

Newfoundland and Labrador's

VITAL Signs

FOCUS ON CLIMATE CHANGE

Special Edition 2022



FORECAST NL



COMMUNITY FOUNDATION OF
NEWFOUNDLAND AND LABRADOR



A special edition of the annual Vital Signs Report
focused on climate change impacts in Newfoundland
and Labrador.




INTRODUCTION

From the devastation of Hurricane Fiona on the Southwest Coast of the island, to the forest fires in Central Newfoundland, and the continued impacts of unpredictable sea ice and thawing permafrost in Labrador, climate change is becoming more and more evident in the lives of Newfoundlanders and Labradorians. We've also experienced firsthand the impact of global supply chain issues on local food prices, giving us a glimpse of what the future of food supply issues might look like as a result of climate change.

Understanding how climate change is impacting life in our province is exactly why the Harris Centre launched Forecast NL. Over the last 18-months, through the Forecast NL project, the Harris Centre held public discussion sessions and panel presentations on how climate change affects the environment, economy, and society in Newfoundland and Labrador.

The ongoing partnership between the Community Foundation of Newfoundland and Labrador and the Harris Centre on the annual Vital Signs report was the perfect



opportunity to bring some of the key issues and understandings that emerged through the Forecast NL project to a broader audience.

We hope this report will be a resource and spark conversations and action about how to create a more climate-resilient Newfoundland and Labrador.

- *Community Foundation of NL and Harris Centre Vital Signs NL Project Team*

What is FORECAST NL?

Forecast NL is a province-wide public engagement and dialogue project focused on climate change and its impacts on the environment, economy and society of NL.

11 panel discussions held with over 30 expert panelists

Topics including:

- *Environmental Changes*
- *Society and Climate Change*
- *Economic Impacts*
- *Clean Tech*
- *Oceans and Fishery*
- *Future of Oil and Gas*
- *Communities and Infrastructure*
- *Food and Farming*

What we HEARD

We asked participants to tell us what worries them most about climate change in NL. Here are some of the things they said:

- Increased coastal **EROSION**
- **FREQUENCY AND SEVERITY** of future **FLOODING**
- Limits of **FOOD** security
- Preparedness for higher intensity storms
- Changes to our **OCEANS** and the impact on the **FISHERY**
- Lack of understanding of seriousness of climate change
- Impact on **INDIGENOUS COMMUNITIES**
- How the **TRANSITION** to a clean economy will effect **JOBS**

What we LEARNED

- Hundreds of people tuned in and engaged as part of the Forecast NL sessions, showing the desire and need for **more opportunities to bring together individuals and groups as we chart our forward course.**
- **Communities across the province** have substantial local knowledge about the ways climate change will impact them, but they need **resources and policy support to help them build resilience.**
- Simultaneous climate and affordability crises are forcing people to reconsider how they get around and feed their families, so we need **more coordinated planning to equitably support people and communities.**

LAND acknowledgement

We respectfully acknowledge Newfoundland and Labrador as the ancestral homelands of the Beothuk, Mi'kmaq, Innu and Inuit of this province. We encourage everyone to reflect on the lands where they are located and to consider the Indigenous peoples for whom these lands are traditional territory as we strive for respectful relationships, collective healing and true reconciliation.

Watch the videos and learn more at: harriscentreforum.ca/forecast-nl

“We need to avoid paralysis and actually do something. It’s more pressing now than ever before. There’s a degree to which the last 20 years have felt like somebody’s morning alarm going off and they keep hitting the snooze button and keep hitting the snooze button and unfortunately, now we’re all late for work.”

– Dr. Joel Finnis, “Climate Change in NL: Impacts and Actions” panel discussion

“Tackling the climate change challenge of our time is an enormous opportunity for economic growth, diversification, and innovation for Newfoundland and Labrador.”

– Kieran Hanley, “The Economic Impact of Climate Change” panel discussion

“We often hear “NL is small and it is a disadvantage”... This is generally an excuse for doing little and to slow down taking bold actions on climate change. However, being a small province is also an advantage! When we collectively decide to take action(s), we will get to see positive results much faster. We can be whatever we have the courage to see. We can be a leader. All we have to do is act like one.”

- Forecast NL participant, online discussion forum

“We really have to pay attention to who is going to be affected, how they are going to be affected, who has the resources, the capacity, and the options to move on.”

– Dr. Barbara Neis, “Climate Change and Our Society” panel discussion



“At this point, the main obstacles to making progress on climate change tend to be more political and social – they’re not necessarily scientific and to a large extent not even necessarily technological. [...] If we are a laggard region, as the rest of the world is moving ahead on low carbon transitions, on green energy transitions, we are then making choices that create social and economic risks for our province.”

– Dr. Mark Stoddart, “Climate Change and Our Society” panel discussion

OUR LANDS ARE OUR FUTURE

A Message from the Innu Nation on climate action

Innu understand that the climate crisis is real – and that solutions are urgently required.

For thousands of years, our culture has been a reflection of what the land itself has taught our ancestors. Because we had the skills and the knowledge, Innu people have thrived in a place once dismissed by Europeans as ‘the lands God gave to Cain’. It is the only land we know.

Because of this deep relationship, we also know that things are changing. The evidence is all around us. The land itself is changing. Places that were once barrens are becoming shrubs, and wetlands are starting to turn into meadows,

and may eventually become forests. The behaviour and migrations of animals – particularly the caribou – have changed, and new species are showing up on our lands and in our waters. Our travels on the land and on the sea are now far less safe, as the ice forms later and is less secure. Our weather – while never predictable – has become very uncertain. And we know that these changes are all happening more quickly in our territory than in many other places where these problems are caused.

Innu may not be responsible for the vast amounts of carbon being pumped into the atmosphere, but we are taking action to do what we can to reduce

emissions in our territory and to accelerate the transition to renewable, low-carbon energy.

We are partners with our neighbours in Nunatsiavut to build, own and operate the Innu-Inuit Envest Limited Partnership, which provide the Voisey’s Bay project with renewable wind power that will replace approximately 10 million litres per year in diesel consumption, and avoid approximately 25,000 tonnes of greenhouse gas (GHG) emissions per year from the Voisey’s Bay mine.

We are also in the early stages of exploring ways to utilize excess hydroelectric capacity from the Lower Churchill

project to create green hydrogen fuel. Green hydrogen produced from hydroelectricity has a very low carbon footprint, and can be used in place of natural gas. In a world which desperately needs alternatives to fossil fuels for energy, many experts believe that green hydrogen is one of the better options for many applications.

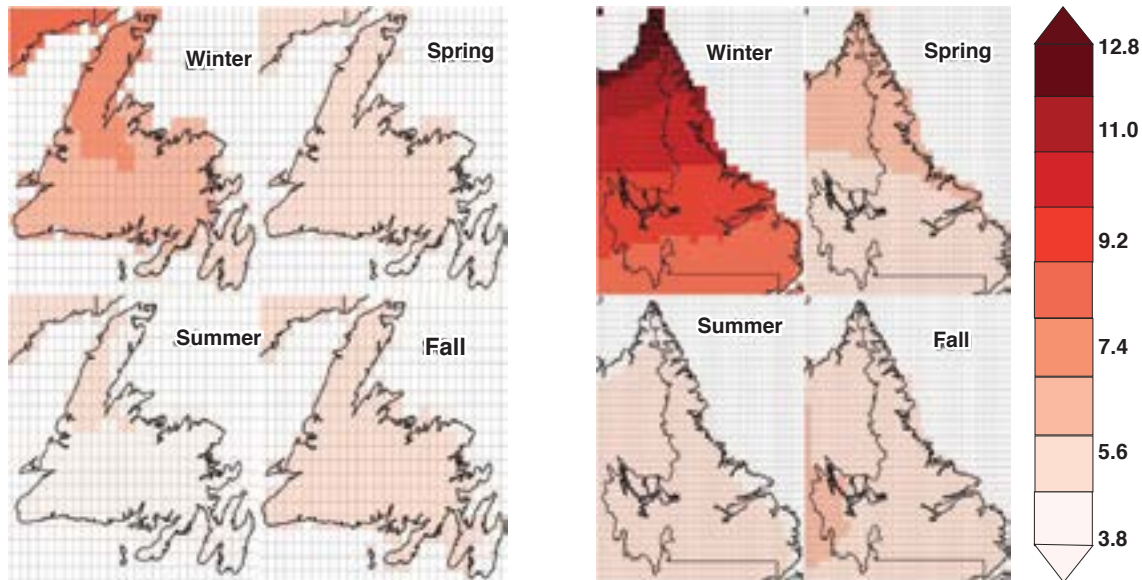
Innu understand that we are only a small part of a global problem, but we are hoping that we can become a much larger part of the solution. As Indigenous people, we know that our lands are our future. We will do everything that we can to try to make a difference today for our children tomorrow.

CHANGING CLIMATE

How will climate change impact the weather and temperatures in NL?

Projected SEASONAL TEMPERATURE changes

(Late century 2041 - 2070)

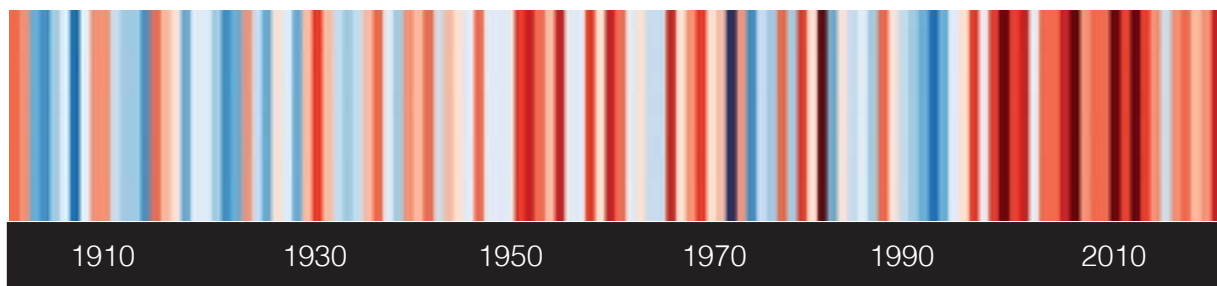


Later this century (2041-2070), areas like Northern Labrador could see average daily temperatures increase by as much as 12.8 degrees in winter time. The island could see average daily winter time increases of 6 degrees on the Avalon and 8 degrees on the Northern Peninsula. By the end of the century, Nain's winter

temperature could resemble present day Corner Brook temperatures, and winter in Corner Brook could resemble present day St. John's.

(Source: Drs. Joel Finnis and Joseph Daraio, Memorial University, *Projected Impacts of Climate Change for the Province of Newfoundland and Labrador: 2018 Update*)

Temperature change in NL since 1901



Each stripe or bar on the Warming Stripe Graph represents average annual temperature. The deeper the red, the warmer the temperature was that year.

(Source: Professor Ed Hawkins and University of Reading, UK, www.showyourstripes.info)



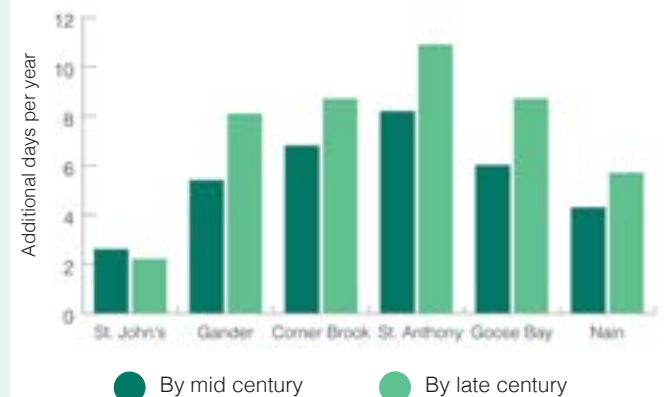
PRECIPITATION

In the coming years, NL will see more large rain and snow events (10+ mm of rain or 10+ cm of snow per day) and more rain and snow during multi-day events.

Even if precipitation intensity is low, consecutive days of rain or snow can have a big impact on natural reservoirs and water bodies, leading to potential flooding.

High Precipitation Days

Number of additional days per year with precipitation of 10+ mm



(Source: Drs. Joel Finnis and Joseph Daraio, Memorial University, *Projected Impacts of Climate Change for the Province of Newfoundland and Labrador: 2018 Update*)

FROST FREE Days

In a single lifetime, the number of frost-free days will nearly double in some seasons in parts of the province. While it will extend the growing season, it can also create an environment more conducive for pests and invasive species.

● Current climate

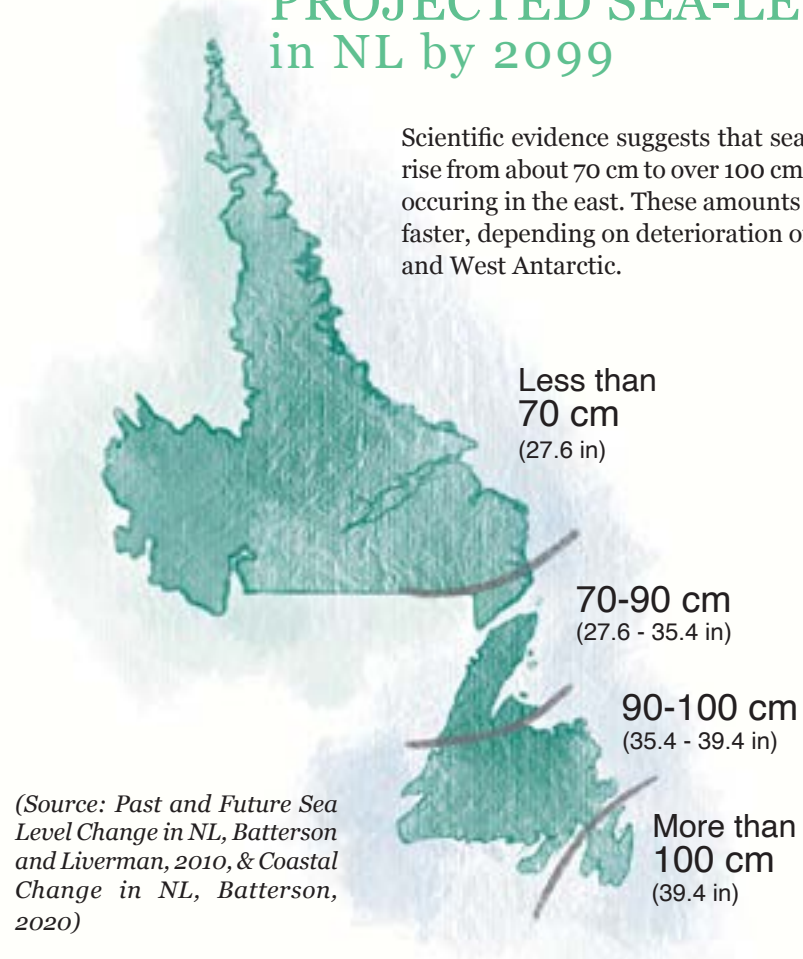
● Future climate



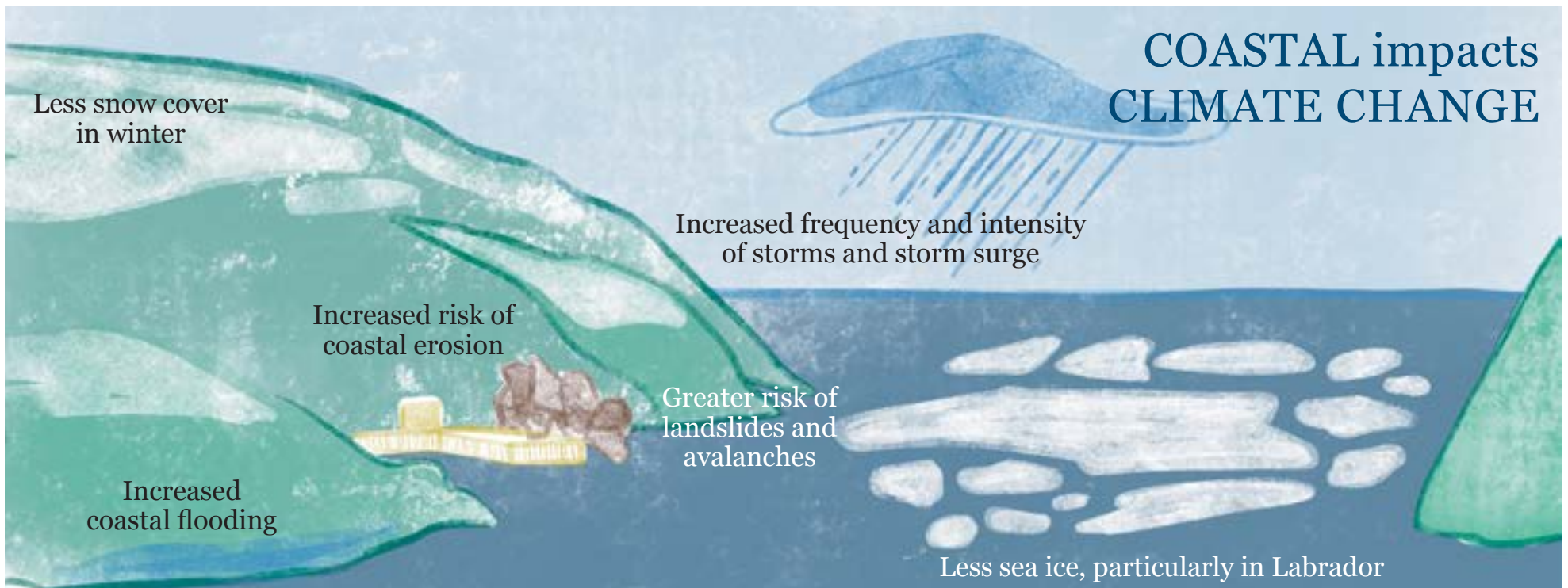
(Source: Government of NL)

PROJECTED SEA-LEVEL RISE in NL by 2099

Scientific evidence suggests that sea levels are expected to rise from about 70 cm to over 100 cm with the highest levels occurring in the east. These amounts could move or happen faster, depending on deterioration of glaciers in Greenland and West Antarctic.



(Source: Past and Future Sea Level Change in NL, Batterson and Liverman, 2010, & Coastal Change in NL, Batterson, 2020)



GREENHOUSE GAS EMISSIONS

Forget your footprint.

How big is YOUR SHADOW?

The climate is changing regardless of our present actions. However, our collective action will contribute to the extent of change. How we locally change and adapt, and what things we accept and approve of, can make things better or worse for the generations to come.

In this spirit, climate journalist Emma Pattee suggests we think about our “climate shadow” rather than our carbon footprint.

“I visualize my climate shadow being made of three parts: my consumption, my choices and my attention”

Emma Pattee

A carbon footprint refers to each person’s direct, personal contribution to greenhouse gases, an idea popularized in ads from British Petroleum in the early 2000s. This idea put the onus on the individual, ignoring the importance of major industrial emitters and climate policy.

Pattee suggests we consider things a little differently.

“I visualize my climate shadow being made of three parts: my consumption, my choices and my attention,” she wrote.

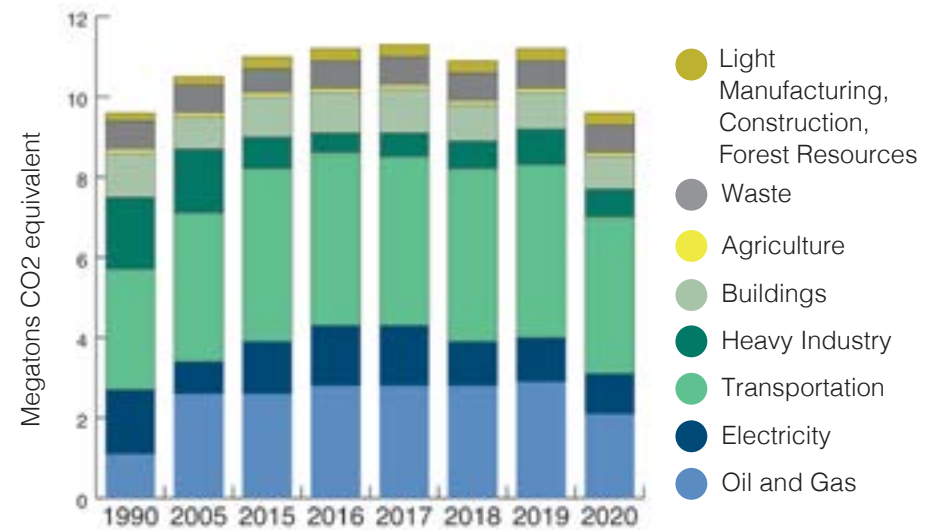
The idea of attention, she suggests, is the most important. It can be as simple as reading an article related to climate change, having a conversation with a friend about a local composting program, writing an email to a town council member, or volunteering with a non-profit to help build and maintain more robust physical and social infrastructure to support the broader community.

“Think of your climate shadow as a dark shape stretching out behind you,” she explained. “Everywhere you go, it goes too, tallying not just your air conditioning use and the gas mileage of your car, but also how you vote, where you work, how you invest your money, how much you talk about climate change, and whether your words amplify urgency, apathy, or denial.”

It’s less about “my” footprint and more about “our” collective effort. It doesn’t ignore industry or the need for provincial and federal government-level action on things like GHG emissions, but recognizes our role in creating the kind of society that demands that action.

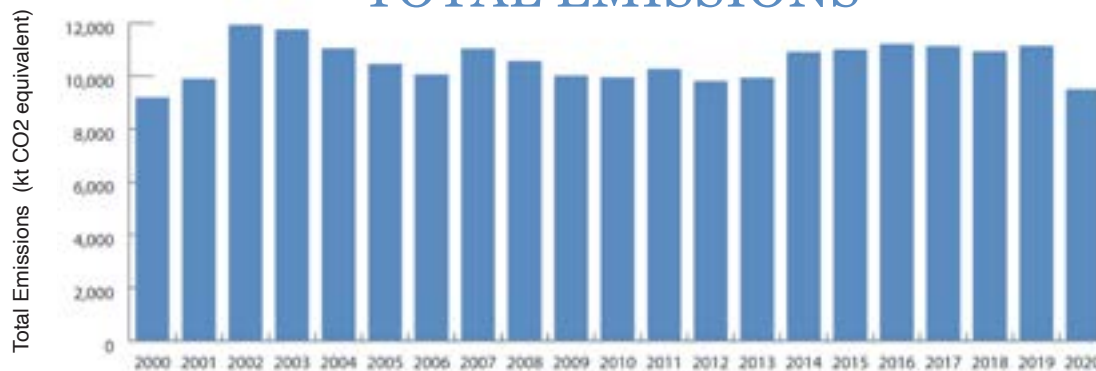
How is NL contributing to GHG emissions?

GHG EMISSIONS by sector



Transportation is consistently the highest contributing sector to greenhouse gas emissions in NL. While emissions dropped in 2020, it is important to remember that much of this drop was due to COVID-19 pandemic restrictions. (Source: Environment and Climate Change Canada, National Inventory Report 1990-2020 Greenhouse Gas)

TOTAL EMISSIONS



NL’s total greenhouse gas emissions increased since 2000, and while it has gone down slightly in some years depending on industry activity, even shutdowns and the introduction of travel restrictions at the onset of the COVID-19 pandemic in 2020 were not enough to drop provincial emissions below what was recorded in 2000. (Source: Government of NL)

TOP 5 industrial GHG EMITTERS

Facility	Total CO2e (tonnes)
Iron Ore Company of Canada	891,321
Holyrood Thermal Generating System	623,857
Hibernia GBS	528,379
Hebron GBS	454,643
SeaRose FPSO	331,484

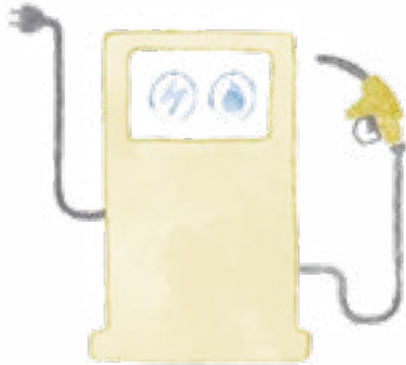
The counts here cover industrial facilities in 2021. All totals are CO2e, or “carbon dioxide equivalent,” so include other greenhouse gas emissions like methane in the total. The Top 5 will change year to year depending on specific facility operations. (Source: Government of NL)



TRANSPORTATION

How is climate change impacting how we get from place to place?

ELECTRIC vehicles



In NL, as of summer 2022, there were:

439 Electric Vehicles

1,659 Hybrid Vehicles

The number of electric and hybrid vehicles has increased significantly since 2016, from just 41 electric vehicles and 464 hybrids.

(Source: Gov. of NL and NL Hydro, 2022)

ACTIVE transportation

Options for getting around like biking, or using electric scooters and E-bikes, can lead to healthier lifestyles, with related infrastructure that can increase community attractiveness, improve accessibility and also offer greenhouse gas reductions.

Seeing this mix of interests, the federal government has offered supports under the banner of climate action; however, there are still significant local hurdles—in perception, policy and committing to infrastructure costs.

Consider bicycling. Fat bikes (with thick tires, able to tackle snow and rough terrain) and, increasingly, E-bikes (with battery-run motors in addition to pedals) are currently seeing financial incentives elsewhere in Atlantic Canada and uptake worldwide. Cycling to work is more common, with three-quarters of Canadian Census Metropolitan Areas seeing an increase since 2001.

But moving people away from NL car culture is a challenge.

“The lack of infrastructure is really holding people back,” said Bicycle Newfoundland and Labrador representative, Ryan Green. “People just don’t feel safe.”

Green’s organization is focused on the sport of cycling but is also actively involved in things like advancing regulation for bicycle use and assessing overall bike use. In NL, poor weather and hills are a factor for some, but infrastructure, like bike racks, signage, bike lanes and dedicated bike paths to allow for safer travel is the real key.

“Infrastructure would make it more equitable,” Green said. “Biking around some of these places [here in St. John’s] is just so bad, no one’s going to want to do it.”

Green suggests smart investment is needed: “Instead of subsidizing gas, perhaps we could subsidize E-bikes and other alternative modes of transportation,” he suggested.

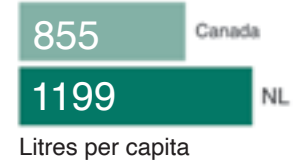
New recreational trails for sport cycling have been added in recent years on the west coast of the island, including between Corner Brook and Steady Brook, by volunteers with the West Coast Cycling Association. Why not more routes for everyday cycling through our town cores and between communities?

Fuel DEMAND

Gasoline



Diesel



NL’s gasoline demand was 36% above the national average in 2019, and diesel demand was 40% above the national average.

(Source: Canada Energy Regulator, 2019)

GHG emissions from light-duty gasoline trucks more than doubled in the last 20 years - from **552** to **1174** kilotonnes of CO2 equivalent.

(Source: Environment Canada National Inventory Report)

Heavy duty EVs

Canada has made a commitment that all new light-duty vehicles will be electric by 2035. But what about our heavy-duty fleets? In 2018, a City of St. John’s emissions inventory showed that the city’s heavy diesel fleet — snowplows, blowers, garbage trucks, dozers at the landfill, and “trackless vehicles” (156 heavy-duty units) — were responsible for 72% of all city corporate transportation-sector GHG emissions. That’s compared to 21% from light-duty vehicles (125 units).

To date, there’s no easy, cost-effective switch-out for all types of heavy-duty vehicles. There are no electric options commercially available in some cases and no timeline on when they might arrive

(though city staff have been on the hunt, reaching out to other municipalities and suppliers). Even so, there have been some advances. Newfoundland Power and Newfoundland & Labrador Hydro, for example, have started to switch in their light-duty fleets but more importantly, when Fortis CEO David Hutchens attended the 2022 Edison Electric Institute conference in the United States, he was able to check out a line of all-electric, heavy-duty vehicles on display. This lineup included an all-electric bucket truck for utility service calls. A flood of new capital into research and development is sure to produce more alternatives, demanding care in fleet planning and purchasing.



ECONOMY

*What effect is climate change having on the economy in NL?
How is it changing various industries in our province?*

NL oil industry - Critical questions in a time of TRANSITION

Burning fossil fuels is humanity's primary, direct contribution to climate change. The climate change response is therefore not just about developing more renewable energy and new technologies, but, fundamentally, it is a transition away from fossil fuels.

Pandemic aside, the world has been using more and more fossil fuels over time, including an eight-fold increase since 1950. Consumption has roughly doubled since just 1980.

As a province, we have to think about this as producers of fossil fuels. Oil exploration, exports, sales, and consumption have injected desperately needed money into Newfoundland and Labrador, supporting critical public services like education and healthcare systems the industry

continues to directly support individuals and families by providing employment.

Not unlike other fossil fuel producers, what Newfoundland and Labrador is struggling with is what our energy transition will look like at the local level. How do we reduce our reliance on fossil fuel revenues? How can we shift quickly while maintaining stability in our public services and employment?

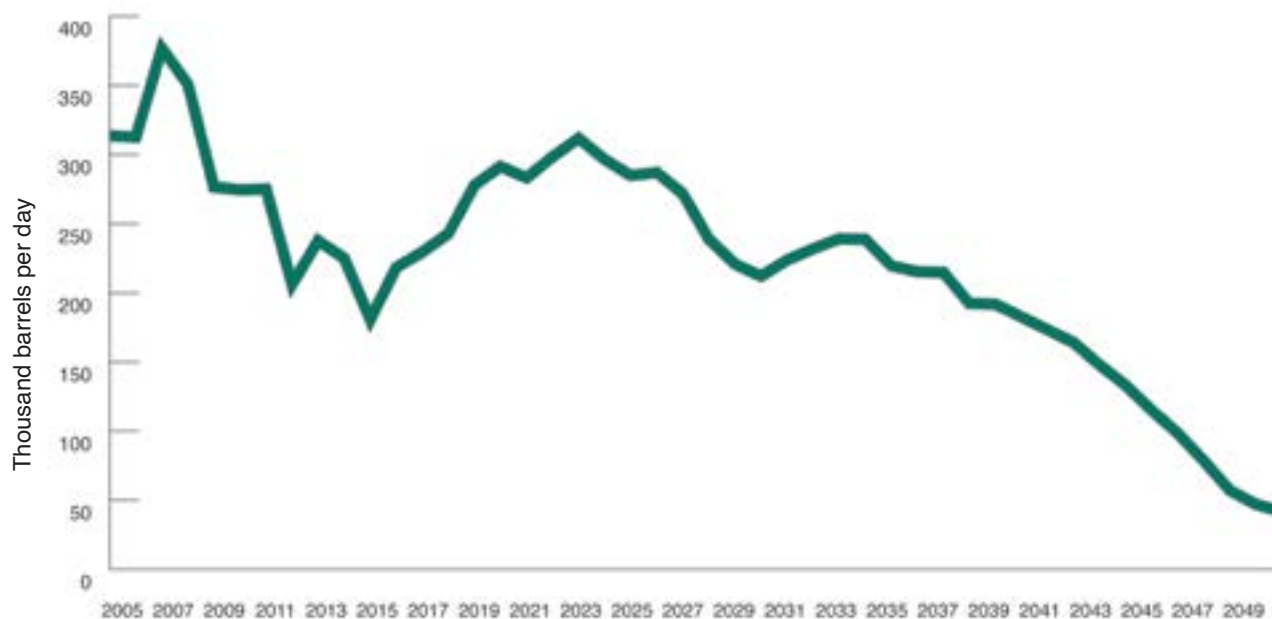
There is an urgent need to act. But how exactly do we take action in Newfoundland and Labrador? What is the time scale?

There are differing views on all of these questions, which are often oversimplified into two fixed camps, pro- and anti-oil. In truth, there is a far more diverse range of

thoughts and opinions, and — if pressed — these different groups have made similar comments on the overall long-term production outlook. In May 2021, Dame Moya Greene and the Premier's Economic Recovery Task Force recommended to Premier Andrew Furey the government work on streamlining oil and gas regulations and revamping benefit structures, to encourage exploration and production right now.

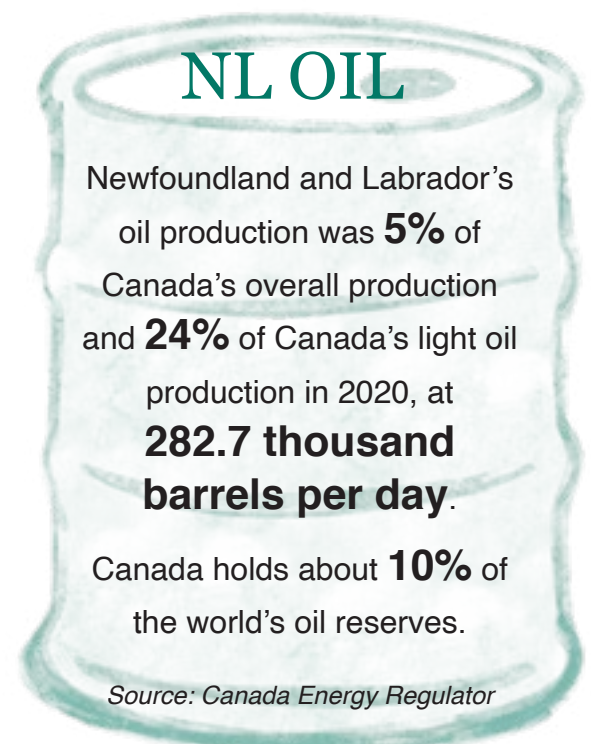
But that wasn't all the advice: "The opportunity, however, for new development in the sector is time-limited, with a narrow window for discovery and development," the group's Big Reset report stated. "Even for existing discoveries and developments of oil reserves, the window is closing."

Projected oil production



The production outlook for oil is constantly changing, with prices and market demands shifting. The most recent projection from the Canada Energy Regulator forecasts a steady decline in production, however, it does not include important considerations such as the impact of the war in Ukraine or the Bay du Nord Project. While the Bay du Nord project has cleared environmental assessment, the development application has yet to be filed.

(Source: Canada Energy Regulator, EF2021 Report)



HYDROGEN: Fuel for the future

The move to hydrogen as a solution for some of the world's toughest energy challenges (like decarbonizing long-haul trucking and marine transportation) presents a potential opportunity for NL.

It's been suggested that NL could become a major international supplier and exporter of green hydrogen, serving domestic, regional and other Canadian customers as well as potential buyers in the northeast US and Europe. Interest from countries like Germany is particularly encouraging.

However, it is important to remember that hydrogen isn't something that is pumped out of the ground—it's manufactured; it's

an end product of an industrial process, just as gasoline is a product created at a refinery. Hydrogen can be made using natural gas, as "grey hydrogen," or it can be made using wind, solar power, or hydroelectric power, as "green hydrogen." There are other types of hydrogen, all differing in exact process, cost, and market interest.

While hydrogen production can help NL fight climate change on a global scale, there are local environmental impacts that will need to be considered. As projects are put forward, both policymakers and individuals will be able to weigh in on whether or not they're agreeable.



SOCIAL LICENSE, essential in climate response

Saqamaw Mi'sel Joe says the Miawpukek First Nation leadership are talking about climate change "all the time these days," in one way or another, with a focus on possible responses. People are prompted by everything from how the increasingly common lack of hard freeze is affecting access to trap lines, to how warming water is affecting salmon populations.

"If we're hoping for things to get better, then we all have to take a look at what's happening now and all make a conscious change," the chief said in an interview. This change includes reducing greenhouse gases and embracing collective action.

This is especially true in the context of electricity. The Miawpukek reserve is powered by the island's electrical grid, which draws

on a mix of power sources, including the nearby Bay d'Espoir hydroelectric plant, the largest electricity producer on the island. A series of small dams and dikes used in the development of that plant caused well-known waterbodies in the area to become deeper and change direction. This often led to land being flooded. As more electrical energy is added to the grid, to meet the anticipated growth in electricity demand, Mi'sel Joe is clear that it is the desire of the Mi'kmaq to see alternatives like wind and solar clearly considered, before utilities default to bigger or new hydroelectric reservoirs.

"We don't need any more lands flooded," he lamented. "That's already been done. Massive amounts of land."

MINING POTENTIAL

Critical minerals an essential piece of the puzzle

Countries around the world are anxious to identify sources of "critical minerals." Canada has a list of 31 known to be in the country. They include things like cobalt, nickel, potash and rare earth elements, and are used in manufacturing everything from batteries to cell phones.

"We have a lot of minerals that a lot of other provinces don't have."

Dr. Derek Wilton, Faculty of Earth Sciences, Memorial University

You can't find them all in Newfoundland and Labrador. However, according to geologist Dr. Derek Wilton, from the 3.7 billion-year-old rock of the Canadian Shield in Labrador to the northeastern end of the Appalachian mountain belt on the island of Newfoundland, the province has great potential. It's what he calls "continent-scale geology."

"We have minerals that a lot of other provinces don't have," he said. One example is

rare earth elements, which have been found not far from Port Hope Simpson.

For Newfoundland and Labrador to become known for critical minerals, it must have companies sussing out resources and bringing them to development; it will demand alerting potential investors to what's here and conducting related science, technology development, and exploration.

It also demands consideration of the environment. The province can differentiate itself from producers in other parts of the world through lowest-emission, ethical production.

Everyone wants a greater share of the headline-making discoveries and commercial deals involving critical minerals – like Vale Newfoundland and Labrador's supply of nickel to clean energy and automotive company, Tesla, to support their manufacturing of electric vehicles.

Fundamentally—and thankfully, Wilton notes, for this province—it "starts with what you have in the ground."

He also explained the Miawpukek First Nation wants to be involved as decisions are made about NL's energy future.

"You have to be a participant to make anything happen."

Chief Mi'sel Joe

"When we sit down to talk about a deal of some kind, or develop a partnership of some kind, our first objective is to be environmentally friendly," he said, pointing to a need to directly protect biodiversity

and traditional land use, as we respond to climate change.

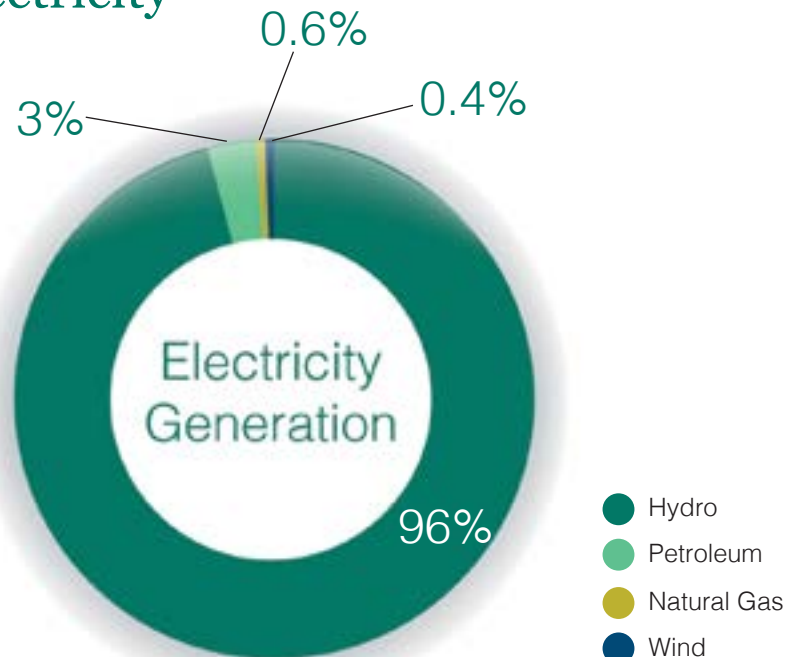
Although there is an appetite—and often a requirement—for government and industry to include an Indigenous partner at the table, Mi'sel Joe cautions that sometimes this involvement is simply tokenism.

He said everyone in the province will have to work together in honest partnership if there is to be genuine progress in the local response to climate change. "We're either going to be a player in helping to change how we do business going forward, or we're just going to sit back and say well let the government deal with it. But I don't think that's the answer either. The government's not going to do it by themselves. You have to be a participant to make anything happen."

ECONOMY_{CONTINUED}



Electricity



NL's electricity generation mix will change as new power sources come online and older generators and plants are decommissioned. (Source: Canada's Energy Regulator, Canada Energy Futures 2021)



What about WIND?

Wind farms in Fermeuse and St. Lawrence have an installed capacity of 27 megawatts of power each. However, the province has recently opened up for new industrial wind development, prompting questions about our future energy mix.

While there is no shortage of wind in NL, there is still uncertainty about what is needed and desired (including what is needed for potential hydrogen production), and how additional wind power will get to where it is needed. There are some significant challenges for regulators and policy makers when it comes to how large wind farms could be and where they might be located, how the electricity grids are managed, as well as how to maximize the opportunity for economic growth while balancing the environmental and community concerns.



Changing Ecosystem, CHANGING FISHERY

A changing climate means shifts in our ecosystems. When there's a fish spotted out of place these days, even before discussions of numbers or value, there are questions for scientists of 'Why this place?' 'Why now?'

"[These] questions have many unknowns," said Dr. Jonathan Fisher, of Memorial University's Marine Institute Centre for Ecosystems Research (CFER).

Dr. Fisher has undertaken detailed research—with colleagues both in the province and beyond—into local Atlantic halibut in the Gulf of St. Lawrence (not to be confused with Greenland halibut, a.k.a. turbot), using electronic tagging. A more recent concern for these researchers is why halibut are reportedly showing up in an area off the coast of Labrador where they had not typically been seen

before—by harvesters, scientists, and folks on the wharf—in significant numbers.

"There is the question about where those halibut [off Labrador] are coming from, questions about their origins," Dr. Fisher said, pointing out that the two managed stocks currently in the region (one in the Gulf of St. Lawrence and one on the Southern Grand Banks—Scotian shelf) haven't been known to travel to Labrador in large numbers.

"It is our goal to get some of these tags out on fish as soon as this year," he said. The tags will give information to help in understanding where the fish spend time, including depth, plus what they might be eating and when they might be reproducing.

Dr. Fisher's colleagues at CFER are assessing and quantifying other activity in our

oceans. For example, there is Dr. Arnault Le Bris's work on Atlantic lobster, including the relationship to changing water temperature.

"The truth is we need to understand better how species are interacting."

Dr. Arnault Le Bris, Centre for Ecosystems Research, Marine Institute, Memorial University

Climate change forecasts show future temperatures off Newfoundland's Southwest coast and into the Gulf of St. Lawrence becoming ideal for lobster.

"The Gulf of St. Lawrence might be the next place where lobster is really abundant," Le Bris said, but quickly added that there are more factors at play than just temperatures. For example, it takes six to nine years for a baby lobster, a popular prey for groundfish, to grow to adult size. As populations change, and different predator and prey species are harvested at different rates, the future becomes more complicated.

"The truth is we need to understand better how species are interacting," he said.

Whole ecosystem models are essential in future-casting, and the best models will have recent research data and analysis worked in. It is important to spot individual novelties, but also understand them in the context of the whole of our changing environment.

WASTE NOT

Opportunity in fish waste

When we process seafood in Newfoundland and Labrador, about 30-70% of harvested finfish and shellfish becomes waste, and is thrown either into the ocean or into a nearby landfill.

“A lot of that waste really isn’t waste. It’s underutilized.”

Dr. Kelly Hawboldt, Faculty of Engineering and Applied Science, Memorial University

“If waste is not recovered, waste becomes a carbon source. It’s really that simple,” said Dr. Kelly Hawboldt, a chemical engineer at Memorial with a particular interest in sustainable processing. This is a problem because carbon sources emit Greenhouse Gases that trap heat and contribute to global warming and climate change.

Therefore, while Dr. Hawboldt says that making better use of organic waste won’t solve global climate change on its own (with fossil-fuel burning the key human contributor), it can play a role in cutting provincial emissions, while also having economic benefits.

Dr. Hawboldt is currently researching ways to use traditional seafood by-products, from shrimp shells to fish heads. There are many avenues to explore, such as the bioprocessing of the raw materials, with the potential of once-wasted seafood being used in the production of biofuel, fertilizers, pharmaceuticals, and biomaterials.

“Newfoundlanders and Labradorians produce a tremendous amount of waste,” Hawboldt said. “We’re not unique. Everybody does. But a lot of that waste really isn’t waste. It’s underutilized. And we want to help change that.”

CLEAN TECH entrepreneurship

“Clean tech represents the largest economic opportunity globally, and that’s what entrepreneurship truly is about – understanding where there’s opportunity and going after it. It’s important to have an entrepreneurial mindset, to be able to recognize opportunities, to come up with creative solutions to capitalize on those opportunities, and to have the resilience to push through and make ideas reality.

There are some entrepreneurial companies here in Newfoundland and Labrador that are doing these things - there is so much entrepreneurial mindset here in Newfoundland and Labrador, in individuals as well as in corporations and companies that want to make a difference.”

– Josh Green, CEO, Mysa

“We need to make sure that our portfolio as a province is extremely diversified; not only on types of energies that we’re able to draw upon and export, but also the types of businesses and the support for entrepreneurs.”

– Ashley Noseworthy, President & CEO, Edgewise Environmental Ltd.

“The issue of climate change and the risks to the economy and society have grown to be a dominant concern for governments and firms, and major changes are underway in the policy environment – this has all happened in a very short period of time. But it’s not just a matter of thinking about climate risks and how we might mitigate these and adapt to the changes in climate, it’s also about thinking through the opportunities that climate change presents, and recognizing that we can make choices – good choices in policy that are informed by what’s happening at the ground level.”

Elizabeth Beale

Economist, former President & CEO of the Atlantic Provinces Economic Council, former member of the Canadian Eco-fiscal Commission, co-chair of the Forecast NL Steering Committee

Growing more local NOT THE WHOLE ANSWER

There’s a long list of ways climate change is affecting farmers: changes in pests; possible drought cutting crop yields; heat overwhelming labourers; and floods killing livestock. There are also calls for an increase in localized food production to limit shortages when supply chains are interrupted. Farming also produces greenhouse gas emissions, and producers are feeling pressure to find ways to lower their emissions.

In NL, there is a push to increase local production, to grow the agricultural industry and generate economic growth through employment and export opportunities. In 2017, the provincial government published The Way Forward Plan on Agriculture, which outlined steps to increase food self-sufficiency from 10% to at least 20% by 2022. Last year, according to the Provincial government, we reached 17% self-sufficiency in fruits and vegetable production.

However, in trying to ramp up production, choices have to be made when it comes to greenhouse gas emissions. More local food doesn’t automatically mean less overall emissions from the food system.

When it comes to GHG emissions, we tend to focus on the transportation of food. However, some studies have found it contributes only about 11% of total food system emissions, with the final delivery to retail being only about 4%; therefore, the greater concern is actually the emissions from production (farms and processing facilities).

What you eat, for instance, is more important than where it’s grown, when it comes to greenhouse gases.

Most importantly, shifting away from emissions-intensive food groups, like meat and dairy, is more important for reducing emissions than slashing fertilizer use or using lower carbon fuels in delivery. There is also research suggesting some foods will cost more, in greenhouse gases, to grow locally than they would to import, given energy consumption, fertilizers, pesticide production, and shipping. Established producers can simply be that much more efficient.

It’s pretty complicated, but consumers will have an important role in setting the landscape. Will we have factories in NL producing dried pasta? Maybe not. At the same time, should we discourage local stores from stocking imported, fresh strawberries in winter? That’s a debate.

“One of the problems I find, and this is really a much larger problem, is human beings in North America feel like they should be able to eat fresh food year-round, and that just doesn’t make a lot of sense,” said Dr. Ivan Emke, arguing against strawberries and vine tomatoes on shelves in late winter.

“I bottle a lot of tomatoes. We eat fresh food but it’s preserved or it’s dried or roasted,” he said. Industrial processing can be energy intensive, and use a lot of plastics, so there’s nuance, but it’s certainly food for thought.

COMMUNITIES & INFRASTRUCTURE

*How will climate change impact our communities?
How are communities already responding?*

Small towns, BIG IMPACTS: Climate change at the municipal level

Given the many different ways climate change can hit home, it is important to talk about how we identify issues and respond at the municipal and community level.

Environmental industry group, Econext, surveyed 42 community stakeholders across the province on what is top of mind. They found, overall, coastal flooding, inland flooding, and waste reduction are priority issues, while larger communities also rank building retrofits, renewable energy installations, vehicle electrification, and public and active transportation high on their list. (See graphic below.)

Levels of concern can differ depending on location, showing a need for an active look at issues arising below the provincial level. Only 9% of people responding, for instance, ranked loss of sea ice high in terms of level of concern. However, it

was consistently a priority in all responses from Labrador.

According to Dr. Kathleen Parewick, Municipalities Newfoundland and Labrador's (MNL) Community Collaboration and Development Coordinator, despite low population numbers, municipal councils are seeing greater service demands. That can be difficult to manage, as most communities only have one full-time staff member (or only part-time staff, or a group of volunteers).

"There is a lot of strength in our small communities to work with," Dr. Parewick said. "Townspople know which culvert is about to overflow, they know where to watch out for things going awry. However, even those means and local knowledge are being stretched at this stage in the game."

Statistics show that water and wastewater infrastructure demands alone, in registered municipalities, sit at more than \$1 billion. Dr. Deatra Walsh, MNL's Director of Advocacy and Communications, says that these numbers are likely to rise when updated, and that they don't include the upgrades and other changes needed in the face of climate change.

"Municipalities do not have the economic capacity to address all of this," Walsh said.

This need is something Memorial University's Dr. Joe Daraio, an engineering professor specializing in civil and environmental infrastructure, has noticed. He suggests better collaboration between communities and engineers is a necessary part of the solution.

"Too often solutions are imposed on communities," he explained. "The engineers need to engage with local folks who live within the infrastructure and would suffer the consequences of a failure to find solutions that work. And communities also need to take the time to understand a little bit more about how engineers do their work."

He gives the example of a culvert or small bridge replacement. Daraio said that, sometimes, putting in the bigger culvert is not the solution; rather, in some cases, changes can be made upstream to reduce otherwise harmful water flows.

"It requires patience," he said, "and a systems rather than single-point perspective. It also requires people power."

COMMUNITY Climate Priorities

% of respondents that selected issue as a community priority

80% Coastal Flooding

80% In-land Flooding

75% Waste Reduction & Diversion

57% Food Security

50% Community Engagement & Public Education

48% Green Space & Ecosystem Protection

48% Building Energy Retrofits

39% Renewable Energy Installations

34% Vehicle Electrification

27% Wildfire

27% Public & Active Transportation

9% Loss of Sea Ice

How READY are NL communities?

% of respondents



10%

Climate change not being discussed



45%

Climate change discussion but no plan or action yet



14%

Climate action planning has begun



7%

Climate action plan but not implemented



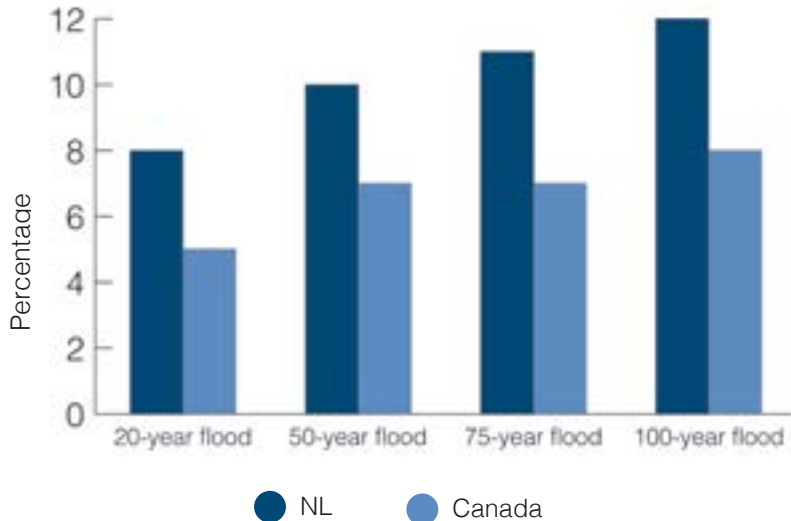
24%

Taking climate action

The researchers noted that responses may show higher levels of action since communities that have begun to think about or act on climate change are more likely to participate in related engagement opportunities such as this survey. (Source: econext and Fundamental Inc. 2022)

Healthcare centres at RISK OF FLOODING

With increases in the frequency and severity of storms, flooding of key community infrastructure like healthcare facilities is a concern for climate change adaptation. According to a Climate Choices Canada report, 8% of NL healthcare facilities are at risk of flooding in a 20-year flood, and 12% are at risk in a 100-year flood.



(Source: Canadian Institute for Climate Choices, 2021)

“I believe that the strength in community is our way out of the crisis. I have always felt that residents in NL have a strong community feeling and they express this ownership in some way or the other in their life. Community resilience exists as an emotion in NL and that is the hope for building resilience against changing climate.”

- Forecast NL participant



“The demands for climate change resilient infrastructure and the related operational funding to support this infrastructure, in terms of the economic impact, these costs are borne by municipalities and their tax-paying residents.”

- Dr. Deatra Walsh, “The Economic Impact of Climate Change” panel discussion

Focus on LABRADOR

Temperature increases, sea ice changes, melting permafrost – there are just some of the environmental changes already happening in Labrador as a result of climate change. For a region with a population so connected to the land, these changes will have tremendous impacts on the health, wellbeing and livelihood of the people who live there. The following are excerpts from the Forecast NL panel discussion on the impacts of climate change on Labrador and the North.



“Getting out on the land and water is very important to who we are, it’s what we are, it’s what makes us Inuit and Innu. Even in my short 52 years, I have witnessed many changes. We cannot go where we once walked, it’s unsafe, ice is softer now, there’s more snow, [...] As Inuit we scratch our heads, we wonder what’s going on, and we are sad. It effects our mental health and it drastically effects how we live.”

- Stan Oliver, Happy Valley-Goose Bay

“There are things we don’t want to lose, it’s very important that we be able to pass on these traditions and cultures to our next generations, but it’s not going to be feasible soon, we’re not going to be able to pass on those traditions of putting a net out under the ice, these things that are slowly fading away from our culture because our lifestyle relies on the snow and ice, and it’s just not there anymore.”

- Jodie Ashini, Sheshatshiu

“I am very hopeful [...] I think young people are taking the right steps and there is a lot of opportunity for us to do what needs to be done, but it’s a matter of ‘is that enough’ – that’s the sad and scary question, but a legitimate one. Young people are doing what they can, but there’s always more to be done. That’s what’s exciting about these conversations, we can figure out ways that we can do more.”

- Abigail Poole, St. Lewis

INDIVIDUALS *How will people directly experience the impact of climate change?*

STAYING HEALTHY in the era of climate change

Beyond the more obvious risks of harm due to climate change—such as direct risk to life by traveling over unexpectedly thin ice, or the negative health impacts of breathing smog—our mental health can also be negatively affected. Newfoundland and Labrador-based psychologist Dr. Janine Hubbard says this is already being experienced throughout the province.

Harm can come, for example, through extreme anxiety over the idea of a climate change-fueled weather event, or a broader, but similarly destructive, fear of the future. It makes sense, Hubbard explains, to be concerned when there is, for example, a hurricane or a blizzard in the forecast:

“These are not irrational fears,” she said. “But it’s a question of how you manage them both in terms of making sure you feel well prepared but also that that fear doesn’t interfere with life.”

These issues of climate-related anxiety are often raised in relation to older children and teens, partly because they are aware that they are the ones who will see how climate change plays out. Hubbard says that teenage years are also a natural time, developmentally, for people to see and feel global concerns; it’s the age when people start to think about their future and place in the world.

What can we do to help our young people? We can show our support by starting a conversation, or engaging in shared educational activities. Participation in climate protests or writing to politicians are other proactive ways young people—and beyond—can positively assert themselves.

In addition to age, the American Psychological Association, reporting on Mental Health and Our Changing Climate in 2017, noted a collection of factors that can make someone more sensitive to the ongoing change and at risk, including disabilities, socioeconomic and demographic inequalities, education level, and income.

Hubbard recommends we pay attention to how issues can compound, and exacerbate eco-anxiety.

“I am really worried about the mental health of our population coming out of the pandemic,” she said. “I am extremely worried about the exhaustion levels, the depleted adrenal systems, the chronic traumatic responses and stresses that we as a population have had over the past two and a half years. And I’m really worried how that’s going to impact us moving forward.”



SAME STORM, DIFFERENT BOATS Food prices and inequality during climate change

Climate change has to be tackled on many fronts, with most of them coming at a high financial cost. But who carries this burden? Climate change can exacerbate existing inequalities — between countries, regions, provinces, and people. It can manifest as an issue in many places, including the cost of food and food security.

Dr. Sylvain Charlebois is senior director of the Agri-Food Analytics Lab at Dalhousie University and leads The Food Professor podcast. In talking about the future of food in Atlantic Canada, he suggests keeping one thing top of mind: “The fact that food is costing more is a phenomenon I think we need to accept, though I know a lot of people tend to not like when I say that.” Dr. Charlebois points out that, as Canadians, we are hard-wired to believe safe, affordable food is a given. Before the

COVID-19 pandemic, about 9.1% of the average Canadian household budget was being spent on food, according to the World Economic Forum.

“That’s very low,” Charlebois said. “We’ve been lucky. But things are changing.”

In addition to the strains on the global food system caused by COVID-19 and the war in Ukraine, Charlebois says we will feel climate change through effects on primary production, processing, transportation, and markets.

Food security is already an issue in NL, and pressures on wild food sources, use of processed foods, and generally higher costs, exacerbate it. These issues can disproportionately affect people and families. “The thing we have to think about is we’re not all equally vulnerable,” Memorial University

sociologist Dr. Barb Neis emphasized in a Forecast NL panel discussion.

“Globally climate change is going to mean more expensive food,” she said, pointing to already-existing issues within the province when it comes to families having access to healthy and fresh food. “So we can talk about growing more food locally, but the food we grow locally is not cheap. For the most part, we are not well positioned for feeding our population.”

Food First NL CEO Josh Smee says that, while there’s a bit more awareness in local society of how many households are one disruption away from a crisis, it’s still common to come across false assumptions of who is vulnerable, food insecure, and/or struggling. There is, he argued, a lack of information on what might happen to the most vulnerable as even planned climate

change responses advance: “For example, right now, there’s a big conversation around the impact of the rising fuel prices on the cost of food production. Fuel goes into all sorts of places. Many of our inputs in food production here are imported. So what happens if we raise the carbon tax by a whole bunch over the next few years to drop down carbon emissions? What will that mean for our food system here? I don’t know. I don’t think anyone does.”

Smee emphasized he’s not seen reports suggesting how changes could play out at a community level. He’s not advocating against climate action; he’s marking where national-level discussion may obscure local realities. If the local effects are seen and addressed early, it can avoid the kind of problems that drive people away from supporting climate action.

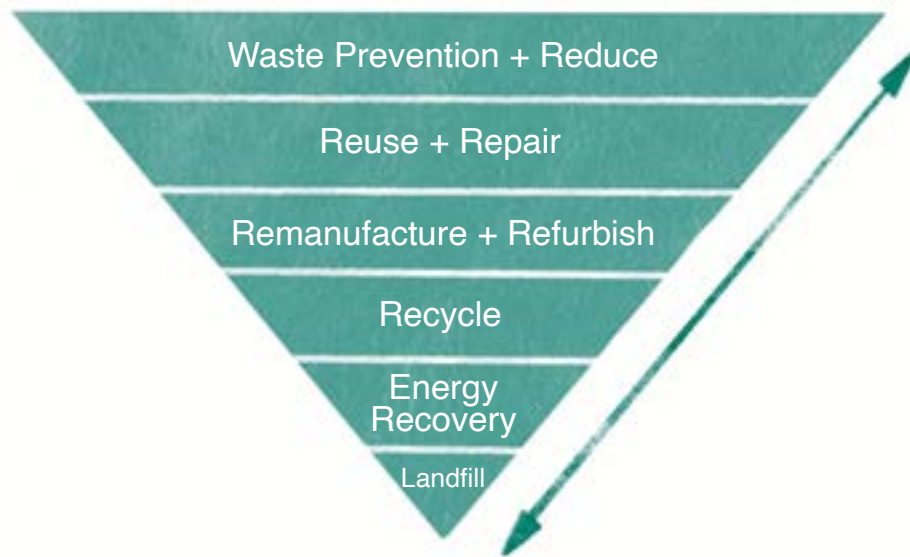
“When we can’t get out to hunt and fish and collect and trap, of course it affects food security”
– Stanley Oliver, Forecast NL panelist, Happy Valley-Goose Bay

“It’s taking these major disruptions, weather events, and catastrophes to see who is vulnerable. By cultivating community resiliency and looking at what’s being done and what’s working, we can address who’s vulnerable before the catastrophe happens.”
– Megan Samms, Forecast NL panelist, Codroy Valley

WASTE & CONSUMPTION

How can we make better use of resources and reduce what goes to waste?

The WASTE Triangle



The waste management hierarchy shows the preferred approaches to waste management focused on the value of materials. The first priority is reducing waste by preventing its generation in the first place, followed by material reuse and repair to extend use whenever possible. (Source: *Environment and Climate Change Canada*)



A load of TRASH

Each person in NL produces:

236 Kg recycling a year

676 Kg landfill garbage a year

An estimated **30%** of residential bagged garbage is organic waste and could be composted.

(Source: *Multimaterial Stewardship Board, 2019 Waste Report Card*)

RETHINKING the three Rs

Most of us live in what is known as a “linear economy,” a “Take-Make-Dispose” approach to life.

Say you’re at home, and you’re beginning a DIY project. You pull out your electric drill from your basement or shed, but the drill isn’t working – perhaps its battery can no longer hold a charge. There’s no obvious fix, so you buy a new drill. This new drill will be made from mined and refined resources; have been processed and manufactured at the lowest possible cost; feature all new components; and be packed in plastic, all before it is delivered to your local store. The old one ends up in a landfill, and after the initial task is complete, your new drill goes into storage. This is the linear economy at work.

Contrast this with what might happen in a “circular economy.” In this situation, maybe the drill and its batteries have been designed for easy repair or replacement parts. Maybe it is manufactured in a way that allows it to operate more efficiently and last longer. Or perhaps you don’t own but borrow, or rent the drill as needed, from a friend or tool library. In a circular economy, companies could be penalized for introducing wasteful products and consumers could pay an up-front premium on cheaply made items to account for the true cost to society, rather than the company’s manufacturing costs.

The circular economy supports the traditional and well-known “Reduce, Re-Use,

Recycle” slogan, with an emphasis on reducing and reusing in particular. “Circular economy advocates would say recycling is only one small, and in fact less important, component [of managing



waste],” said Dr. Nicholas Lynch, an associate professor of geography at Memorial University who is currently researching pathways to building a circular culture. In a circular economy, “companies will design and manufacture for re-use,” Dr. Lynch explained, “down to even the type of fibres used in manufacturing clothing.”

Governments will also be responsible for developing policy to check consumption and promote ‘green’ approaches, while citizens like you and me must actively vet claims made by companies and governments alike, actively seeking any opportunity to avoid needless consumption.

PLASTIC problems

In 2019, the **global production and incineration of plastics** was expected to produce more than **850 million metric tons of GHGs**.

That’s **equal to** the emissions from **189, 500-megawatt coal power plants**.

(Source: *The Centre for International Environmental Law, 2019*)

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The Leslie Harris Centre of Regional Policy & Development is Memorial University's hub for public policy and regional development issues. The Centre links Memorial faculty, students, and staff with groups across Newfoundland & Labrador, supporting active community engagement. As a broker and facilitator of ideas and information, the Harris Centre builds connections, encourages informed debate, and supports collaboration to enhance the province through mutually beneficial partnerships.

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