developing nations, clean energy vs fossil energy

use, trends in human energy consumption, transportation, etc) (IPCC, 2021). As such, climatic models use emission scenarios with different index of radiative forcing levels (a measure of downward directed radiant energy on Earth's surface as a result of mainly ghg emissions reached by 2100, which goes from 1.5 W/m2 or 1.5 RCP (the objective of the Paris Accords) to 8.5W/m2. Most climate models use either the RCP 4.5 or 8.5, the former is seen as a moderate emission scenario where ghg emission levels stabilize in the later half of the 21 st century (Ouranos, 2022) while the later portrays a more extreme, high emissions scenario where co2 and other ghg levels continue to steadily increase in the atmosphere.

The development of climate modeling has enabled projection of climate change on a localized level with the practice of downscaling (Climate Atlas of Canada, 2018, par. 5) while also enabling modeling of past climates where existing sources of climate data are sparse or incomplete, which is the case in most of northern Quebec. Thus, climate projections as well as complementary, modeled, past changes, produced by existing sources will be documented in the following section to offer a broader understanding of climate history and future possibilities on Naskapi territory and its beneficiaries.

Methodology

Two reputable "climate maps" showed climate projections for Naskapi territory (Climate Atlas of Canada, 2018; Chaumond & Maillhot, 2017b). Both databases were found to be of significant interest to the assessment of observed and projected climate change on Naskapi territory; their datasets are complementary (in terms of climate variables covered) yet are uniformized on their methods as both use downscaling of global climate simulations under emissions scenarios RCP 4.5 and 8.5, provided by the Coupled Model Intercomparison Project (CMIP5) (Chaumond & Maillhot, 2017a, 2017, Climate Atlas par. 2-5). As such, both databases will be used complementary through reproduced tables with certain data derivations. A limiting factor for both programs are that only using RCPs 4.5 and 8.5 hardly offers a complete portrait of possible future development of climate change, although such decision is understandable given that the CMIP5 ensemble only includes models based on RCPs 4.5 and 8.5 (as opposed to for example older CMIP3 which included RCP 2.6)

Climate Atlas of Canada (2018, par. 1) uses climate model data and downscaled projections of temperature and precipitation from the Pacific Climate Impacts Consortium (PCIC) to project climate change in Canada on a regional level, including Naskapi territory. Such regional projections are mapped at 10x10 km resolution, although the available online map uses the 1: 250 000 scale (the projections remained scaled at 10x10km from the nearest location point, ex: Schefferville), and use PCIC's Bias Correction with Constructed Analogues and Quantile mapping, Version 2; BCCAQv2, which itself is derived from the (mean of) 24 CMIP5 global models that fall under two emissions scenarios, RCP 4.5 and 8.5 (AR5 standards, IPCC 2014) (Climate Atlas of Canada, 2018, par. 2).

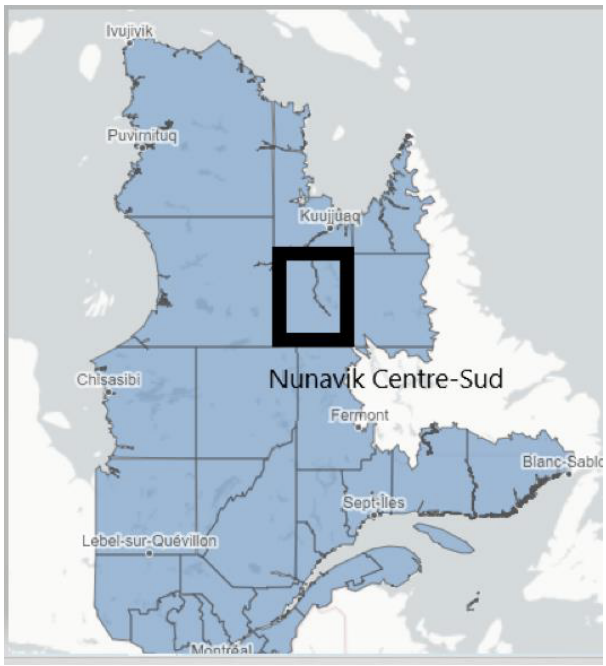
While more than 11 “squares” on the Climate Atlas map cover Naskapi territory, 2 were chosen, with reference points of Schefferville and Saffray Lake (Northern Naskapi territory limit, southeast of Kuujjuaq).

Figure 11: “Schefferville” and “Saffray Lake” squares.

Retrieved from https://climateatlas.ca/map/canada/plus30_2030_85#lat=57.06&lng=-64.18&z=6

For Ouranos’ Climate Portraits map and database (2018), the CMIP5 climate modeling ensemble was also used, this time to carry out cluster analysis in the optic of selection of a subset of simulations (11) using rcp 4.5 and 8.5. It also employed 10x10km grid resolution in the post processing method of 1-d quantile downscaling (Chaumond & Maillhot, 2017a, data source and methods section). The area corresponding to “Nunavik centre-sud” (figure 12) was used for data reproduction as part of this study.

Figure 12: Nunavik Centre-Sud area used for data reproduction



Retrieved from:https://www.ouranos.ca/climate-portraits/#/

Results

Table 19: 2040 and 2070 Horizon projected climate change Schefferville area (10x10km)

RCP 8.5 2040 Horizon

		1976-2005	2021-2050					
RCP 8.5 (high emission scenario)		Mean	10th percentile	change	50th	change	90th	change
Mean Temperature (°C)	annual	-4.1	-3.3	0.8	-1.8	2.3	-0.2	3.9
Mean Temperature (°C)	spring	-6.4	-7	-0.6	-4.4	2	-1.6	4.8
Mean Temperature (°C)	summer	11.3	-11.5	-22.8	13.2	1.9	15	3.7
Mean Temperature (°C)	fall	-1	-0.4	0.6	1.2	2.2	2.8	3.8
Mean Temperature (°C)	winter	-20.7	-20.6	0.1	-17.5	3.2	-14.2	6.5
Precipitation (mm)	annual	777	727	-50	881	104	999	222
Precipitation (mm)	spring	164	109	-55	159	-5	216	52
Precipitation (mm)	summer	261	208	-53	279	18	355	94
Precipitation (mm)	fall	228	189	-39	255	27	328	100
Precipitation (mm)	winter	144	116	-28	166	22	225	81
Hot days (30°C + max) days	anually	0	0	0	1	1	3	3
Cold days (-30°C + min)day	anually	35	30	-5	17	-18	6	-29
Date of first fall frost		15-Sep	11-Sep	-4	23-Sep	8	06-Oct	21
Date of last spring frost		10-Jun	14-Jun	4	02-Jun	-8	17-May	-24
Frost-free season (days)	anually	94	93	-1	110	16	132	38
Icing days	anually	169.6	172	2.4	156.2	-13.4	140	-29.6

RCP 8.5 2070 Horizon

		1976-2005	2051-2080					
RCP 8.5 (high emission scenario)		Mean	10th	change	50th	change	90th	change
Mean Temperature (°C)	annual	-4.1	-1.4	2.7	0.6	4.7	2.5	6.6
Mean Temperature (°C)	spring	-6.4	-5.4	1	-2.4	4	0.8	7.2
Mean Temperature (°C)	summer	11.3	13.2	1.9	15.2	3.9	17.3	6
Mean Temperature (°C)	fall	-1	1.5	2.5	3.2	4.2	5.1	6.1
Mean Temperature (°C)	winter	-20.7	-17.2	3.5	-14	6.7	-10.9	9.8
Precipitation (mm)	annual	777	773	-4	916	139	1061	284
Precipitation (mm)	spring	164	117	-47	174	10	238	74
Precipitation (mm)	summer	261	213	-48	285	24	369	108
Precipitation (mm)	fall	228	194	-34	270	42	346	118
Precipitation (mm)	winter	144	131	-13	186	42	252	108
Hot days (30°C + max) days	anually	0	0	0	3	3	8	8
Cold days (-30°C + min)days	anually	35	14	-21	5	-30	0	-35
Date of first fall frost		15-Sep	19-Sep	4	03-Oct	18	18-Oct	33
Date of last spring frost		10-Jun	09-Jun	-1	24-May	-17	07-May	-34
Frost-free season (days)	anually	94	105	11	129	35	154	60
Icing days	anually	169.6	159.8	-9.8	142	-27.6	122.9	-46.7

RCP 4.5 2040 Horizon

		1976-2005	2021-2050					
RCP 4.5 (moderate emission scenario)		Mean	10th	change	50th	change	90th	change
Mean Temperature (°C)	annual	-4.1	-3.6	0.5	-2.2	1.9	-0.6	3.5
Mean Temperature (°C)	spring	-6.4	-7.3	-0.9	4.7	11.1	-2	4.4
Mean Temperature (°C)	summer	11.3	11.4	0.1	13	1.7	14.8	3.5
Mean Temperature (°C)	fall	-1	-0.8	0.2	0.8	1.8	2.4	3.4
Mean Temperature (°C)	winter	-20.7	-21.2	-0.5	-17.9	2.8	-14.7	6
Precipitation (mm)	annual	777	719	-58	845	68	977	200
Precipitation (mm)	spring	144	111	-33	160	16	212	68
Precipitation (mm)	summer	261	207	-54	277	16	352	91
Precipitation (mm)	fall	228	185	-43	246	18	316	88
Precipitation (mm)	winter	144	111	-33	162	18	219	75
Hot days (30°C + max) days	anually	0	0	0	1	1	2	2
Cold days (-30°C + min)days	anually	35	35	0	20	-15	7	-28
Date of first fall frost		15-Sep	09-Sep	-6	21-Sep	6	03-Oct	18
Date of last spring frost		10-Jun	15-Jun	5	03-Jun	-7	18-May	-23
Frost-free season (days)	anually	94		-94		-94		-94
Icing days	anually	169.6		-169.6		-169.6		-169.6

RCP 4.5 2070 Horizon

		1976-2005	2051-2080					
RCP 4.5 (moderate emission scenario)		Mean	10th	change	50th	change	90th	change
Mean Temperature (°C)	annual	-4.1	-2.6	1.5	-1	3.1	0.8	4.9
Mean Temperature (°C)	spring	-6.4	-6.4	0	-3.6	2.8	-0.4	6
Mean Temperature (°C)	summer	11.3	12	0.7	13.8	2.5	15.6	4.3
Mean Temperature (°C)	fall	-1	0.1	1.1	1.8	2.8	3.6	4.6
Mean Temperature (°C)	winter	-20.7	-19.4	1.3	-16.2	4.5	-12.7	8
Precipitation (mm)	annual	777	759	-18	876	99	1007	230
Precipitation (mm)	spring	144	114	-30	165	21	225	81
Precipitation (mm)	summer	261	211	-50	280	19	353	92
Precipitation (mm)	fall	228	198	-30	259	31	332	104
Precipitation (mm)	winter	144	119	-25	171	27	231	87
Hot days (30°C + max) days	anually	0	0	0	1	1	4	4
Cold days (-30°C + min)days	anually	35	24	-11	12	-23	2	-33
Date of first fall frost		15-Sep	14-Sep	-1	26-Sep	11	10-Oct	25
Date of last spring frost		10-Jun	13-Jun	3	30-May	-11	13-May	-28
Frost-free season (days)	anually	94	96	2	116	-94	139	45
Icing days	anually	169.6				-169.6		0

All data reproduced and derived from: https://climateatlas.ca/map/canada/

plus30_2030_85#z=5&lat=53.01&lng=-71.15&grid=221

Table 20: 2040 and 2070 Horizon projected climate change Lac Saffray area (10x10km) 8.5 RCP scenario

		1976-2005	2021-2050						2051-2080					
RCP 8.5 (high emission scenario)		Mean	10th percentil	change	50th	change	90th	change	10th	change	50th	change	90th	change
Mean Temperature (°C)	annual	-5	-4.1	0.9	-2.5	2.5	-0.8	4.2	-1.9	3.1	0	5	2.2	7.2
Mean Temperature (°C)	spring	-8.2	-8.7	-0.5	-6.1	2.1	-3.4	4.8	-6.8	1.4	-3.9	4.3	-0.7	7.5
Mean Temperature (°C)	summer	9.5	9.7	0.2	11.4	1.9	13.4	3.9	11.2	1.7	13.3	3.8	15.8	6.3
Mean Temperature (°C)	fall	-1	-0.4	0.6	1.1	2.1	2.6	3.6	1.3	2.3	3.1	4.1	4.9	5.9
Mean Temperature (°C)	winter	-20.6	-20	0.6	-16.7	3.9	-13	7.6	-16	4.6	-12.5	8.1	-8.9	11.7
Precipitation (mm)	annual	567	537	-30	631	64	731	164	579	12	686	119	797	230
Precipitation (mm)	spring	100	78	-22	110	10	146	46	82	-18	121	21	164	64
Precipitation (mm)	summer	179	141	-38	192	13	249	70	147	-32	203	24	262	83
Precipitation (mm)	fall	168	142	-26	188	20	238	70	148	-20	199	31	253	85
Precipitation (mm)	winter	120	96	-24	141	21	195	75	114	-6	163	43	222	102
Hot days (30°C + max) days	anually	0	0	0	0	0	2	2	0	0	2	2	5	5
Cold days (-30°C + min)days	anually	32	22	-11	11	-21	2	-30	6	-26	2	-30	0	-32
Date of first fall frost		15-Sep	11-Sep	-4	25-Sep	10	09-Oct	24	23-Sep	8	07-Oct	22	21-Oct	36
Date of last spring frost		14-Jun	16-Jun	2	02-Jun	-12	22-May	-23	09-Jun	-5	24-May	-21	07-May	-38
Frost-free season (days)	anually	89	91	2	109	20	129	40	107	18	131	42	155	66
Icing days	anually	169.6	172	2.4	156.2	-13.4	140	-29.6	159.8	-9.8	142	-27.6	122.9	-46.7

4.5 RCP scenario

		1976-2005	2021-2050						2051-2080					
RCP 4.5 (moderate emission scenario)		Mean	10th	change	50th	change	90th	change	10th	change	50th	change	90th	change
Mean Temperature (°C)	annual	-5	-4.5	0.5	-2.9	2.1	-1.2	3.8	-3.4	1.6	-1.6	3.4	0.3	5.3
Mean Temperature (°C)	spring	-8.2	-9.1	-0.9	-6.5	1.7	-3.8	4.4	-8.1	0.1	-5.3	2.9	-2.2	6
Mean Temperature (°C)	summer	9.5	9.4	-0.1	11.1	1.6	13.2	3.7	10.1	0.6	12	2.5	14	4.5
Mean Temperature (°C)	fall	-1	-0.8	0.2	0.7	1.7	2.2	3.2	0	1	1.7	2.7	3.4	4.4
Mean Temperature (°C)	winter	-20.6	-20.6	0	-17.2	3.4	-13.7	6.9	-18.6	2	-15.1	5.5	-11.2	9.4
Precipitation (mm)	annual	567	528	-39	623	56	726	159	546	-21	647	80	757	190
Precipitation (mm)	spring	100	79	-21	111	11	146	46	82	-18	115	15	154	54
Precipitation (mm)	summer	179	141	-38	193	14	251	72	140	-39	193	14	250	71
Precipitation (mm)	fall	168	134	-34	183	15	233	65	140	-28	192	24	247	79
Precipitation (mm)	winter	120	92	-28	136	16	189	69	98	-22	147	27	199	79
Hot days (30°C + max) days	anually	0	0	0	0	0	1	1	0	0	1	1	2	2
Cold days (-30°C + min)days	anually	32	26	-6	13	-19	2	-30	15	-17	6	-26	0	-32
Date of first fall frost		14-Sep	10-Sep	-4	21-Sep	7	03-Oct	19	14-Sep	0	26-Sep	12	10-Oct	26
Date of last spring frost		14-Jun	18-Jun	4	03-Jun	-11	22-May	-23	13-Jun	-1	30-May	-15	13-May	-32
Frost-free season (days)	anually	89	86	-3	106	17	127	38	96	7	116	27	138	49
Icing days	anually	169.6		-169.6		-169.6		-169.6		-169.6		-169.6		-169.6

All data reproduced or derived from: https://climateatlas.ca/map/canada/plus30_2030_85#z=5&lat=55.13&lng=-70.05&grid=234

Table 21: Nunavik Centre-Sud climate change data horizon 2100

Note: read results as 50th percentile [10th, 90th]

Mean temperature					
season	1981-2010	2041-2070		2071-2100	
		rcp 4.5	rcp 8.5	rcp 4.5	rcp 8.5
Annual	-4.8	-2.3 [-3.0, -1.2]	-1.1 [-2.2, -0.2]	-1.4 [-3, -0.3]	1.7 [-1.0, 3.0]
Winter	-21.5	-17.5 [-18.8, -15.8]	-15.5 [-17.5, -14.2]	-15.8 [-18.3, -14.8]	-11.7 [-16.0, -10.1]
Spring	-7.6	-5.8 [-6.5, -4.5]	-4.6 [-5.8, -4.2]	-5.2 [-6.3, -3.8]	-1.6 [-4.1, -0.6]
Summer	10.6	12.7 [11.8, 13.9]	13.2 [12.3, 14.9]	12.9 [11.7, 14.4]	15.6 [13.7, 17.6]
Autumn	-1.1	1.2[0.4, 2.4]	2.1 [1, 3.3]	2.0 [0.3, 2.8]	4.5 [2.4, 6.2]

Maximum temperature					
	1981-2010	2041-2070		2071-2100	
season		rcp4.5	rcp8.5	rcp4.5	rcp 8.5
Annual	-0.5	1.6 [1.1, 2.9]	2.8 [19.9, 3.7]	2.6 [1.1, 3.6]	5.4 [3.1, 6.8]
Winter	-17	-13.4 [-14.8, -11.5]	-11.7 [-13.4, -10.5]	-11.9 [-14.2, -10.8]	-8.1 [-12.2 -6.8]
Spring	-2.8	-1.5 [-2.2, -0.1]	-0.2 [-1.6, 0.2]	-0.7 [-2.0, 0.4]	2.2 [0.3, 3. 5]
Summer	15.4	17.4 [16.6, 18.5]	17.8 [16.8, 19.6]	17.6 [16.5, 19,1]	20.3 [18.7, 22.5]
Autumn	1.9	4.1 [3.3, 5.2]	4.7 [3.8, 6.2]	4.8 [3.3, 5.7]	7.2 [5.4, 8.9]

Solid precipitation (mm equivalent)					
Season	1981-2010	2041-2070		2071-2100	
		RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Annual	276	285 [280, 300]	294 [284, 314]	294 [268, 315]	302 [275, 320]
Winter	116	137 [126, 143]	150 [127, 154]	142 [134, 159]	166 [160, 180]
Spring	81	82 [79, 88]	87 [78, 93]	84 [78, 94]	83 [72-101]
Summer	1	0 [0, 1]	0 [0, 0]	0 [0, 2]	0 [0, 0]
Autumn	80	68 [63-76]	61 [55, 74]	65 [56, 77]	42 [30, 68]

growing degree days at 4 celsius					
	1981-2010	2041-2070		2071-2100	
		rcp4.5	rcp 8.5	rcp 4.5	rcp 8.5
annual	724	977 [877, 1132]	1061 [971, 1285]	1039 [881, 1201]	1404 [1153, 1746

Minimum temperature					
	1981-2010	2041-2070		2071-2100	
season		rcp 4.5	rcp 8.5	rcp 4.5	rcp 8.5
annual	-9	-6.4 [-7.1, -5.3]	-5.1 [-6.3, -4.1]	-5.4 [-7.1, -4.2]	-2 [-4.6, -0.8]
winter	-25.8	-21.6 [-22.9, -20.0]	-19.3 [-21.5, -17.9	-19.8 [-22.4, -18.8]	-15.4 [-19.8, -13.3]
spring	-12.4	-10.4 [-10.9, -8.9]	-9.2 [-10.0, -8.4]	-9.6 [-10.6, -7.9]	-6.2 [-8.5, -4.4]
summer	5.9	7.9 [7.0, 9.2]	8.5 [7.5, 10.2]	8.4 [7.0, -9.7]	10.7 [8.8, 12.7]
autumn	-4.1	-1.5 [-2.7, -0.5]	-0.5 [-2.9, -0.4]	-0.9 [-2.8, -0.1]	2.0 [-0.7, -3.5]

Liquid precipitations (mm)					
Season	1981-2010	2041-2070		2071-2100	
		RCp 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Annual	373	420 [384, 464]	458 [418, 496]	451 [406, 480]	512 [474, 566]
Winter	0	1 [0, 3]	1 [0, 4]	1 [0, 3]	7 [1, 15]
Spring	38	45 [37, 55]	45 [39, 60]	46 [36, 71]	62 [41, 95]
summer	217	223 [212, 237]	232 [220, 245]	232 [206, 260]	236 [218, 257]
autumn	120	150 [133, 170]	169 [144, 197]	167 [135, 177]	203 [184, 238]

Other relevant climate related projection visualizations Existing climate visualizations allow for snapshots of foreseen climate change across Naskapi territory, something that data itself is much less efficient in expressing. Nunavik Climate Report Tome 2 (Chaumond & Maillot, 2017a) uses the Cordex climate models ensemble to simulate future climate change. Appendix 1 includes examples of climatic variables that affect the ecosystems of Naskapi territory and that were not best expressed in tables 20-22.

Projected Climate Change - Discussion of results

Climate projections, throughout Naskapi territory, foresee significant climate change regardless of emissions scenarios (rcp4.5 and 8.5). In the medium term (2021-2050), differences between scenarios are slight (ex: 1.9 °C and 2.3 °C change in annual mean temperature for Schefferville 2021-2050 with RCP 4.5 and 8.5 scenarios, respectively). In the long run, climate change predictions tend to vary depending on emission scenario (3.5°C vs 6.6 °C in annual mean temperature for Schefferville 2050-2080 depending on RCP). Such results are expected, given that both emission scenario forecast an increase in global emissions in the first half of the 21st century but the moderate scenario involves a stabilization of emission in the later half of the century while the high emissions one involves a continuation of steadily climbing emission levels. While liquid precipitation and temperature increase trends observed with historical climate change data are prolonged under all climate change forecast sources, projected data (tables 20-22) shows highest temperature increases in winter, which diverges with historical climate results (tables 2-6, 10-14), which show that statistically significant changes have occurred mostly in summer and fall, indicating highest temperatures increases during those seasons. Solid precipitations are also expected to increase (table 22), which was not found to hold true historically with a slight penchant for the contrary (tables 8, 16). Chaumond & Maillhot (2017b) did project lesser occurrence of snow precipitation as a % of total precipitation in fall (especially September) (figure 15), which matches historical data while going against the climate portrait the consortium published. Oppositely, they predicted increased solid precipitations in January and February (2017b, p. 11).

Increases in temperatures and liquid precipitation are strongly projected to positively impact frost-free season, growing season length and intensity (figure 14, table 22), and extreme heat days (tables 20-21) while negatively impacting snow cover period length and intensity (tables 9,16,21 & 22), thawing-freezing days (figure 13), extreme cold days (tables 20-21) and ice freeze period. The observations of 249 Naskapis in a 2012 survey (Mameamskum, 2014, p. 30) corroborate such trends, suggesting that they have also historically occurred.

Observed and predicted effects of climate change on vegetation, land cover, soil and infrastructure

Disclaimer: Literature diversity is scarce, meaning reliance on a small set of sources per subject is unfortunately expected for subjects with no extensive academic or formal track record in the area.

Hydrology

The historical and projected development of hydrology has thankfully been studied previously under the cQ2 project in Northern Quebec (above 55th parallel) by a consortium formed by Hydro-Quebec, the MDDELCC, Rio Tinto and Ouranos in continuous fashion, with last available data presented in 2014 (Chaumond & Mailhot, 2017a, p. 44). 4 watersheds of the Ungava Bay hydrologic network (Caniapiscau (C.) False, (F) À la Baleine (ALG) and George (G)) that are present on Naskapi territory were studied as part of the cQ2 project. All 4 watersheds had data collected at the following hydrometric station id: 103702 (C.), 103801 (F), 104001 (ALG) and 104803 (G). Three variables were tested for change as part of the study: average annual water flow, average water flow at spring run-off (crue des eaux), and average start of spring run-off period (Chaumont & Mailhot, 2017a, p.52).

Methodology

Hydrologic model HSAMI is used for past and future simulations, matched with the CMIP climate model ensemble for non-hydrologic climatic variables. The reference period used was 1970-2000, while the projections are for horizon 2050 and 2080. Even for the reference period, much of the database is reconstituted given missing values and adjustment for accuracy/bias correction (ex: account for water inflow and the effect of melting ice on river flow). The estimated data accounted for roughly 50% of the reference period for all 4 watersheds (A La Baleine and George River at slightly north of 50% with Caniapiscau and False River stations at slightly less than 50%). The substantial amount of data from the reference range being estimated is an obvious limitation of the study, although the Nash-Sutcliffe calibration coefficient shows satisfactory accuracy of results (>0.5 value) for all 4 points, with Caniapiscau scoring the lowest (0.60s range) while other stations maintained above 0.8 (Chaumont & Mailhot, 2017a, figure 3-6).

Figure 18: Methodological process used by the consortium Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p. 45)

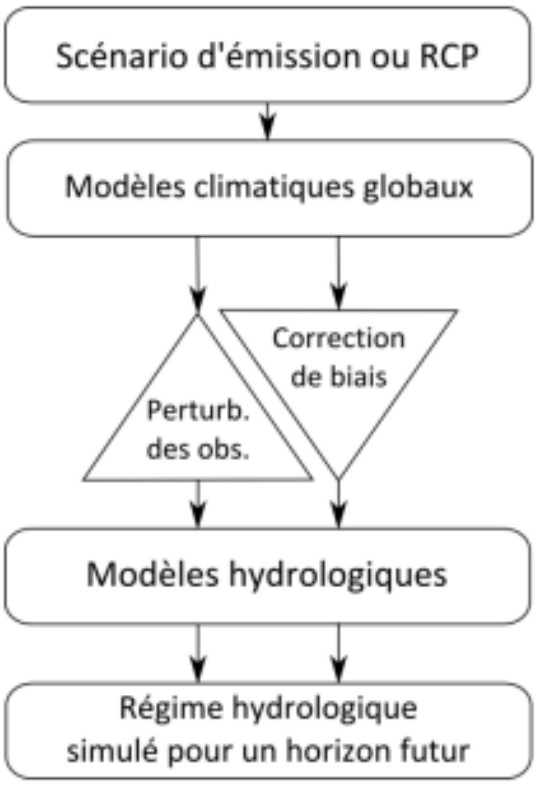


Figure 19: North of Quebec Watersheds map

Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p.46)

Results based on 350 simulations using 100 4.5 RCP scenarios and 92 8.5 RCP ones:

Table 23: Annual change in water flow

ID	Nom	Débit reconstitué (1970-2000)		Changement de débit annuel moyen (H50)						Changement de débit annuel moyen (H80)					
		Moyenne	Écart-type	RCP4.5 (m³/s)			RCP8.5 (m³/s)			RCP4.5 (m³/s)			RCP8.5 (m³/s)		
		m³/s	m³/s	25e	50e	75e	25e	50e	75e	25e	50e	75e	25e	50e	75e
093801	Grande Rivière de la Baleine	526.5	336.5	41.6	56.4	80.2	56.8	79.6	116.5	46.3	73.0	97.0	79.0	102.0	150.3
094206	Petite Rivière de la Baleine	108.2	63.0	9.5	12.0	15.7	12.8	15.2	22.6	9.7	15.6	21.5	16.1	21.0	33.5
095002	Nastapoca	201.0	118.8	21.7	28.0	39.4	27.4	34.1	47.5	23.9	35.4	45.0	42.2	49.8	73.0
096101	Innuksuac	116.5	66.2	13.2	17.7	22.6	17.2	23.3	32.0	14.6	23.0	30.0	26.3	34.9	49.9
102001	Arnaud	304.2	344.1	39.4	52.4	65.8	58.4	71.1	91.2	51.9	71.5	81.0	86.4	110.5	148.4
102004	Hamelin	45.7	67.4	5.1	7.0	8.6	7.1	8.8	12.3	6.5	9.0	11.3	10.0	13.5	18.5
102701	Aux Feuilles	529.9	628.9	53.8	85.9	107.1	78.4	110.7	129.1	70.7	108.0	126.3	120.3	151.2	199.2
103603	Aux Mélèzes	86.2	131.0	6.9	10.7	13.7	8.6	15.6	19.1	7.0	13.2	18.9	16.0	21.5	31.1
103801	False	26.4	39.4	1.5	3.5	4.2	2.9	4.4	6.6	2.6	3.5	6.2	4.8	6.9	9.0
104001	À la Baleine	466.2	701.4	13.7	46.5	60.0	32.1	63.8	90.3	27.0	45.4	83.9	57.0	92.6	124.4
104803	George	456.0	603.1	18.1	50.0	60.7	25.5	52.1	82.0	27.9	51.6	79.4	47.3	80.8	120.5

Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (figure 3-3).

Table 24: Average change in water flow during Spring run-off

ID	Nom	Débit moyen de crue reconstitué (1970-2000)		Changement de débit de crue moyen (H50)						Changement de débit de crue moyen (H80)					
		Moyenne	Écart-type	RCP4.5 (m³/s)			RCP8.5 (m³/s)			RCP4.5 (m³/s)			RCP8.5 (m³/s)		
		m³/s	m³/s	25e	50e	75e	25e	50e	75e	25e	50e	75e	25e	50e	75e
093801	Grande Rivière de la Baleine	830.5	156.6	181.2	226.9	292.2	211.7	247.6	332.7	152.7	254.4	341.0	219.4	340.6	378.2
094206	Petite Rivière de la Baleine	182.7	34.6	27.2	38.9	54.6	30.9	45.6	57.7	28.2	47.6	58.8	35.3	54.4	72.5
095002	Nastapoca	311.6	40.9	13.8	37.9	48.2	31.2	46.2	64.9	18.5	50.2	76.1	61.9	80.7	101.9
096101	Innuksuac	228.3	55.4	19.7	30.6	38.0	26.7	36.7	51.5	26.7	38.8	56.8	33.7	66.6	74.5
102001	Arnaud	1051.7	229.7	41.4	108.9	170.1	57.1	134.5	214.8	70.7	151.7	233.7	80.8	217.3	300.3
102004	Hamelin	200.4	40.9	6.4	13.3	26.8	8.3	19.9	34.9	7.7	21.9	36.3	12.2	24.9	44.4
102701	Aux Feuilles	2117.0	562.6	143.0	225.8	348.0	162.7	329.4	454.6	187.6	232.3	522.5	288.5	429.2	532.7
103603	Aux Mélèzes	406.4	105.9	26.2	40.4	58.6	48.0	63.9	86.5	29.3	50.6	91.9	68.4	89.1	114.9
103801	False	125.3	25.3	6.1	12.5	17.6	10.7	14.8	21.4	7.7	16.4	22.2	10.6	19.0	23.7
104001	À la Baleine	2267.4	500.1	61.8	177.1	260.2	145.2	268.2	324.7	92.4	250.2	400.7	238.3	335.5	464.7
104803	George	1889.4	507.6	34.5	190.3	390.1	114.1	209.3	415.3	50.4	230.9	423.0	113.2	369.4	536.3

Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (figure 3-4)

Table 25: Average day of start of Spring Run-off

ID	Nom	Jour de début de crue reconstitué (1970-2000)		Changement du jour de début de crue (H50)						Changement du jour de début de crue (H80)					
		Moyenne	Écart-type	RCP4.5 (jours)			RCP8.5 (jours)			RCP4.5 (jours)			RCP8.5 (jours)		
		jours juliens		25e	50e	75e	25e	50e	75e	25e	50e	75e	25e	50e	75e
093801	Grande Rivière de la Baleine	129	9.3	-5.4	-0.3	2.5	-9.1	-2.6	0.3	-8.4	-3.1	1.1	-15.5	-10.7	-5.2
094206	Petite Rivière de la Baleine	143	9.0	-6.9	-3.9	-0.5	-9.4	-6.5	-1.6	-10.1	-6.2	-1.2	-18.7	-12.5	-8.3
095002	Nastapoca	144	10.0	-9.8	-7.6	-6.1	-11.5	-8.9	-6.9	-11.4	-9.7	-5.6	-19.7	-16.3	-9.6
096101	Innuksuac	153	10.1	-13.5	-8.1	-5.7	-14.1	-12.3	-8.5	-19.6	-10.6	-6.5	-28.0	-20.1	-15.0
102001	Arnaud	156	10.4	-17.9	-9.5	-7.1	-15.3	-13.3	-8.8	-16.8	-11.5	-7.2	-25.9	-23.4	-16.1
102004	Hamelin	159	10.3	-13.4	-9.1	-5.8	-14.9	-12.9	-8.6	-15.7	-11.3	-7.4	-26.2	-22.6	-15.7
102701	Aux Feuilles	146	10.3	-13.1	-7.4	-5.5	-14.0	-12.1	-8.3	-17.8	-10.0	-6.5	-26.6	-18.8	-14.3
103603	Aux Mélèzes	138	10.3	-12.7	-7.9	-4.9	-12.4	-9.9	-7.2	-15.8	-9.5	-6.2	-24.2	-16.9	-12.6
103801	False	133	10.7	-11.6	-6.6	-3.9	-13.5	-8.9	-6.6	-14.1	-8.2	-5.1	-24.0	-16.5	-12.6
104001	À la Baleine	140	11.5	-11.9	-7.7	-4.0	-13.8	-9.3	-7.4	-13.9	-8.4	-5.5	-23.7	-16.3	-12.6
104803	George	140	12.3	-10.5	-8.1	-6.1	-15.1	-9.8	-7.7	-14.1	-9.8	-7.6	-25.2	-17.6	-13.5

Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (figure 3-45).

Discussion of Results

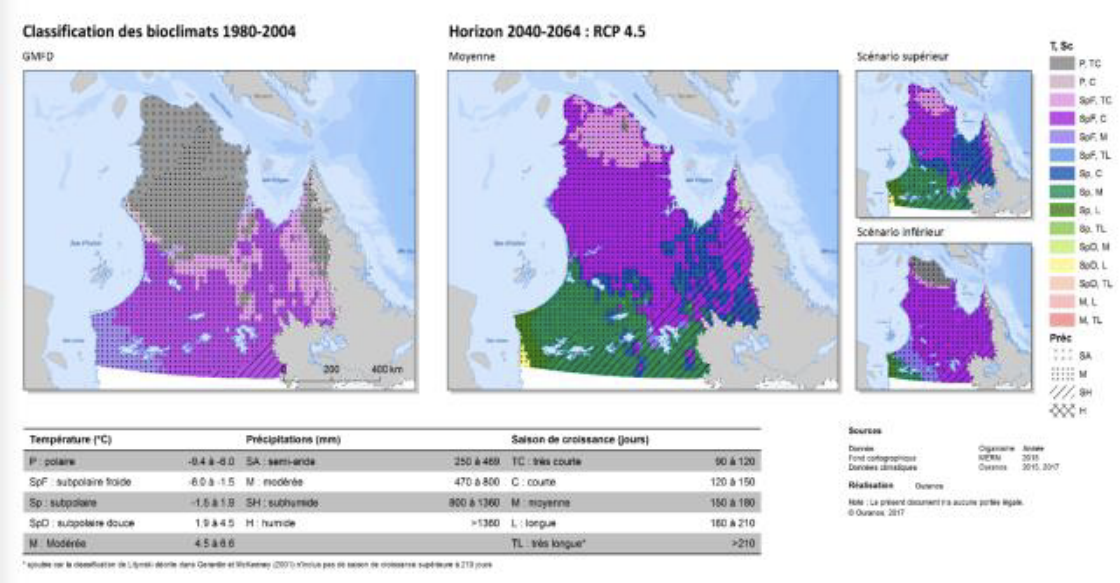
While the Caniapiscau river basin did not project any significant change (thus its omission from tables 23-25), the False, George and A la Baleine river watersheds showed varying degrees of probable upward change in waterflow (annual average or spring run-off) and earlier start of spring run-off season. A la Baleine and George River projected significantly higher change in values for both water flow metrics compared to the False River, which could be symptomatic of the fact that the A la Baleine and George River already support quite higher water flows than the False River (466m3/s, 455m3/s and 26m3/s respectively for annual average water flow, table 23). Most pronounced changes were projected for the 2080 range using rcp 8.5, which follows logical trends in climate projection (furthest projected period, high emission scenario producing the most changes).

Reasons for increase in water flows are to be studied more profoundly, but higher shore water levels of the Ungava Bay as well as increased precipitation, both attributable to climate change, could play a significant role. Decreased snow cover and higher temperatures, which go hand in hand, are the main culprits behind earlier spring run-off and consequently earlier peak stream flows (Chaumont & Mailhot, p. 47, Young et al. 2017, p.37). Increased water flows and earlier peak stream flows and spring run-off can have many ecological repercussions from affecting fish (change in habitat, mismatch from hatching season with typical oxygen and temperature conditions, (more in section 5.4) (Young et al. 2017 p. 37, 51), to caribou migrations (overflowing rivers = safety hazard, delays migration, disorganizes herds (Le Corre, 2016)) as well as possibly changing shoreline vegetation (favorable to spruce-moss forest and deciduous forests (Foret Ouverte, 2019,vegetation nord quebecois)) and breeding habitat for parasitic and biting insects.

Bioclimatic change

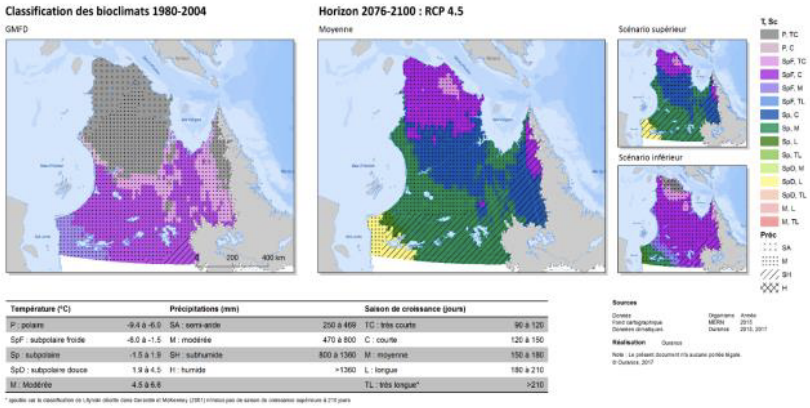
Charron (2015), mapped the possible change in bioclimates in Nunavik within the 21st century, a useful baseline metric of possible change in terms of ecosystems, vulnerable species and potential risk of invasive species in the medium to long run (Fournier & Logan, 2017, p. 71). Such mapping source is the only one of its kind produced in recent years that concerns Naskapi territory, although it is arguable that it is based on McKenney (2001)'s simpler bioclimatic modeling endeavor, which classifies the presence of 4 distinct biomes in Nunavik opposed while Charland proposes 7. Projected bioclimatic evolution for the ranges 2040-2064 and 2076-2100 are based on climate models (24) ensemble CORDEX (Fournier & Logan, 2017, p. 72-73). Expected range data (1981-2010) was obtained through 4 sources of climate recalculation (CFSR, ERA-Interim, JRA55 and MERRA).

Results: Figure 18: bioclimate classification 2040-2064 RCP 4.5



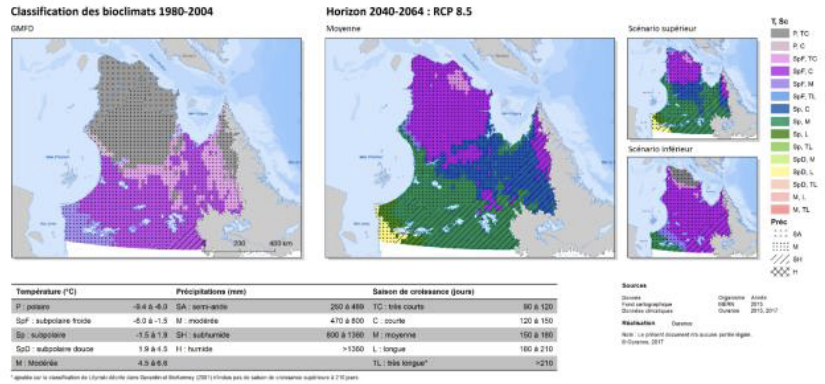
Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p. 80/ figure 4-3)

Figure 19: bioclimate classification 2076-2100 RCP 4.5



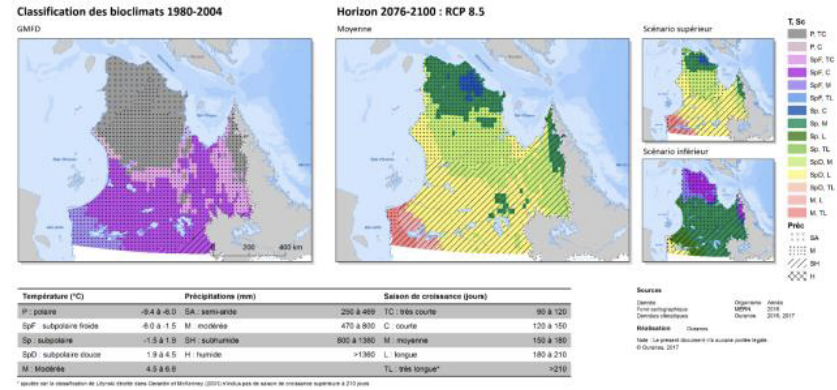
Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p. 81/ figure 4-4)

Figure 20: bioclimatic classification 2040-2064 scenario RCP 8.5



Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p. 82/ figure 4-5)

Figure 21: bioclimatic classification 2076-2100 scenario RCP 8.5



Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p. 83/ figure 4-6).

Discussion of Results:

Current bioclimatic modeling shows subpolar cold and polar (george river basin) present on Naskapi territory. The predicted 2040-2064 range shows the apparition of non-cold subpolar climate on Naskapi sector for both emission scenarios, which for comparison, was a climate classification found by Gerardin & McKenney (2001) in the late 1990s on Cote-Nord, Baie-James, Abitibi-Temiscamingue and Gaspesie regions, as opposed to the disappearing (current) subpolar cold climate. A subpolar warm classification could appear on the south-western half of NNK territory in the rcp 8.5 scenario for the time period (2076-2100), which would be comparable to the temperature climate found by Gerardin & McKenney (2001) in southern Abitibi, Outaouais, Bas-St Laurent and Mauricie.

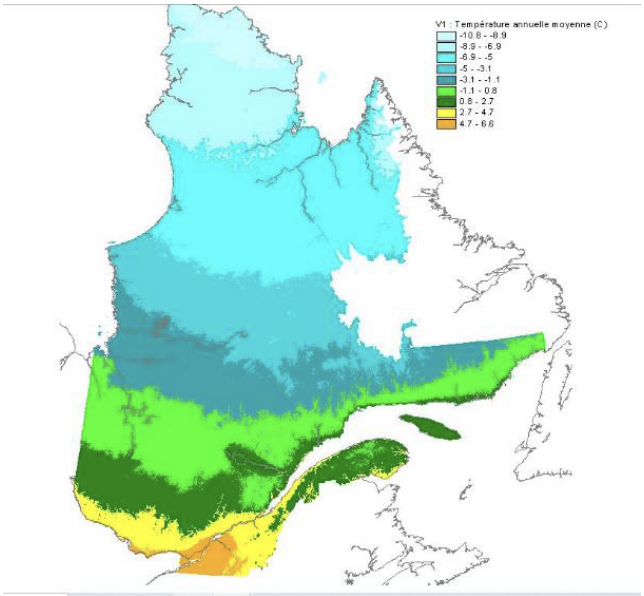


Figure 22: Gerardin & McKenney (2001). Bioclimatic classification. Bright green = subpolar, Darker green = subpolar warm

With the rcp 8.5 scenario (2050, 2080), the growing season will also probably be prolonged on most of NNK territory at varying levels, most likely from a super short (90-120 days) to 120-150 (short) or for the 2080 period, into moderate range (150-180). Exact repercussions of such changes are hard to predict, given that they rely on a predicted bioclimatic change themselves and that there is no indication that phenology (seasonal timing of plant and animal activities), specifically the migration of bio-organisms can match the fast rate of climate change. Moreover, natural obstacles (rivers, mountains, etc.) and anthropogenic barriers (ex: habitat fragmentation) mitigate migration (Berteaux et al. 2010, p. 14). Nonetheless, bioclimatic models are something worth taking into consideration as a generalized measure of biological change related to climate change.

Vegetation and land cover

Given that vegetation, as compared to most other forms of living organisms, has a very slow "life rhythm" (Chaumont & Mailhot, 2017a, p. 87), effects of a changing climate on flora and land cover might only be noticeable after an extended period of time, as opposed to sudden change in animal behavior for instance. Thus, the prediction of changing vegetation with climate change as the cause tends to be speculative, given the numerous, complex factors that can influence vegetation growth.

However, climate trends such as increased temperature, precipitation and growing season length and intensity point towards a densification of vegetation when other conditions (ex: soil substrate quality, adequate terrain) are favorable to such growth (Chaumond & Mailhot, 2017a, p. 144, Rupp et al. 2001). A warmer, more humid climate usually bolds well for vegetation given lesser hydric stress and better germination quality (Chaumond & Maillhot, 2017a. p. xxii), although such changes can throw the whole ecology out of whack in the long run.

Spruce-lichen, tundra forest, deciduous forests and forest fires

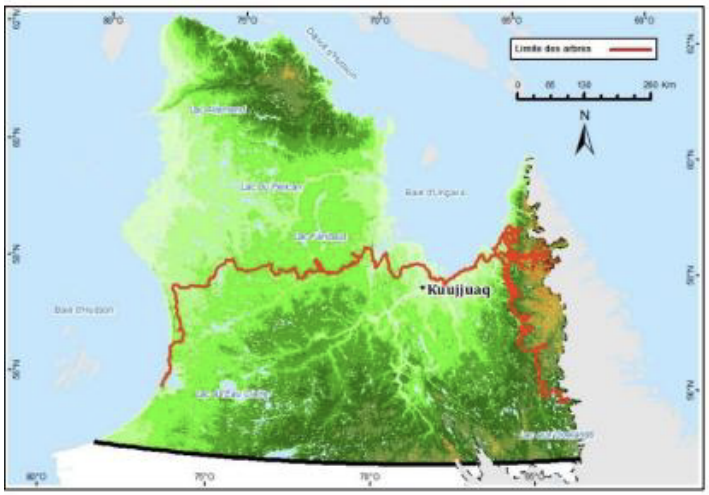
As such, the thickness/density of spruce-lichen and spruce-moss forest, the vegetation cover types most prevalent around Kawawachikamach (Foret Ouverte, 2019), is predicted to increase as germination is favored by increased temperature and reduced hydric stress (Kawawachikamach area historically having a very short growing season as well as few precipitations) (figure 18-21, Charron, 2015; Tremblay, 2017). Spruce-moss (or tundra forest) and lichen forest are also predicted to probably expand their range north (Tremblay, 2017, p. 148) but limiting factors such as soil humidity, eolian and hydric stress, permafrost thawing and presence of large herbivores, defoliating insects could act as limiting factors. Densification and expansion of spruce-lichen and spruce moss forests could have significant impacts on ecology, notably on insect, avian populations and even larger herbivores such as caribous, which sees about 20% decreases in time spent foraging when oestrid flies disturbance is at its peak (Witter et al. 2012, p. 4,9). On the other hand, densification of lichen cover could be beneficial to caribou's wintering range and offspring productivity in the following spring.

While there are positive indications of forest growth and densification, it is possible that those could be negated by the increased prevalence of forest fires and or defoliating insects (Tremblay, 2017). While increases in precipitation levels and humidity mostly negate the effect of higher temperature on forest fire risks, if temperatures increase at higher rates than precipitations or if temperature increases are temporally mismatched with precipitation increases (ex: higher temperature in spring, more precipitation

in fall), then the risk of forest fires increases significantly (Boucher et al, 2019). Black spruce, the dominant tree species of spruce lichen and spruce moss forests/forest tundra is rather vulnerable to forest fires (the #1 black spruce abundance and range limiter), with Boucher et al. (2019) projecting a 0.5-1% annual increase in area burned for the species in the George river area paired with a 2071-2100 time interval through the use of climate modeling, although no significant trends were obtained for the Kawawachikamach region. Forest fire is thus also the primary cause of caribou habitat lost, specifically lichen (Joy et al. 2003, Rupp et al. 2006). Prevalence of forest themselves (density) is also a risk factor for forest fire (Payette et al. 2001), which is set to become more and more important. Interestingly, White spruce, unlike other tree species present on NNK territory, benefits from forest fires (Tremblay, 2017), which in the event of increased forest fires, could mean possible changes in vegetation composition.

Besides density, it is speculated that the tree line could move further up, with areas where black spruce previously showed stunted growth now reaching an “adolescent phase”, thus increasing the average height of trees (Tremblay, p. 118). However, per Giardin et al. 2016; Mcmanus et al., 2012, the Canadian boreal forest barely grew even if mean temperatures increased from 0.5 to 3 degrees for the 1986-2010 period, which suggests that climate itself is an inconsistent predictor of land cover. It is theorized that heightened hydric stress could pose problems to the growth of black spruce, even though its optimal temperature for germination (15-21 celsius) is reached (Black & Bliss, 1980, Meunier et al. 2007, Tremblay, 2017). Given that caribou typically opt for habitat beyond the tree line as calving grounds, it is plausible that a change in tree line geography could alter caribou distribution (Sharma et al., 2009).

Figure 23: Tree line in Nunavik (Tremblay, 2017, p. 99)



Tracé de la limite actuelle des arbres au Nunavik (Québec). L'arrière-plan présente la topographie (altitude croissante de vert pâle à rouge). Source du tracé : ministère des Forêts, de la Faune et des Parcs du Québec, Direction des inventaires forestiers.

Besides spruce-lichen and spruce-moss land covers, exceptional subarctic deciduous first are also likely to expand due to favorable growing season, temperature and precipitation trends, specifically in locations where nearby terrain allows for expansion (wind protection, adequate soil substrate, etc.) (Tremblay, 2017, p. 149). Such micro-climates are known to support a richer biodiversity and are of great conservation value.

White spruce and tamarack, which is said to be used for Naskapi implements and crafts (Weiler, 2009) has responded positively to climate change, especially higher temperatures (Tremblay & Levesque fig 5-9, Dufour-Tremblay et al. 2012a). Overall, it is also probable that proportion of black spruce-

Shrubs

Erect shrubs (Mameamskum, 2014; Tremblay, 2017) have and are projected to continue to enjoy higher density and range as a result of favorable climate conditions. Shrub species such as dwarf birch (betula glandulosa) and salix species (alaxensis, agyrocarpa, calciola, glauca, planifolia, vestita) (Fraser et al. 2011; Tremblay et a. 2012; McManus et al. 2012; Ropars & Boudreau, 2012) are believed to have been the greatest winners from climate change, which can be explained notably by its capacity for adaptation to different environmental conditions, which is a limiting factor for many plant species even if climate conditions are favorable (Wahren et al. 2005). Per Tremblay (2017), the main driver of shrub expansion is a reduction of snow cover (up to 8 weeks less by 2100), which causes major modification to the tundra through an increased growing period.

On the flip side, erect shrub expansion has come at the expense of local abundance of other plant types, especially dwarf shrubs, which happen to be the plants who produce fruits (berries). Near Umiujaq, fruit producing shrubs presence was very weak in areas where betula glandulosa covered more than 50% of territory (Lussier, 2016). Negative effects of betula glandulosa on presence and abundance of empetrum nigrum, Vaccinium vitis idea ad v. uliginosum, all species which fruits were reported to be collected by the Naskapi in the Weiler Report (2009) could possibly transpose onto Naskapi territory, although research is needed to validate such claim. Such idea seems to match with Naskapi observations of smaller, drier berries, and less prevalence of such plants (Mameamskum, 2014). It is theorized that, since erect shrubs and dwarf shrubs (fruit-producing) compete for similar poor soil nutrient conditions (Shevtosova, 1997; GRET, 2007), but that the taller erect shrubs block the ability of dwarf shrubs to receive sufficient sunlight (Wahren et al. 2005), increased in erect shrubs abundance creates umbrage which negatively affects sunlight conditions for dwarf shrubs (Lavalee, 2013; Lussier, 2016). As mentioned, there is no study that affirmatively claims such impact on Naskapi territory, although the observed growth in erect shrubs abundance matched with claims about declining fruit production of dwarf shrubs does point in that direction, especially given that such phenomena has been scientifically verified in other parts of Nunavik

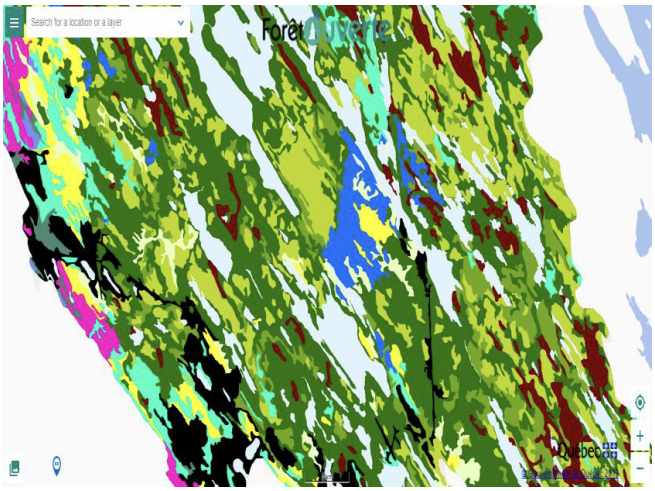
(Lussier, 2016, Tremblay, 2017). Per Myers-Smith et al. (2011), erect shrubs' greater phenotypic plasticity, enabling greater adaptability to environmental and climate change procures a comparative advantage over dwarf shrubs.

Note: Reduced productivity and density of berry producing shrubs could have a negative impact on rodents, passerines (Norment, 1997), geese (Cadieux et al. 2005) and ptarmigan populations as they all rely on berries as a significant food source. This in turn would invariably affect the faunic landscape and Naskapi land-use, primarily hunting (and obviously berry picking).

Wind level

Results in maximum wind gust speed in section 3.1.4 (table 19) show reduced wind speed across the board for the Schefferville area. While impacts of such changes are hard to quantify, it could have possibly played an ecological role along those lines: protection of species (shrubs, ptarmigans, rodents) who benefit from snow cover (which is projected to decrease heavily) as higher wind speed decreases snow cover, which can damage shrubs (Ropars and Boudreau, 2012); High stress windy environment related to lesser vertical growth of black spruce, an ecological staple of the Naskapi sector (Kempes et al. 2011, Aczel, 2021).

Figure 24: Mapping of vegetation near Kawawachikamach (black elongated, vertical strip). 25x10 km

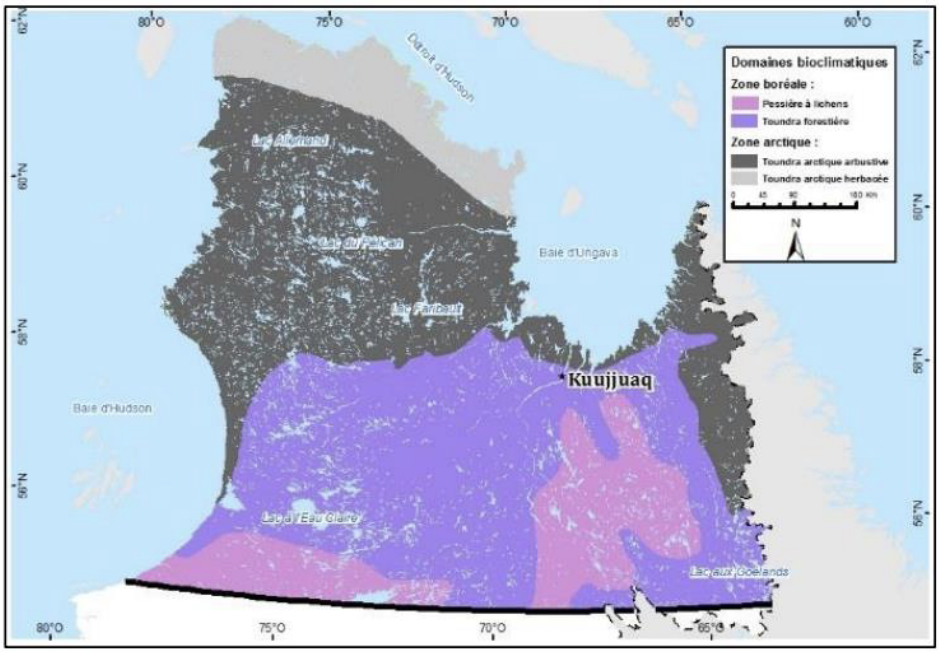


Source: https://www.foretouverte.gouv.qc.ca/?context=_carte_nord&zoom=12&center=-73.94861,53.26899&invisiblelayers=*&visiblelayers=64f1d32446713d65776636cf65c6653b,1da64ddfeaf23710b8a9ad95133fb5d8 (vegetation du Nord Quebecois)

Legend source: Planete ouverte, vegetation du nord Quebecois)

Near Kawawa, area constituted of dominantly spruce and moss vegetation (dark green) of density of trees >4m at 25-40% (especially near water) with some patch of spruce and lichen cover (light green) at 25-40% tree density, + some mix of both (darker light green). Tree density seems to grow as we move away from centers of human activity, generally from 10-25% into the 25-40% range. Vegetation is sparser as we move west, with dominance of erect shrubs (pink) and patches of dwarf shrubs (yellow).

Figure 25: vegetal bio climates in Nunavik



Source: https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf (p. 191)

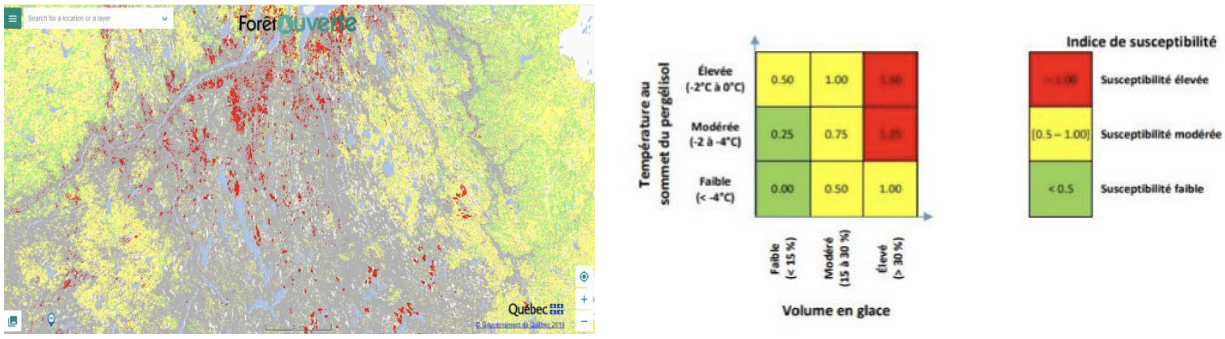
Figure 26: Significant minetrophe peat/fen west of Waukach lake, peatlands account for 3% of earth's surface yet stock 30% of all soil carbon (Xue et al., 2021; Harris et al., 2021).

Source: forêt ouverte, carte vegetation nord québécois

Permafrost, soil composition and hunting routes

While most Naskapi infrastructure (buildings, mining, roads for cars) are concentrated in the Schefferville-Kawawachikamach-Lac-John area, south of continuous or even discontinuous ranges for permafrost, that does not make the thawing of permafrost as a consequence of increased soil temperature a non-issue for Naskapis.

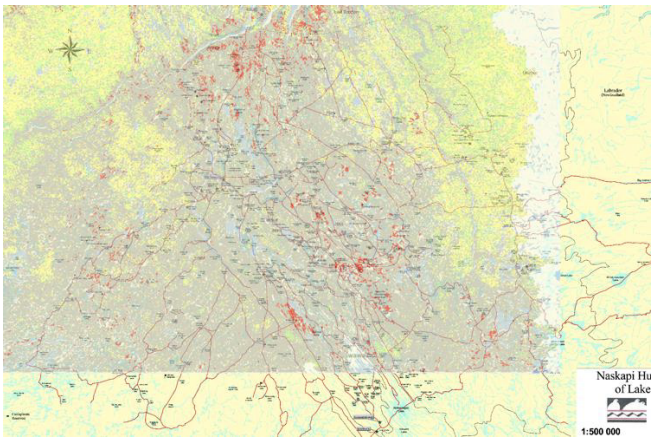
Figure 27: Permafrost thawing risk map



Source: https://www.donneesquebec.ca/recherche/dataset/pergelisol-au-nunavik/resource/57e28373-204c-4571-b153-7c5e228c35e4

Naskapi hunting routes and a thawing permafrost

Given that Naskapi travel significantly over its territory, for food gathering and/or leisure, it is possible that if travel/hunting trails (vtt, snowmobile use) cross over areas where existing permafrost is likely to thaw in the near future, such practice might become a significant safety hazard. In fact, experienced Naskapi hunters have already mentioned being incapable of safely navigating trails they have used for hunting for decades, citing unpredictability of weather, higher variation day to day, season to season, changing soil composition and ice cover (Mameanmskum, 2014). To see if thawing permafrost significantly hinders the ability of Naskapis to travel and practice traditional activities, I have matched (doubled) a map of Naskapi traditional trails with a foret ouverte's risk of permafrost thawing layering (2019).



Source of land routes map, see figure 1

(hint: Naskapi Nation of Kawawachikamach)

High risk of thawing areas (in red, p>1) are relatively sparse yet they sometimes occur on or near (hard to tell precisely) Naskapi routes, which in general do a great job of avoiding such unstable terrain. Medium and low risk areas in yellow and green are located mostly further north and probably do not see much use now given that the hunting of the George River caribou herd has been prohibited since 2013.

Interestingly enough, when comparing such mapping with one done for vegetation cover in Northern Quebec, areas seen as at high risk of thawing seem to correspond to areas where there is significant peatland (see figure 26, west of Waukash lake for example). While this should be studied attentively (other than peatlands containing large amounts of ice/permafrost soil due to low oxygenation and temperature), for any relevant conclusions to be made out of it, if the foreseen thawing holds true, it would have massive repercussions in terms of co2 released into the atmosphere, given that peatlands stock enormous quantities of co2.

Ecological impact of a thawing permafrost

In terms of pure ecology, thawing permafrost at the moment of thaw might cause degradation of local vegetation. However, given that (newly) unfrozen soil gives access to a higher quality germination potential (more beds, warmer temperature), regrowth should be relatively fast although possibly different than pre-thaw given a changing soil composition (Tremblay, 2017, p. 126).

Effects of climate change on Naskapi traditional trails

Even while leaving permafrost out of the analysis, the bioclimatic outlook for hunting trails is one of caution, given unpredictable and unrecognizable route conditions. While they did not specify which ones, some Naskapis mentioned that some trails are rendered unusable (Mameanmkum, 2014, p. 10). Most often cited reasons for lack of accessibility to backcountry routes and land use activities are a lesser period of freeze/icing days, which is projected to diminish significantly (15-46.7 annual day lost) in the long run (2080) per table 20, with Naskapi reports saying such process has already started (Mameanmkum, 2014, p. 12). Loss of ice cover period was thought by fishermen to negatively affect fishing period given longer period of uncertainty over ice conditions (unsafe) while the ice cover remains significant enough to prevent “summer” fishing (Mameamkum, 2014 p. 13). This is undoubtedly also related to loss of ice cover thickness from about 36 down to 24 and less on most lakes in winter per the Naskapis (2014, p. 22). Warmer temperatures in spring also cause an increase in liquid precipitations (figure 8-9, 13-15) which could possibly flood trade routes or at the very least render them extremely muddy for a vtt vehicle, not to mention a loss of snow cover (figure 16). Overall, the aggregate effect of lesser accessibility to its territory means loss of cultural value for the Naskapis, economic losses and increased reliance on what they call “supermarket food” (Mameamskum, 2014, p. 26-27)

Conclusion

As a general pattern, historical climate trends transpose to future climate change scenarios, although specificities (ex: historical changes in climate were most pronounced in summer while forecasts predict the largest variations in winter) tend to differ. General patterns in historical climate (increased temperature in summer, increased liquid precipitations in the spring and fall, etc.) and its effect on Naskapi territory and land use (changes in animal and fruit producing plant food sources availability, decreased accessibility to land and its resources) also matches Naskapi observations, a testament to the knowledge of its people on their land. This comes as no surprise given that they experienced first-hand the effects of an increasingly changing climate on their territory (especially since the 1990s per most graphed climate variables, figure 3-10), which besides the well documented decline in caribou and other land resources' abundance, includes the increasingly precarious state of hunting routes; threatened by a thawing permafrost and increased (shrub) vegetation density. Naskapis have seen land accessibility even more comprised in the fall and spring (critical seasons as numerous animal resources are at peak abundance) given that reduced snow cover and ice cover period threaten the safe use of snowmobiles and ice fishing practices (Mameamskum, 2014), trends that are predicted to linger in the future (figure 3-10). This will invariably affect Naskapi land use but also faunal and floral activity. As such, it is forecasted (Berteaux, 2018) that diversity is set to increase as temperature and precipitation increases result in favorable climatic conditions for a wider range of species (see appendix II). Such changes in ecological composition are likely to affect trophic relations between species, sometimes at the expense of already well-established ones that play vital roles in the current ecosystems and that are part of Naskapi land use practices. Notably, certain species of erect shrubs (salix genus, betula glandulosa particularly) have by all accounts increased in occurrence frequency and density as snow cover period length has decreased, a trend predicted to exacerbate (Tremblay, 2017). This was often observed to be detrimental to the presence of fruit producing rampant shrubs (section 4.3.2), appreciated by the Naskapis as well as the local mammals and birds as the growth of taller erect shrubs outcompetes them for sunlight and space. Other trophic changes can be more covert but nonetheless of dramatic impact; for instance, favorable climatic conditions to moose and their preferred floral habitat might also attract/sustain a larger grey wolf population (appendix II), a known predator of caribou, the Naskapi's traditional big game food source. As such, it would be of interest for ecologists and the NNK alike to study possible links between different known historical or forecasted climatic and environmental change and the past or future development of specific land resources, as allowed by climate data and forecasts on the effects of the environment on NNK territory. An understanding of drivers of change in resource abundance patterns in relation to the climate is key information in the preservation and deepening of Naskapi knowledge of its territory.

References

Aczel, M.R. (2021). A Comparison of Tree Growth in Two Sites near Schefferville, Quebec. *Electronic Green Journal, 1*/45. doi: 10.5070/G314547207

Berteaux, D., Blois, S. de, Angers, J.-F., Bonin, J., Casajus, N., Darveau, M., Fournier, F., Humphries, M. M., McGill, B., Larivée, J., Logan, T., Nantel, P., Périé, C., Poisson, F., Rodrigue, D., Rouleau, S., Siron, R., Thuiller, W., & Vescovi, L. (2010). The CC-Bio Project: Studying the Effects of Climate Change on Quebec Biodiversity. *Diversity*, 2(11), 1181–1204. https://doi.org/10.3390/d2111181

Berteaux D., Casajus, N. & Ropars, P. (2018). *Changements climatiques et toundra du Nunavik : exposition, sensibilité et vulnérabilité*. Rapport présenté au Consortium Ouranos sur la climatologie régionale et les changements climatiques.

Boucher, D., Gauthier, S., Thiffault, N., Marchand, W., Girardin, M., Urli, M. (2019) *How climate change might affect tree regeneration following fire at northern latitudes: a review*. Laurentian Forestry Centre. https://doi.org/10.1007/s11056-019-097545-6

Boulanger-Lapointe, N., Henry, G. H. R., Lévesque, E., Cuerrier, A., Desrosiers, S., Gérin-Lajoie, J., Hermanutz, L., & Collier, L. S. (2020). Climate and environmental drivers of berry productivity from the forest–tundra ecotone to the high Arctic in Canada. *Arctic Science, 6*(4), 529–544. https://doi.org/10.1139/as-2019-0018

Cadieux, MC, Gauthier, G., & Hughes, R. J. (2005). Feeding Ecology of Canada Geese (Branta canadensis interior) in Sub-Arctic Inland Tundra during Brood-Rearing (Écologie alimentaire de Branta canadensis interior pendant la période d'élevage des jeunes dans un milieu d'eau douce sub-arctique). *The Auk, 122*(1), 144-157. http://www.jstor.org/stable/4090355

Charron, I. (2017). *Portrait climatique au Nunavik: changements en cours et attendus Session 3c*. https://www.ouranos.ca/wp-content/uploads/Charron_3C.pdf

Chaumont, D. & Mailhot, A. (2017). *Élaboration du portrait bioclimatique du Nunavik*. Ouranos (2). https://mffp.gouv.qc.ca/documents/forets/inventaire/Portrait_bioclimatique_Nunavik_Tome_2.pdf
Climate Atlas of Canada (2018). Climate Atlas of Canada. https://climateatlas.ca/

Crowley, T. J., & Berner, R. A. (2001, June). *Paleoclimate. CO2 and climate change*. ResearchGate; American Association for the Advancement of Science. https://www.researchgate.net/publication/11996487_Paleoclimate_CO2_and_climate_change

Data Sources and Methods | Climate Atlas of Canada. (2018). Climateatlas.ca. https://climateatlas.ca/data-sources-and-methods

Dept. of Fisheries, Forestry and Agriculture NFL (2020). *Aerial Survey of the George RIver Caribou Herd-July 2020*. Newfoundlandlabrador. 9:35

Environment Canada. (2012). *Historical Data - Climate - Environment and Climate Change Canada*. Weather.gc.ca. https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

Fournier, C & Logan, C (2017). *Élaboration du portrait bioclimatique du Nunavik*. Ouranos (2). https://mffp.gouv.qc.ca/documents/forets/inventaire/Portrait_bioclimatique_Nunavik_Tome_2.pdf

Foret Ouverte. (2019). Gouv.qc.ca. https://www.foretouverte.gouv.qc.ca/?context=_carte_nord&zoom=12¢er=-73.94861,53.26899&invisiblelayers=*&visiblelayers=64f1d32446713d65776636cf65c6653b,1da64ddfeaf23 710b8a9ad95133fb5d8

Hunting Ban Announced on George River Caribou Herd. (2013). Gov.nl.ca. https://www.releases.gov.nl.ca/releases/2013/env/0128n08.htm

IPCC, 2021: Climate Change 2021: The Physical Science Basis. *Cambridge University Press*. doi:10.1017/9781009157896.

Joy, S.M., Reich, R.M., Reynolds, R.T. (2003) A non-parametric, supervised classification of vegetation types on the Kaibab National Forest using decision trees. *International Journal of Remote Sensing, 24*(9), 1835-1852, DOI: 10.1080/01431160210154948

Kempes, C. P., West, G. B., Crowell, K., & Girvan, M. (2011). Predicting Maximum Tree Heights and Other Traits from Allometric Scaling and Resource Limitations. *PLoS ONE, 6*(6), e20551. https://doi.org/10.1371/journal.pone.0020551

La situation du caribou au Québec - Ministère des Forêts, de la Faune et des Parcs. (2022, January 11). Ministère Des Forêts, de La Faune et Des Parcs. https://mffp.gouv.qc.ca/la-faune/especes/caribou-quebec/

Lavallée, C. (2013) *Impact de l'augmentation du couvert ligneux érigé et d'un réchauffement expérimental sur la productivité d'Empetrum nigrum L., Vaccinium uliginosum L. et V. Vitis-idaea L., à Kangiqsujuaq et Kangiqsualujjuaq (Nunavik)*. [M.Sc. thesis, Université du Québec à Trois-Rivières.]

Le Corre, M.R.V., Dussault, C., & Cote, S.D. (2016). Weather Conditions and Variation in Timing of Spring and Fall Migrations of Migratory Caribou. *Journal of Mammology, 98*(1), 260-271

Lussier, I. (2016). Impact de l'arbustation récente sur l'abondance et la productivité de Vaccinium uliginosum L., Vaccinium vitis-idaea L. et Empetrum nigrum à Umiujaq (Nunavik). [M.Sc. thesis, Université du Québec à Trois-Rivières].

Mameamskum, J. (2014). *Assessment of Climate Change Impacts On the Caribou, The Land, and The Naskapi Nation, and Identification of Priority Adaptation Strategies.* Ouranos. https://www.ouranos.ca/wp-content/uploads/RapportMameamskum2014_EN.pdf

Mailhot, A. & Chaumont, D. (2017a). *Élaboration du portrait bioclimatique du Nunavik.-Tome 1. Rapport présenté au Ministère de la forêt, de la faune et des parcs.* Ouranos (1). https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf

Mailhot, A. & Chaumont, D (2017b). *Élaboration du portrait bioclimatique du Nunavik.-Tome 2. Rapport présenté au Ministère de la forêt, de la faune et des parcs.* Ouranos (2). https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome2-Fr.pdf

Meunier, P., Hovius, N. & Haines, A. J. (2007, October 30). Regional patterns of earthquake-triggered landslides and their relation to ground motion. *Geographical Research Letter, 34*(20). https://www.researchgate.net/publication/215614457_Regional_patterns_of_earthquake-triggered_landslides_and_their_relation_to_ground_motion

McKenney, D. (2001) *Une classification climatique du Québec à partir de modèles de distribution spatiale de données climatiques mensuelles : vers une définition des bioclimats du Québec*. Direction du patrimoine écologique et du développement durable, ministère de l'Environnement, Québec.

McKenney, D. W., Pedlar, J. H., Lawrence, K., Campbell, K., & Hutchinson, M. F. (2007). Potential Impacts of Climate Change on the Distribution of North American Trees. *BioScience, 57*(11), 939–948. https://doi.org/10.1641/b571106

McManus, F., Van Doorn, K., & Yiend, J. (2012). Examining the effects of thought records and behavioral experiments in instigating belief change. *Journal of Behavior Therapy and Experimental Psychiatry, 43*(1), 540–547. https://doi.org/10.1016/j.jbtep.2011.07.003

Montzka, S. A., Dlugokencky, E. J., & Butler, J. H. (2011). Non-CO2 greenhouse gases and climate change. *Nature, 476*(7358), 43–50. https://doi.org/10.1038/nature10322

Morrissette-Boileau, C., Boudreau, S., Tremblay, J.-P., & Côté, S. D. (2018). Revisiting the role of migratory caribou in the control of shrub expansion in northern Nunavik (Québec, Canada). *Polar Biology, 41*(9), 1845–1853. https://doi.org/10.1007/s00300-018-2325-2

Myers-Smith, I. H., Forbes, B. C., Wilmking, M., Hallinger, M., Lantz, T., Blok, D., Tape, K. D., Macias-Fauria, M., Sass-Klaassen, U., Lévesque, E., Boudreau, S., Ropars, P., Hermanutz, L., Trant, A., Collier, L. S., Weijers, S., Rozema, J., Rayback, S. A., Schmidt, N. M., & Schaepman-Strub, G. (2011). Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. *Environmental Research Letters, 6*(4), 045509. https://doi.org/10.1088/1748-9326/6/4/045509

Naskapi Nation of Kawawachikamach. (2022). Development of Climate Action Plan. *Naskapi Nation of Kawawachikamach*

Norment, C. & Fuller, M.E. (1997). Breeding-season frugivory by Harris' sparrows (Zonotrichia querula) and white-crowned sparrows (Zonotrichia leucphrys) in a low-arctic ecosystem. *Canadian Journal of Zoology, 75*(5):670-679

Payette, S., Delwaide, A., Caccianiga, M., & Beauchemin, M. (2004, September 28). *Accelerated thawing of subarctic peatland permafrost over the last 50 years*. Geophysical Research Letters, 31 (18). https://www.researchgate.net/publication/228929597_Accelerated_thawing_of_subarctic_peatland_permafrost_over_the_last_50_years

Payette, S., & Delwaide, A. (2004). Dynamics of Subartic Wetland Forests Over the Past 1500 Years. *Ecological Monographs, 74*(3), 373–391. https://doi.org/10.1890/03-4033

Portraits climatiques. (2022). Ouranos.ca. https://www.ouranos.ca/climate-portraits/#/

Rettie, W.J., Messier, F. (2000). Hierarchical Habitat Selection by Woodland Caribou: Its Relationship to Limiting Factors. *Ecography, 23* (4). Pp. 466-478.

Ropars, & Boudreau, S. (2012, March). Shrub expansion at the foresttundra ecotone: Spatial heterogeneity linked to local topography. *Environmental Research Letters, 7* (1). https://www.researchgate.net/publication/230903658_Shrub_expansion_at_the_foresttundra_ecotone_Spatial_heterogeneity_linked_to_local_to po graphy

Rupp, T. S., Chapin, III, F. S., & Starfield, A. M. (2001). Modeling the Influence of Topographic Barriers on Treeline Advance at the Forest-Tundra Ecotone in Northwestern Alaska. *Climatic Change, 48*(2/3), 399–416. https://doi.org/10.1023/a:1010738502596

Rupp, T.S., Hu, F. S., Brubaker, L. B., Gavin, D. G., Higuera, P. E., Lynch, J. A., Rupp, T. S., & Tinner, W. (2006). How Climate and Vegetation Influence the fire Regime of the Alaskan Boreal Biome: The Holocene Perspective. *Mitigation and Adaptation Strategies for Global Change, 11*(4), 829–846. https://doi.org/10.1007/s11027-005-9015-4

Sharma, S., Couturier, S., & Côté, S. D. (2009). Impacts of climate change on the seasonal distribution of migratory caribou. *Global Change Biology, 15*(10), 2549–2562. https://doi.org/10.1111/j.1365-2486.2009.01945.x

Taillon, J., Festa-Bianchet, M., & Côté, S. D. (2012, March). Shifting targets in the tundra: Protection of migratory caribou calving grounds must account for spatial changes over time. *Biological Conservation, 147* (1): 163-173.

Tremblay, M. (2017). *La végétation dans un climat changeant : portrait et perspective d'évolution.* Ouranos (2). https://www.ouranos.ca/wp-content/uploads/RapportNunavik2018-Tome1-Fr.pdf

Warren, M., Hudson, J. M. G., & Henry, G. H. R. (2009). Increased plant biomass in a High Arctic heath community from 1981 to 2008. *Ecology, 90*(10), 2657–2663. https://doi.org/10.1890/09-0102.1

Webshootertk. (2013). *PCMDI - CMIP5 Overview*. Llnl.gov. https://pcmdi.llnl.gov/mips/cmip5/

Weiler, M.H. (2009). *Naskapi Land Use in the Schefferville Region*. New Millenium Capital Organization. https://www.gov.nl.ca/ecc/files/env-assessment-projects-y2010-1380-appendix-k-weiler-naskapi-land-use-jan2009.pdf

Appendix1– CordexClimate Models

Figure 13: Freeze-Thawing days

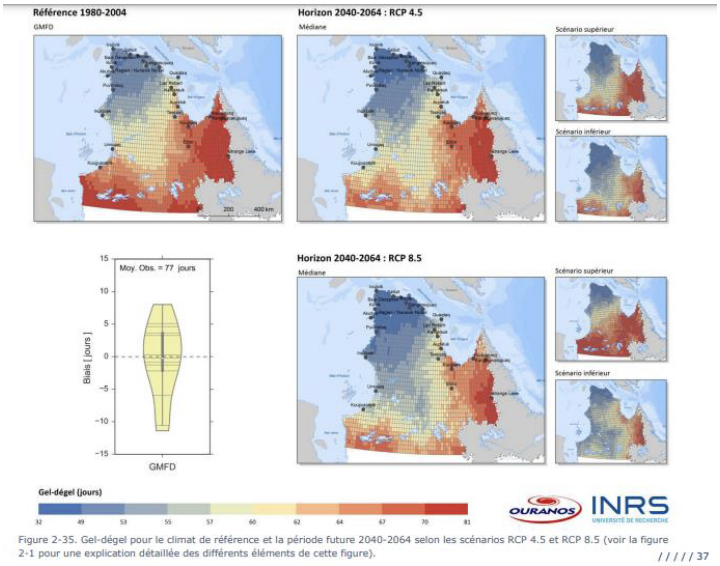


Figure 2-35. Gel-dégel pour le climat de référence et la période future 2040-2064 selon les scénarios RCP 4.5 et RCP 8.5 (voir la figure 2-1 pour une explication détaillée des différents éléments de cette figure).

https://mffp.gouv.qc.ca/documents/forets/inventaire/Portrait_bioclimatique_Nunavik_Tome_2.pdf (p. 37)

Figure 14: Growing season length

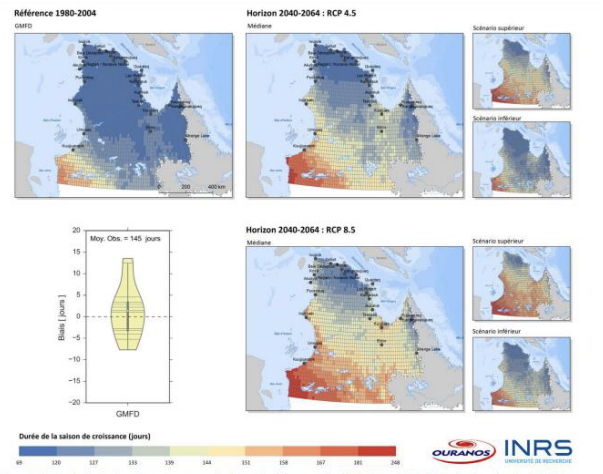


Figure 2-49. Durée de la saison de croissance pour le climat de référence et la période future 2040-2064 selon les scénarios RCP 4.5 et RCP 8.5 (voir la figure 2-1 pour une explication détaillée des différents éléments de cette figure).

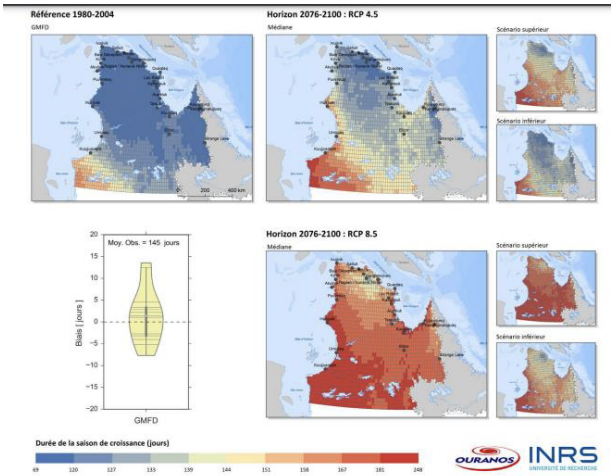


Figure 2-50. Durée de la saison de croissance pour le climat de référence et la période future 2076-2100 selon les scénarios RCP 4.5 et RCP 8.5 (voir la figure 2-1 pour une explication détaillée des différents éléments de cette figure).

https://mffp.gouv.qc.ca/documents/forets/inventaire/Portrait_bioclimatique_Nunavik_Tome_2.pdf (p. 51)

Figure 15: Percentage of total precipitations as snow (September)

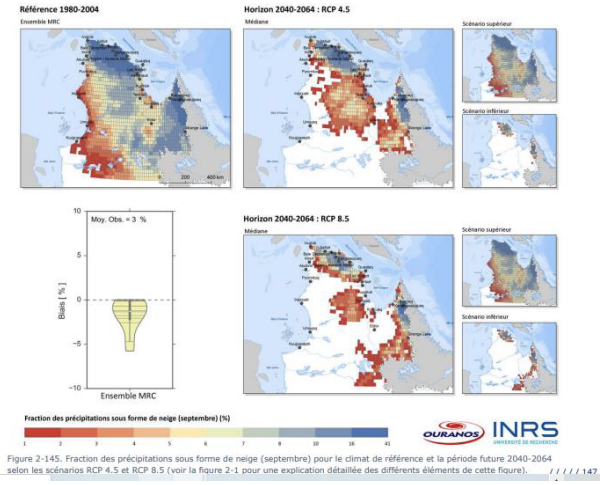


Figure 2-145. Fraction des précipitations sous forme de neige (septembre) pour le climat de référence et la période future 2040-2064 selon les scénarios RCP 4.5 et RCP 8.5 (voir la figure 2-1 pour une explication détaillée des différents éléments de cette figure).

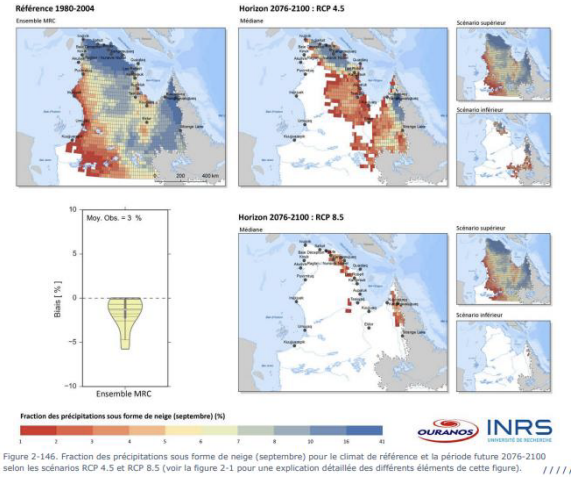
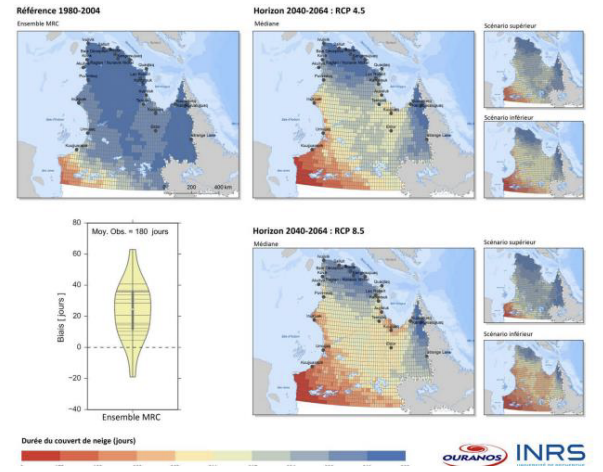


Figure 2-146. Fraction des précipitations sous forme de neige (septembre) pour le climat de référence et la période future 2076-2100 selon les scénarios RCP 4.5 et RCP 8.5 (voir la figure 2-1 pour une explication détaillée des différents éléments de cette figure).

https://mffp.gouv.qc.ca/documents/forets/inventaire/Portrait_bioclimatique_Nunavik_Tome_2.pdf (p. 148)

Figure 16: Snow cover period length



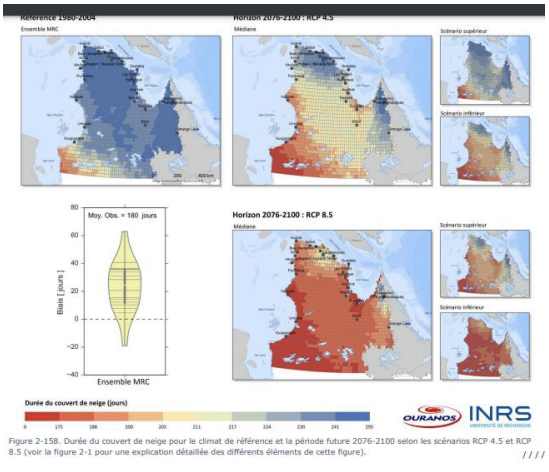


Figure 2-158. Durée du couvert de neige pour le climat de référence et la période future 2076-2100 selon les scénarios RCP 4.5 et RCP 8.5 (voir la figure 2-1 pour une explication détaillée des différents éléments de cette figure).

https://mffp.gouv.qc.ca/documents/forets/inventaire/Portrait_bioclimatique_Nunavik_Tome_2.pdf (p. 160)

Appendix 2 – species distribution on NNK territory: past and forecast

Specie	Modeled range for historical period (1981-2010)	2010-2040 RCP 4.5	2010-2040 RCP 8.5	2040-2070 Rcp 4.5	2040-2070 Rcp 8.5	2070-2100 Rcp 4.5	2070-20100 RCP 8.5
American Black Bear (=)	Presence - Across NNK territory (all)	Loss George river basin (-)	[...]	[...]	[...]	[...]	Across NNK territory (+)
American Marten (=)	All	[...]	[...]	[...]	[...]	[...]	[...]
American Mink (+)	All but northeastern section	All but Northern Ungava Bay Peninsula (+)	All but Northern Ungava Bay Peninsula (+)	Virtually all (+)	All (+)	All	[...]
American Water Shrew Apparition on NNK territory (widespread) (+)	No presence	All but SW (+)	All but SW (-)	All (+)	[...]	[...]	[...]
Arctic Fox (=)	All	Constant presence across periods					
Arctic Hare (-)	N, E, parts	Covers KWW area	[...]	Lost of most S range (-)	[...]	[...]	Only present Ungava Peninsula (-)
Arctic Shrew Apparition on NNK grounds (widespread) (+)	No	[...]	[...]	[...]	Sporadic Presence S (+)	No	Virtually All (+)
Canadian Lynx (+)	All but Upper George River bassin	Virtually all (+)	[...]	[...]	[...]	[...]	[...]
Cinereus Shrew (=)	All	All but parts of Northeastern Labrador (-)	[...]	[...]	[...]	[...]	All (+)
Coyote Apparition on NNK grounds (widespread) (+)	No	[...]	[...]	[...]	Presence South and East of KWW (+)	Virtually no presence	All but Ungava Peninsula (+)
Eastern Chipmunk Apparition on NNK grounds (+)	No	[...]	[...]	[...]	Sparse; N of KWW (Canapiscau basin) and E of Attikamagen lake (+)	No	All but Ungava Peninsula (+)
Eastern Heather Vole (+)	All but Upper George River Basin	[...] (slight increased northern range) (+)	[...] (slight increased northern range) (+)	All but Ungava Peninsula (+)	[...]	[...]	All (+)
Groundhog (+)	Caniapiscau river basin and lower George River basin	Virtually all (+)	[...]	[...]	All (+)	[...]	[...]

House mouse Widespread apparition (+)	No	All (+)	[...]	[...]	[...]	[...]	[...]
Little Brown Bat (+)	Southern NNK territory (up to Wheeler river)	W and SE (+)	[...]	Virtually all (+)	All (+)	Virtually all	All
Meadow Jumping Mouse Widespread apparition (+)	No	All	[...]	[...]	[...]	[...]	[...]
Meadow Vole (=)	All	[...]	[...]	[...]	[...]	[...]	[...]
Moose (-)	All but upper george river bassin *does not seem to match historical observations	Some Presence W of KWW (-)	Some presence (more) W of KWW (+)	Virtually none (-)	W and S of KWW (+)	Presence extreme W of NNK territory (-)	W of KWW (-)
Muskrat (=)	All	[...]	[...]	[...]	[...]	[...]	[...]
North American Beaver (+)	All but Ungava Bay	Loss of NE range	[...]	[...]	[...]	[...]	Virtually all (+)
North American Deer Mouse (+)	Eastern strip	Near all but George River Basin (+)	Near all but George River Basin (+)	All Quebec territory (+)	All (+)	[...]	[...]
North American Porcupine (+)	Up to Riviere de la Baleine	Expanded northern range. Up to Kangiqsualujjuaq (+)	[...]	All but isolated area south of Torngat Mountains National reserve/all Quebec territory (+)	[...]	[...]	All (+)
Northern Bog Lemming (-) disparition on NNK grounds	All	Kawawa area, upper George River Basin (-)	[...]	Only upper GRB (-)	Sparse presence upper GRB (-)	upper GRB + isolated presence (2 points) west of KWW	Virtually non-present (-)
North American Flying Squirrel (+)	Presence south of Kawawa at the southern limit of Naskapi grounds	All (+)	[...]	[...]	[...]	[...]	[...]
Polar Bear* -natural barriers may apply (-)	All	Virtually All	[...]	[...]	[...]	[...]	Loss of southern range (only sporadic presence (-)
Red squirrel (=)	All	Virtually all	[...]	[...]	[...]	All	All
Caribou Disparition on NNK grounds (-)	All	Only isolated area in upper George river basin (GRH) (-)	Slightly larger range in the same area (+)	Dramatically decreased presence in the same area (-)	No (-)	[...]	[...]
Rock vole (+) Widespread apparition	No	All but West of Kawawa (+)	[...]	All (+)	[...]	[...]	[...]

Snowshoe hare (+)	All but East of G (except SE part of GR where it is present further E)	All but Ungava Peninsula (+)	[...]	[...]	[...]	[...]	All
Southern Red-Backed vole (+)	All but North East of George River Bassin	Virtually All	[...]	All	[...]	[...]	[...]
Star-nosed mole (+) Widespread apparition	No	All	[...]	[...]	[...]	[...]	[...]
Striped Skunk (+) Widespread apparition	No	[...]	[...]	[...]	Sparse presence Caniapiscau basin (+)	No	All but Ungava Peninsula (+)
Ungava Collared Lemming (-)	Kawawachikamach region and George River Basin	Ungava peninsula (-)	[...]	No	[...]	[...]	[...]
White Tailed-Deer (+) Widespread apparition	No	[...]	[...]	[...]	[...]	[...]	Up to the 54.5th parallel
Wolverine (-) Disparition	All	Sparse Kawawa religion, West of George River in the North (-)	[...]	West of George River in the North	No (-)	Sparse Ungava Peninsula	No
Woodland Jumping Mouse (+) Widespread apparition	No	All but Upper George River Bassin (+)	[...]	Virtually All (+)	All (+)	[...]	[...]
Game birds (waterfowl, lagopus genus) Does not include migratory ranges for migratory species (spring and fall migration) unless specified otherwise given lack of data.							
Canada Geese (=) (summer and migration)	All	Stable over time, no indications of decreased migratory numbers					
Snow Geese (-) (migration)	Breeding grounds Not found on NNK territory but its probable diminution in breeding range in the Arctic is likely to result in a diminished migration volume in the East-Atlantic migration corridor						
American Black Duck (Summer) (=)	Virtually all	Loss of range east of George River (-)	[...]	[...]	[...]	Virtually all	Virtually all
Mallard (summer) (+) Apparition	No	All	[...]	[...]	[...]	[...]	[...]

American Wigeon (summer) (+) (apparition)	No	Sparse Presence up to 57th parallel (+)	Up to 57th Parallel (+)	[...]	All but Ungava Peninsula (+)	Up to 57th Parallel	All but Ungava Peninsula
Green-Winged Teal (summer) (+)	All but Northeast of George River (56th parallel and up)	All (+)	[...]	[...]	[...]	[...]	[...]
Northern Pintail (+)	Koksoak bassin + south of Kawawa (in Labrador/54.5th parallel)	All	[...]	[...]	[...]	[...]	[...]
Greater Scaup (summer) (-) Disparition on NNK range	All	Virtually all (-)	Sparse presence throughout Naskapi territory; presence near Kawawa and GRB (-)	Near Kawawa: East shore of Swampy Bay river, East shore of Godwood river. GRB (-)	Virtually non-present except pockets northeast of George River (-)	George River Bassin	No (-)
Surf Scoter (summer) (-) Quasi-disparition NNK range	Up to 57th parallel except east of George River	Sparse presence throughout NNK territory, present near Kawawa (-)	Slight increase in range (+)	Sparse presence throughout NNK territory, present near Kawawa	Local presence south of Kangiqsualujjuaq (-)	[...]	Virtually non-present (-)
Black Scoter (summer) (-) Disparition on NNK range	All but Ungava Peninsula	Up to 56th parallel (-)	[...]	Isolated presence near Kawawa (Godwood and Swampy Bay river) and along George River (-)	No	[...]	[...]
Long-Tailed Duck (summer) (-)	Only in northernmost NNK territory when it comes to breeding and summer range (58th parallel +) and along the Labrador Coast Diminution of breeding range in the Arctic and on the Labrador coast could alter migration volume in fall and spring						
Harlequin Duck (summer) (+)	Widespread north of 56.5th parallel as well as on Labrador coast, sporadic presence in the Kawawa region and much of Naskapi practical range for waterfowl hunting	Similar but with increased presence south of Kawawa (Attikamagen lake and below)	Slightly decreased range between 55 and 57 N (-)	[...]	Increased presence near and northeast of Kawawa (+)	Virtually all (+)	All (+)
Willow Ptarmigan (Year-round) (-)	All	[...]	[...]	[...]	Virtually all (-)	All	Presence mostly in Ungava Peninsula, north of 57th

Typical habitat: stunted willow thickets on flat tundra to possibly be compromised my increased vegetation density							parallel for year-round range. Wintering range, not covered in the dataset, would most likely still cover significant NNK territory.
Rock Ptarmigan (year-round) (-) Predicted Disparition of year-round population on NNK grounds	Year-round range North of 57N, wintering range historically went as far south as Sept-Iles	NE NNK range (57N+) (-)	[...]	No Hard to tell how the wintering range would evolve, likely presence on NNK range but possibly scarcer.	[...]	[...]	[...]
Sharp-Tailed Grouse (year-round) (+) Possible localized apparition under RCP 8.5 2071-2100	No	[...]	[...]	[...]	[...]	[...]	Sporadic presence mostly SE of George River and NW of Caniapiscau river. (+)
Spruce Grouse (year round) (+)	All but Ungava Peninsula	Slight Diminution of NE range (-)	Slight gain in NE NNK territory	[...]	[...]	[...]	Virtually all, all Quebec territories for the NNK (+)
Ruffed Grouse (year round) (+) Widespread apparition from 2010-2040 onwards, would be an indicator of the emergence of mixed wooded areas and dense shrubbery	No	All	[...]	[...]	[...]	[...]	[...]

Data derived from https://ahasverus.shinyapps.io/bioclimaticatlas/

1300, boulevard Saint-Joseph
Lachine (Québec) H8S 2M8

collegial.sainteanne.ca

COLLÉGIAL INTERNATIONAL
SAINTE-ANNE