

CLIMATE AND CULTURE CHANGE: Science, Storytelling, and Solutions

Think Global, Link Local Event
United Nation Association Canada - Vancouver
March 10, 2023

Ian Mauro | Executive Director | Pacific Institute for Climate Solutions | picsdir@uvic.ca

PICS and our partner universities are grateful to live, learn, and be in relation with Indigenous peoples from across many traditional and unceded territories, covering many regions of BC. We are honoured to live on this land and are committed to reconciliation, decolonization, and climate solutions that are co-developed with Indigenous peoples and communities.

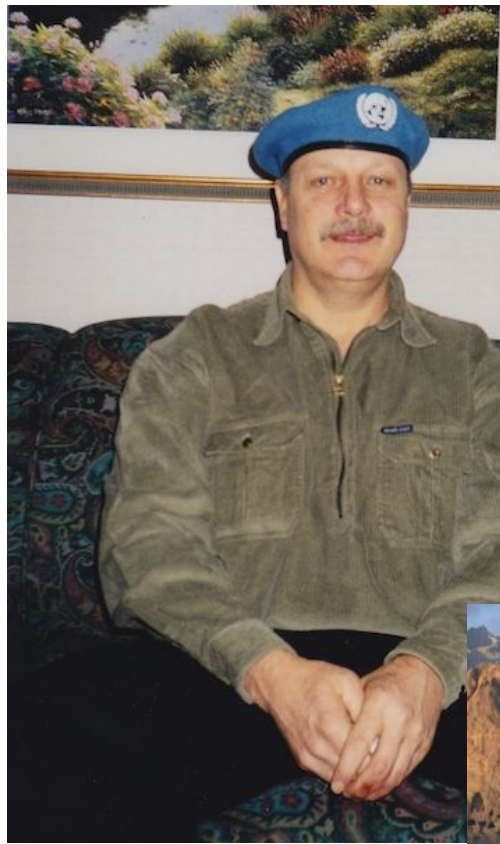
World out of Balance

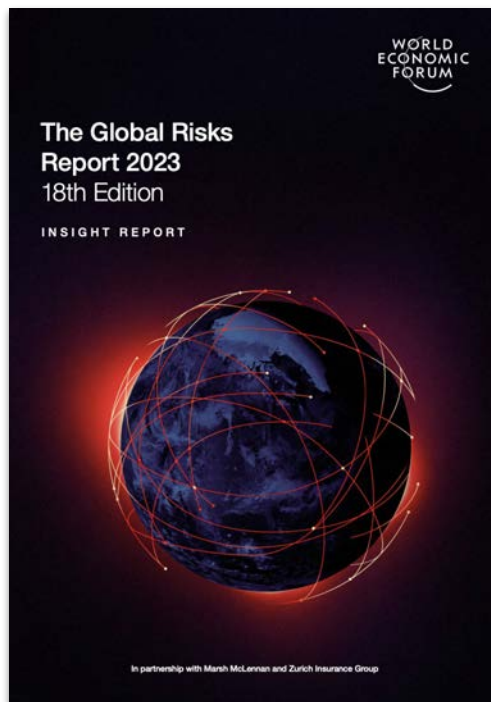
Monde en déséquilibre

Prince George, British Columbia



Atlas climatique  Climate Atlas
du Canada of Canada





The Global Risks Perception Survey (GRPS) has underpinned the *Global Risks Report* for nearly two decades and is the World Economic Forum's premier source of original global risks data. This year's GRPS has brought together leading insights on the evolving global risks landscape from over 1,200 experts across academia, business, government, the international community and civil society. Responses for the GRPS 2022-2023 were collected from 7 September to 5 October 2022.

2 years

1	Cost-of-living crisis
2	Natural disasters and extreme weather events
3	Geoeconomic confrontation
4	Failure to mitigate climate change
5	Erosion of social cohesion and societal polarization
6	Large-scale environmental damage incidents
7	Failure of climate change adaptation
8	Widespread cybercrime and cyber insecurity
9	Natural resource crises
10	Large-scale involuntary migration

Risk categories

Economic

Environmental

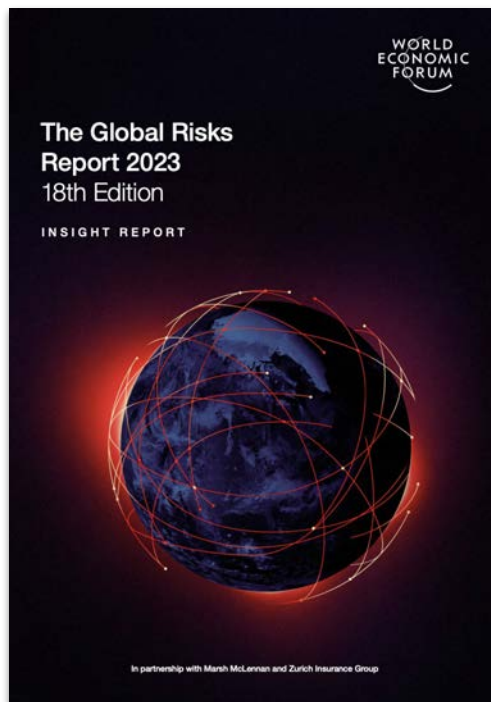
Geopolitical

Societal

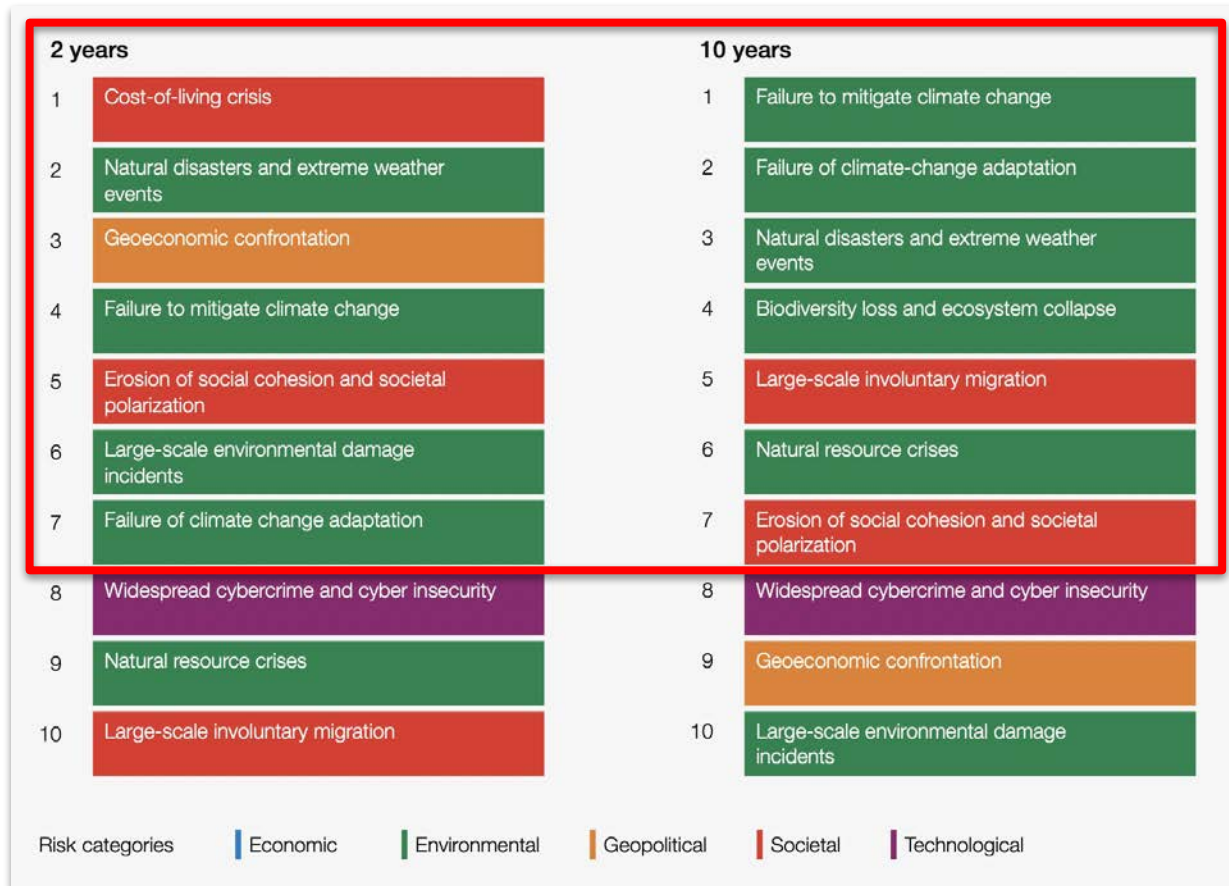
Technological

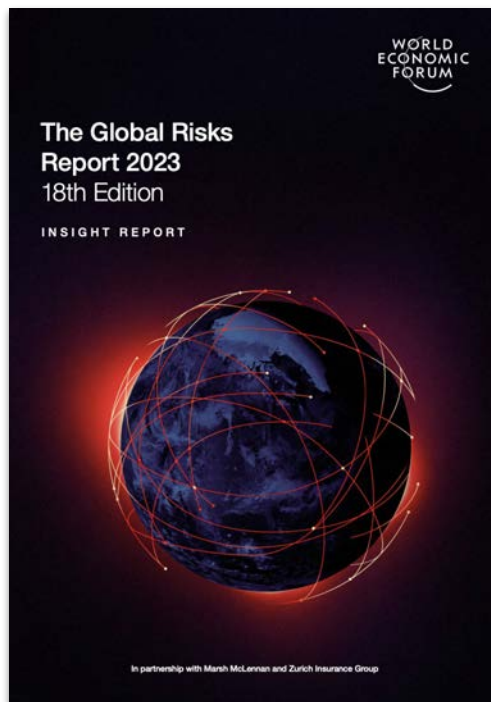
10 years

1	Failure to mitigate climate change
2	Failure of climate-change adaptation
3	Natural disasters and extreme weather events
4	Biodiversity loss and ecosystem collapse
5	Large-scale involuntary migration
6	Natural resource crises
7	Erosion of social cohesion and societal polarization
8	Widespread cybercrime and cyber insecurity
9	Geoeconomic confrontation
10	Large-scale environmental damage incidents

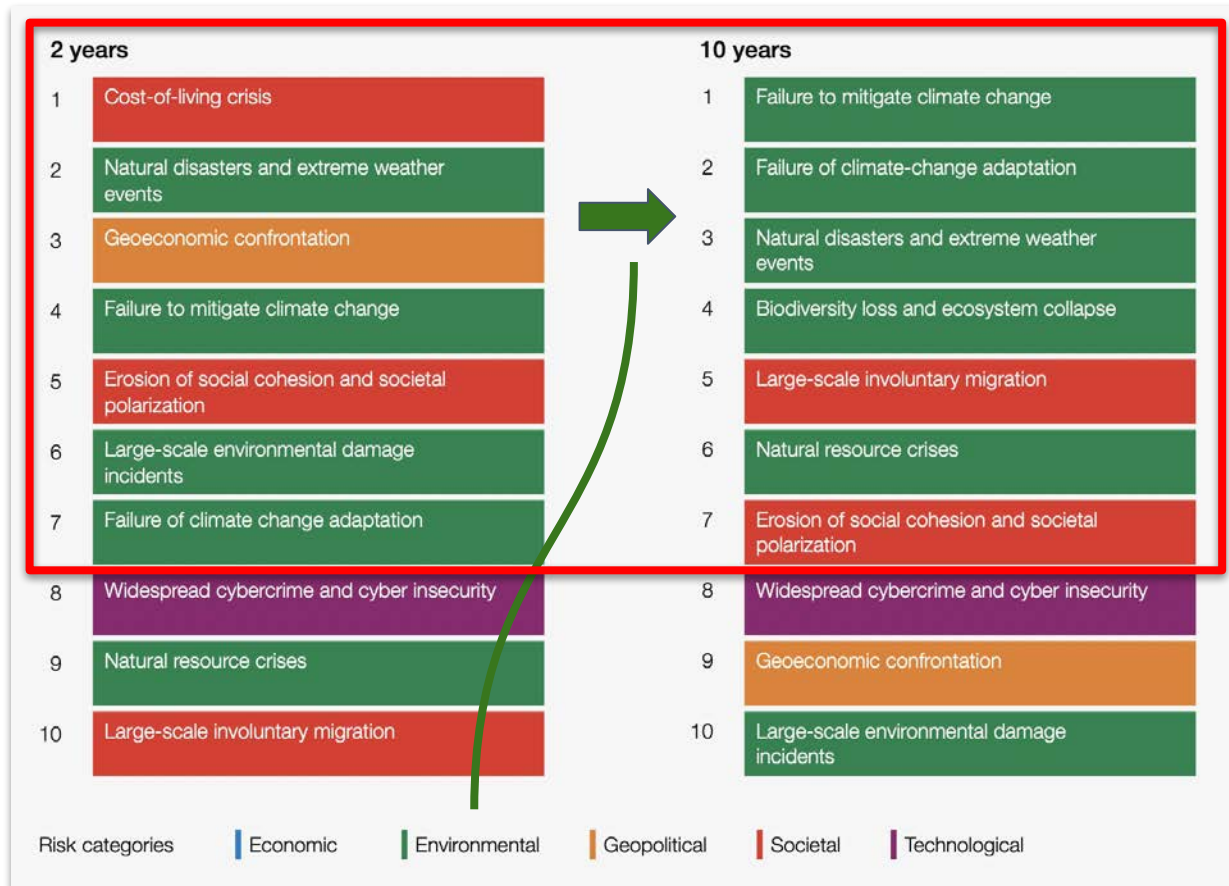


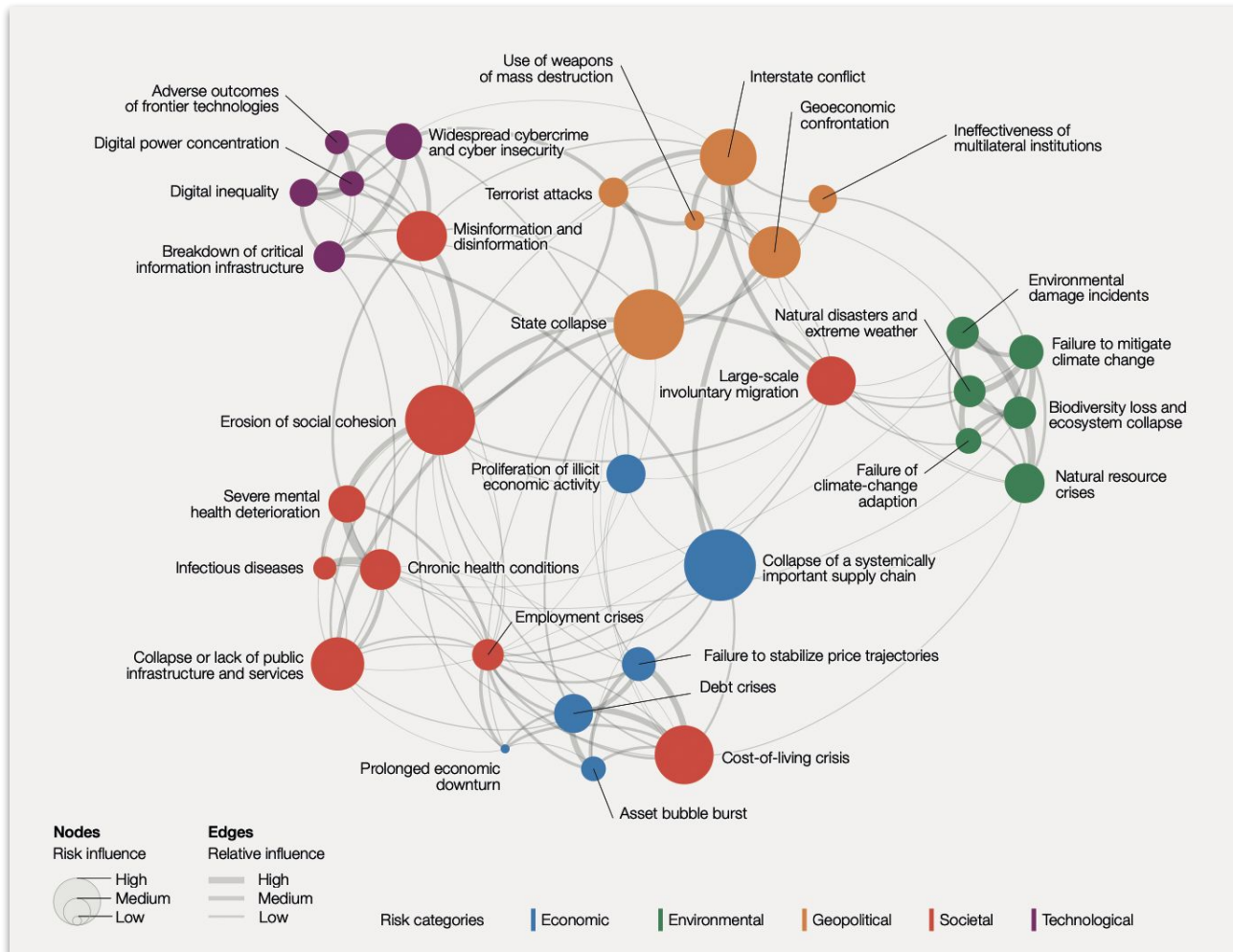
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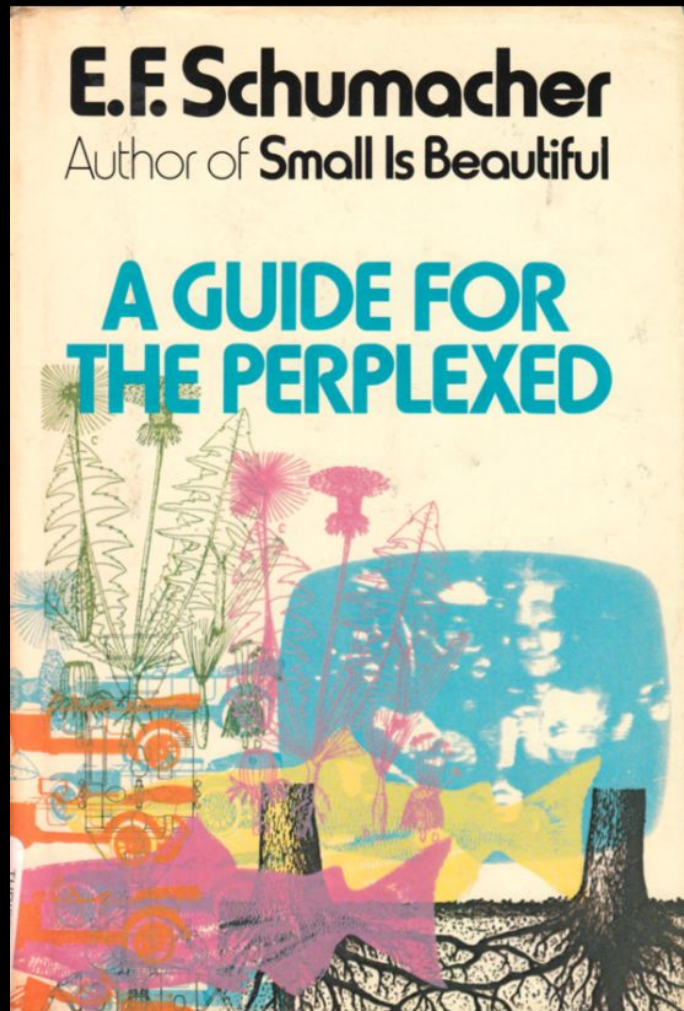




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“All through school and university I had been given maps of life and knowledge on which there was hardly a trace of many of the things that I cared about and that seemed to me to be of the greatest possible importance to the conduct of my life.”

1

On Philosophical Maps

On a visit to Leningrad some years ago¹ I consulted a map to find out where I was, but I could not make it out. From where I stood, I could see several enormous churches, yet there was no trace of them on my map. When finally an interpreter came to help me, he said: "We don't show churches on our maps." Contradicting him, I pointed to one that was very clearly marked. "That is a museum," he said, "not what we call a 'living church.' It is only the 'living churches' we don't show."

It then occurred to me that this was not the first time I had been given a map which failed to show many things I could see right in front of my eyes. All through school and university I had been given maps of life and knowledge on which there was hardly a trace of many of the things that I most cared about and that seemed to me to be of the greatest possible importance to the conduct of my life. I remembered that for many years my perplexity had been complete; and no interpreter had come along to help me. It remained complete until I ceased to suspect the sanity of my perceptions and began, instead, to suspect the soundness of the maps.

The maps I was given advised me that virtually all my ancestors, until quite recently, had been rather pathetic illusionists

"I remember that for many years my perplexity had been complete; and no interpreter had come along to help me. It remained complete until I ceased to suspect the sanity of my perceptions and began, instead, to suspect the soundness of the maps."

every educated person knew that there was not really a God, certainly not one capable of creating anything, and that the things around us had come into existence by a process of mindless evolution, that is, by chance and natural selection. Our ancestors, unfortunately, did not know about evolution, and so they invented all these fanciful myths.

The maps of *real* knowledge, designed for *real* life, showed nothing except things which allegedly could be *proved* to exist. The first principle of the philosophical mapmakers seemed to be "If in doubt, leave it out," or put it into a museum. It occurred to me, however, that the question of *what constitutes proof* was a very subtle and difficult one. Would it not be wiser to turn the principle into its opposite and say: "If in doubt, show it *prominently*"? After all, matters that are beyond doubt are, in a sense, dead; they constitute no challenge to the living.

To accept anything as true means to incur the risk of error. If I limit myself to knowledge that I consider true beyond doubt, I minimize the risk of error, but at the same time I maximize the risk of missing out on what may be the subtlest, most important, and most rewarding things in life. Saint Thomas Aquinas, following Aristotle, taught that "The slenderest knowledge that may be obtained of the highest things is more desirable than the most certain knowledge obtained of lesser things."² "Slender" knowledge is here put in opposition to "certain" knowledge, and indicates uncertainty. Maybe it is necessarily so that the *higher* things cannot be known with the same degree of certainty as can the *lesser* things, in which case it would be a very great loss indeed if knowledge were limited to things beyond the possibility of doubt.

The philosophical maps with which I was supplied at school and university did not merely, like the map of Leningrad, fail to show "living churches"; they also failed to show large "unorthodox" sections of both theory and practice in medicine, agriculture, psychology, and the social and political sciences, not to mention art and so-called occult or paranormal phenomena, the mere mention of which was considered to be a sign of mental deficiency. In particular, all the most promi-

"The maps of *real* knowledge, designed for *real* life, showed nothing except things which allegedly could be *proved* to exist...they also failed to show large 'unorthodox' sections of both theory and practice..."

San Francisco Chronicle

NORTHERN CALIFORNIA'S LARGEST NEWSPAPER

SATURDAY, NOVEMBER 1, 1997

Cyclists in costume join S.F.'s Halloween

By Manny Fernandez,
Henry K. Lee, Torri Minton
and Jaxon Van Derbeken
Chronicle Staff Writers

San Francisco's most free-wheeling street celebrations converged under a black moon last night — on bicycles, in-line skates and on foot, they transformed the city into a circus of Elvises, nude Lady Godivas, cycling sperm, larger-than-life human stop signs and a one-man salute to El Niño.

It was the first time that Critical Mass, the huge monthly bicycle ride, and the outlandish revelry that is Halloween in San Francisco coincided.

The giant party started at 6 p.m. when about 1,500 Critical Mass riders, many of them in costume, rolled across the city

HALLOWEEN: Page A11 Col. 3



BIG TREE

	FT	METERS
HEIGHT	304	92.6
DIAMETER	21.6	6.6
CIRCUMFERENCE	68	20.7
ESTIMATED AGE	1500	YRS

1 DEC 97

RESEARCH ARTICLE | EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES | 



Historical change of El Niño properties sheds light on future changes of extreme El Niño

Bin Wang , Xiao Luo, Young-Min Yang, , and Jian Liu  [Authors Info & Affiliations](#)

The 1997-1998 El Niño, for example, caused thousands of deaths from severe heat, flooding, drought, and coastal storms, and generated as much as \$96 billion in damage, according to the United Nations. Oct 23, 2019

Climate Change is Making El Niños More Intense, Study Finds

David Suzuki Foundation

Finding solutions

May 16, 2002

Fax: 204 275 3147

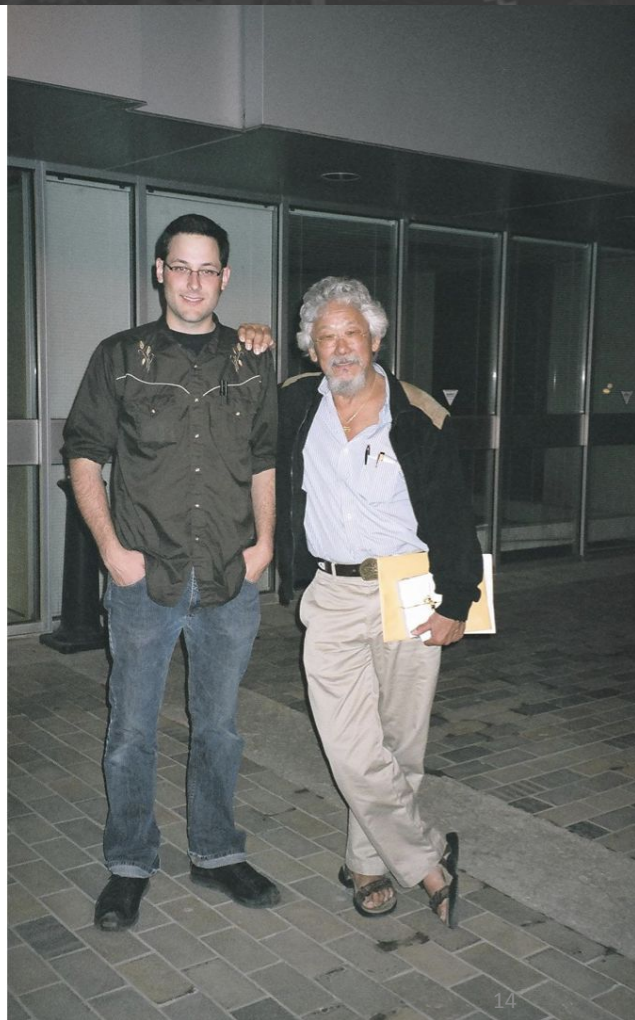
Dear Mr. Mawo + Dr. McLachlan:

Thank you for your letter and the information. You've got excellent people in your place although my friend Ed Wilson disappoints me with his faith in GMOs. I'm afraid I'm only stopping in Toronto long enough to give my talk + then I'm off to Calgary. Sorry I won't have the time in Toronto.



2211 West 4th Ave., Suite 219
Vancouver, BC, Canada V6K 4S2
Tel: (604) 732-4226
Fax: (604) 732-0752
www.davidsuzuki.org

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Inuit Knowledge and Climate Change



QAPIRANGAJUQ:
Inuit Knowledge and Climate Change

Nunavut-based director Zacharias Kunuk (*Atanarjuat The Fast Runner*) and researcher and filmmaker Dr. Ian Mauro (*Seeds of Change*) have teamed up with Inuit communities to document their knowledge and experience regarding climate change. This documentary, the world's first Inuktitut language film on the topic, takes the viewer "on the land" with elders and hunters to explore the social and ecological impacts of a warming Arctic. This unforgettable film helps us to appreciate Inuit culture and expertise regarding environmental change and indigenous ways of adapting to it.

FEBRUARY 17TH 7:30PM
VENUE: ZOO PALAST 2 (Berlin)

FEBRUARY 18TH 10:00PM
VENUE: CINESTAR IMAX (Berlin)

LIVE Q&A WITH CO-DIRECTORS

ISUMA
Vtape
THE UNIVERSITY OF WINNIPEG
TELEFILM CANADA
Conseil des arts Canada Council for the Arts

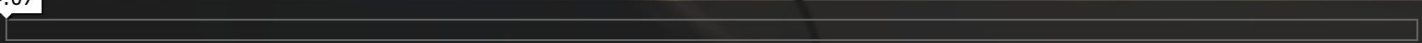






Perhaps the earth has
tilted on its axis.

54:07



The Novaya Zemlya effect: An arctic mirage

W. H. Lehn

Department of Electrical Engineering, University of Manitoba, Winnipeg, R3T 2N2 Canada

(Received 13 September 1978)

The arctic mirage is an atmospheric refraction phenomenon caused by a temperature inversion in the lower atmosphere. It is classified into three basic types, two of which (*hillinger* and *hafgerdingar* effects) occur fairly frequently. The third is the Novaya Zemlya effect, reported by polar explorers on several occasions as an anomalous sunrise during the polar winter, when the position of the sun was below the horizon. The Novaya Zemlya effect consists of the trapping of light rays beneath a thermocline of large horizontal extent. Within the thermocline layers, the coefficient of refraction must exceed 1, while above and below it the coefficient must be less than 1, so that upward rays repeatedly bounce back from the thermocline and are transmitted far around the earth's curvature. The anomalous sunrise is a special case of this general phenomenon. The properties of the Novaya Zemlya effect, analyzed using a laterally uniform stratified model, agree with those reported by polar expeditions. A narrow strip or window at the horizon, with or without an image of the sun in the window. An observation sketch in Antarctica is reconstructed to demonstrate the model's accuracy.

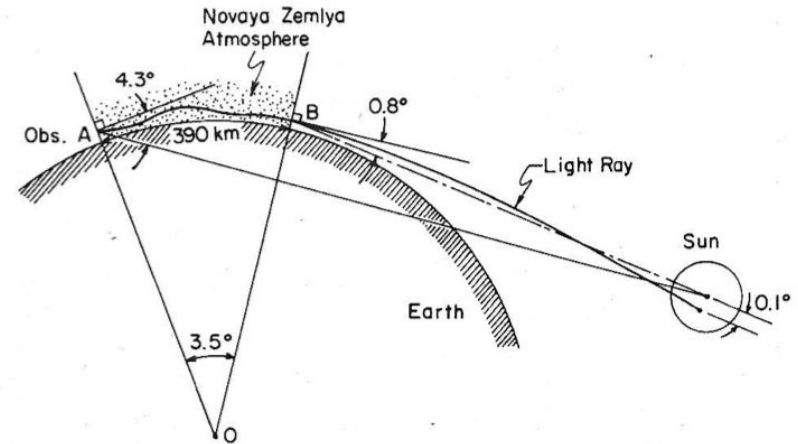
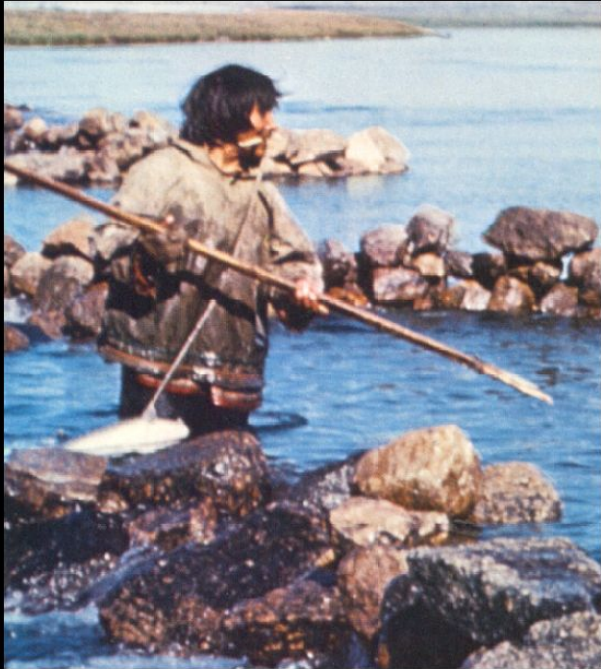


FIG. 9. Configuration producing the best reconstruction of Liljequist's observation.

Refraction and Spear Fishing





Things I Mean to Know

There are so many facts about the world that we take for granted—without ever questioning how we know them. Of course the earth revolves around the sun. Of course my dog loves me. But how exactly do we know things like that are true? This week, stories of people trying to unspool some of life's certainties, and what they find.

 Download |  Share a clip |  Transcript |   



This American Life



Geophysical Research Letters*

Research Letter

Polar Drift in the 1990s Explained by Terrestrial Water Storage Changes

S. Deng, S. Liu ✉, X. Mo, L. Jiang, P. Bauer-Gottwein

First published: 22 March 2021 | <https://doi.org/10.1029/2020GL092114> | Citations: 1

This article was corrected on 17 MAY 2021. See the end of the full text for details.

Plain Language Summary

The Earth's pole, the point where the Earth's rotational axis intersects its crust in the Northern Hemisphere, drifted in a new eastward direction in the 1990s, as observed by space geodetic observations. Generally, polar motion is caused by changes in the hydrosphere, atmosphere, oceans, or solid Earth. However, short-term observational records of key information in the hydrosphere (i.e., changes in terrestrial water storage) limit a better understanding of new polar drift in the 1990s. This study introduces a novel approach to quantify the contribution from changes in terrestrial water storage by comparing its drift path under two different scenarios. One scenario assumes that the terrestrial water storage change throughout the entire study period (1981–2020) is similar to that observed recently (2002–2020). The second scenario assumes that it changed from observed glacier ice melting. Only the latter scenario, along with the atmosphere, oceans, and solid Earth, agrees with the polar motion during the period of 1981–2020. The accelerated terrestrial water storage decline resulting from glacial ice melting is thus the main driver of the rapid polar drift toward the east after the 1990s. This new finding indicates that a close relationship existed between polar motion and climate change in the past.

Geophysical Research Letters*

Oceans |  Free Access

Long-term polar motion excited by ocean thermal expansion

Felix W. Landerer ✉, Johann H. Jungclaus, Jochem Marotzke

First published: 04 September 2009 | <https://doi.org/10.1029/2009GL039692> | Citations: 5

Abstract

[1] Ocean warming is commonly considered unable to excite significant long-term trends in polar motion. Here, however, we argue that this assumption needs to be revised. We demonstrate that steric sea level rise leads to a distinct pattern of horizontal mass redistribution within ocean basins and hence to ocean bottom pressure changes that alter Earth's inertia tensor on decadal and longer time scales. Based on Earth system model simulations, we estimate that ocean warming leads to polar motion of 0.15 to 0.20 milli-arcseconds per one millimeter of thermal sea level rise. This is equivalent to a polar motion rate of about 0.47 milli-arcseconds per year towards 155°W to 160°W for current projections of steric sea level rise during the 21st century. The proposed polar motion signal is therefore not negligible in comparison to other decadal and secular signals, and should be accounted for in the interpretation of polar motion observations.

Climate Change 2021

The Physical Science Basis

Summary for Policymakers



United Nations

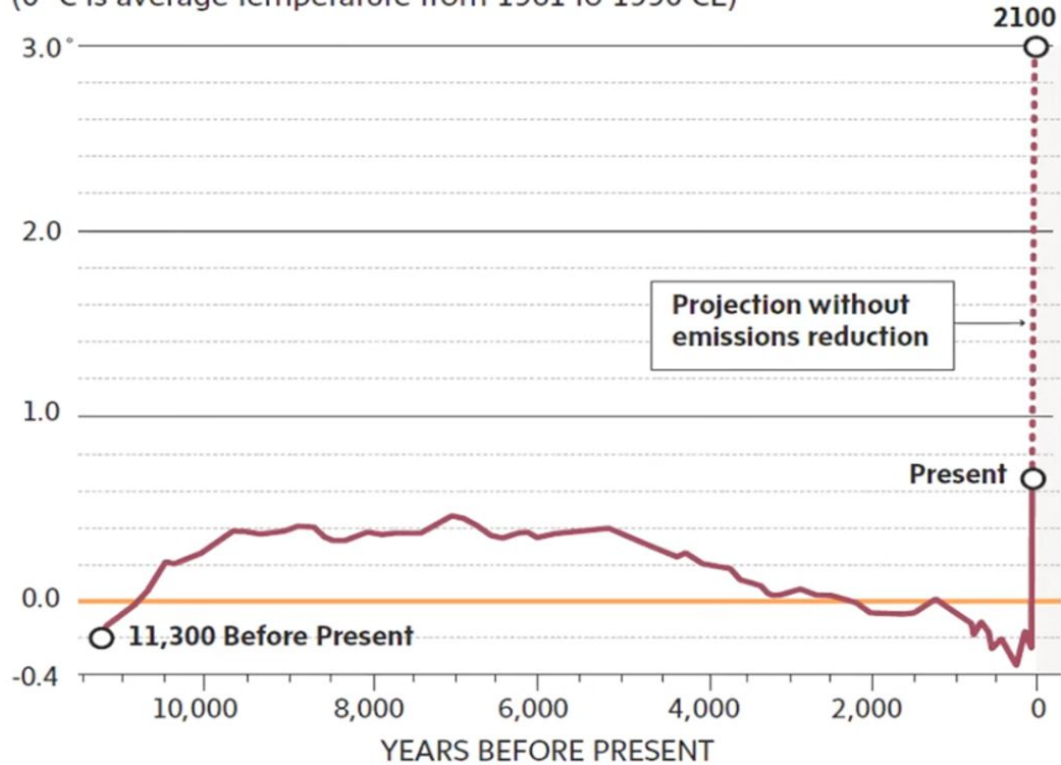
Secretary-General Calls Latest IPCC Climate Report 'Code Red for Humanity', Stressing 'Irrefutable' Evidence of Human Influence

SG/SM/20847

9 AUGUST 2021

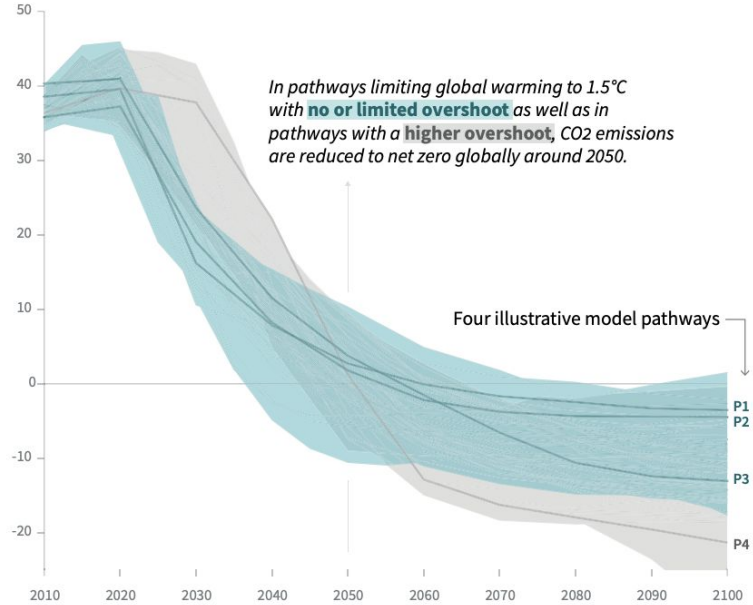
Temperature anomaly

(0° C is average temperature from 1961 to 1990 CE)



Global total net CO₂ emissions

Billion tonnes of CO₂/yr

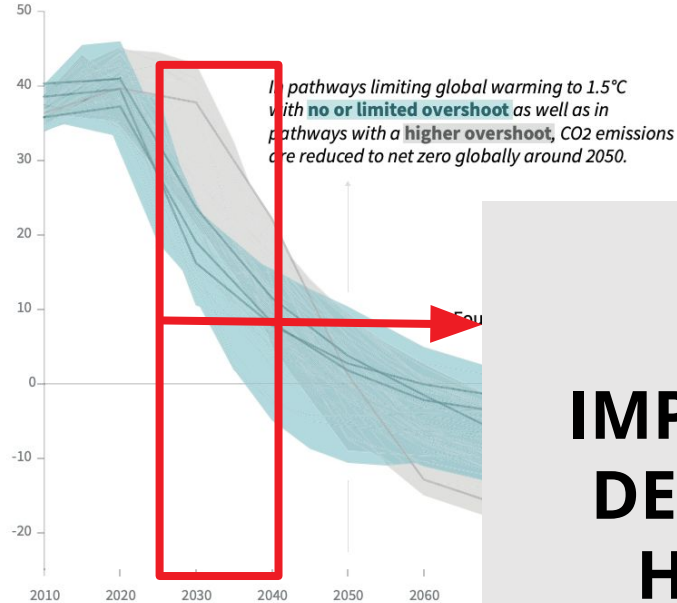


Timing of net zero CO₂
Line widths depict the 5-95th
percentile and the 25-75th
percentile of scenarios



Global total net CO₂ emissions

Billion tonnes of CO₂/yr



THE
MOST
IMPORTANT
DECADE IN
HUMAN
HISTORY

Timing of net zero CO₂
Line widths depict the 5-95th
percentile and the 25-75th
percentile of scenarios





INTEGRITY MATTERS: NET ZERO COMMITMENTS BY BUSINESSES, FINANCIAL INSTITUTIONS, CITIES AND REGIONS

REPORT FROM THE UNITED NATIONS'
HIGH-LEVEL EXPERT GROUP ON THE
NET ZERO EMISSIONS COMMITMENTS
OF NON-STATE ENTITIES

CHAIR'S NOTE

It's Time to Draw a Red Line Around Greenwashing

The Honourable Catherine McKenna

Chair, High-level Expert Group on
the Net Zero Emissions Commitments
of Non-State Entities



"We urgently need every business, investor, city, state and region to walk the talk on their net zero promises. We cannot afford slow movers, fake movers or any form of greenwashing."

António Guterres,
UN Secretary General

We are at a critical moment for humanity. The window to limit dangerous global warming and ensure a sustainable future is quickly closing. This is the stark but unequivocal finding of recent climate change reports.

And we can all see it.

In 2022 alone, China experienced severe drought while half of Pakistan flooded. Deadly heatwaves killed tens of thousands in India and massive wildfires spread across Spain and California. East Africa's worst drought in decades threatens millions with starvation. In my country, Canada, one year earlier a heat dome over Lytton, British Columbia reduced the town to ash.

Climate change and extreme weather are undermining health, food and water security, nature, safety, and socio-economic development. A recent UN report shows that while the curve of global emissions is bending, it is not happening quickly enough to limit temperature rise to 1.5°C. Instead of being on track to reduce emissions by 45% by 2030, emissions are set to increase by close to 11%.

We are making progress but we are still too far from where we need to be.

Nor can we use the current confluence of global crises to stall action and entrench a status quo that fundamentally undermines security. Russia's illegal war in Ukraine reminds us that energy, climate, food and national security are inextricably linked and that moments of acute crisis

COP 26, Blah, blah, blah

CONTRIBUTORS OPINION

No more 'blah blah blah.' At COP26 in Glasgow, it's time for rich nations like Canada to keep their promises and pay for climate adaptation

BC

By Bruce Campbell Contributor
Mon., Nov. 1, 2021 | 5 min. read



Greta Thunberg: COP26 is just 'blah blah blah' and won't lead to real change

VIEW 26 COMMENTS



Climate Change 2022: Impacts, Adaptation and Vulnerability

REPORT
MULTIMEDIA

The Working Group II contribution to the Sixth Assessment Report assesses the impacts of climate change, looking at ecosystems, biodiversity, and human communities at global and regional levels. It also reviews vulnerabilities and the capacities and limits of the natural world and human societies to adapt to climate change.

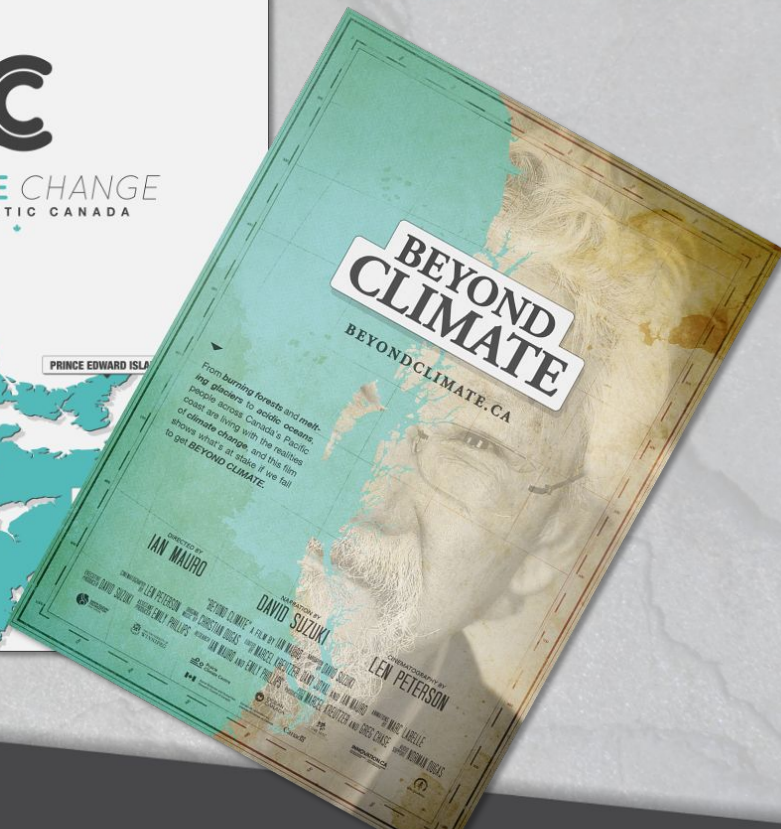


António Guterres ✓
@antonioguterres



I've seen many reports, but nothing like the new @IPCC_CH climate report, an atlas of human suffering & damning indictment of failed climate leadership.

Climate Change Storytelling





BEYOND CLIMATE

BEYONDCCLIMATE.CA

From *burning forests* and *melting glaciers* to *acidic oceans*, people across Canada's Pacific coast are living with the realities of *climate change*, and this film shows what's at stake if we fail to get *BEYOND CLIMATE*.

DIRECTED BY
IAN MAURO

NARRATION BY
DAVID SUZUKI

CINEMATOGRAPHY BY
LEN PETERSON

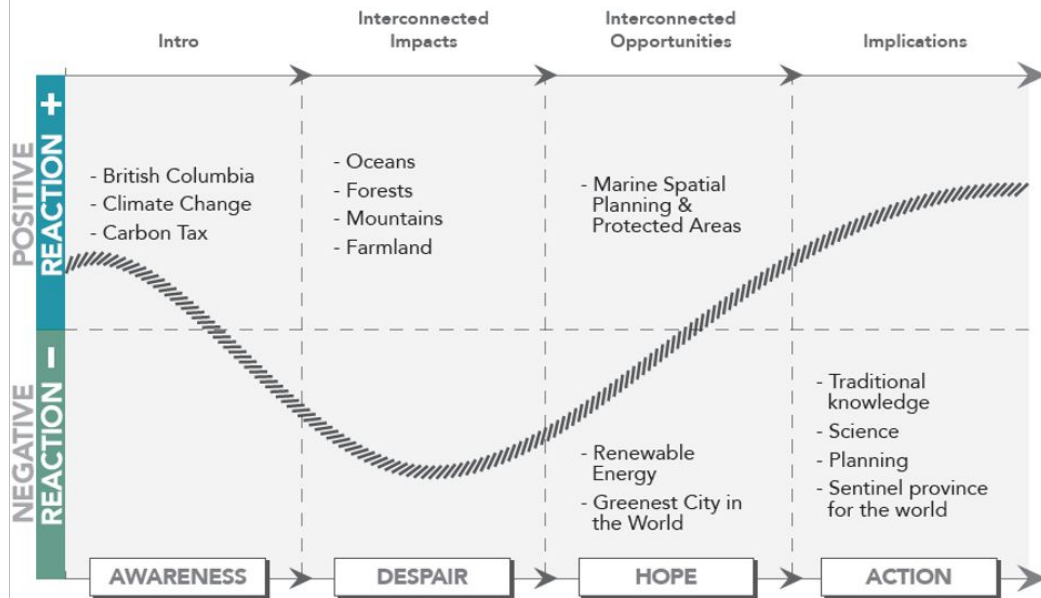
"BEYOND CLIMATE" A FILM BY IAN MAURO NARRATED BY DAVID SUZUKI

SCREENPLAY BY LEN PETERSON EDITOR CHRISTIAN DUGAS PRODUCTION DESIGNER MARCEL KREUTZER DIRECTOR OF PHOTOGRAPHY DARY JOYAL AND IAN MAURO EXECUTIVE PRODUCERS MARC LABELLE

PRODUCED BY DAVID SUZUKI PRODUCED BY EMILY PHILLIPS RESEARCH BY IAN MAURO AND EMILY PHILLIPS EXECUTIVE PRODUCERS MARCEL KREUTZER AND GREG CHASE EXECUTIVE PRODUCERS NORMAN DUGAS



STORYLINE



introduced by
IAN MALCOLM

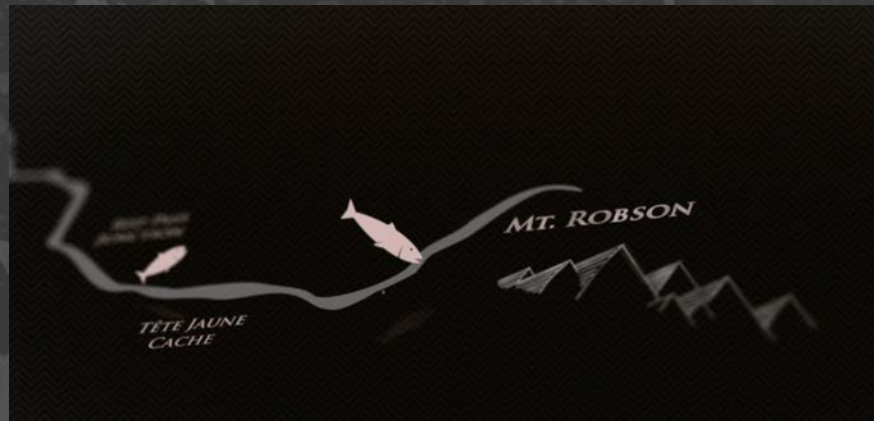
narrated by
DAVID SUZUKI

introduced by
LEN PETERSON

BEYOND CLIMATE



JOAN NORDLI
NEAR MT. ROBSON



JOAN NORDLI
1,300 KM FROM THE PACIFIC COAST
(NEAR MT. ROBSON)

CLIMATE ATLAS OF CANADA



24 Global Climate Models



25 Map Variables



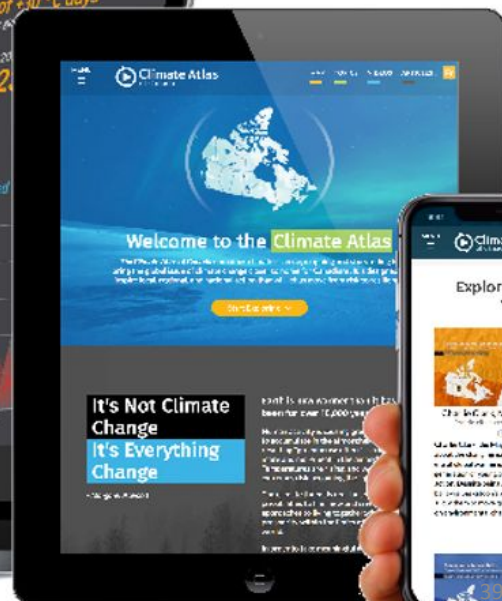
300+ Interviews



250+ Map Layers



2000 Towns, Cities & Regions



CLIMATE ATLAS OF CANADA

Launched 2018

1ST NATIONAL CLIMATE
PORTAL

MEDIA/USER IMPACT

APPLIED ADAPTATION



HEAT WAVES AND HEALTH

A SPECIAL REPORT ON
CLIMATE CHANGE IN CANADA

Heat Waves of the Future

Longer, hotter, and more of them: a look at what climate models project for Canada

Heat and Your Health

Heat stress and social vulnerability: what you need to know to stay safe

Risk to Resilience

Take action to prevent global warming from getting worse

AUGUST 2019

Winnipeg Free Press

Heat waves increasing danger in
Canada's forecast: report



BY TIM BONNEVILLE / WINNIPEG FREE PRESS

Executive director Ian Klaus, centre, and researchers at the University of Winnipeg's Prairie Climate Centre which published a report suggesting there could be an increase in severe heat waves across the country in the coming years as a result of climate change.

Heat Waves of the Future

What is a heat wave?

In general, a heat wave is an extended period of unusually hot weather. There isn't a simple, commonly accepted scientific definition of a heat wave. For this map and report, we define it as a period of at least three days in a row that reach 30 °C or higher. We use this because 30 °C is experienced as a 'hot' day anywhere in Canada, and a string of these hot days will increase the likelihood of heat impacts that matter to Canadians.

What will heat waves be like in the future?

Heat waves are projected to become longer, hotter, and more frequent.

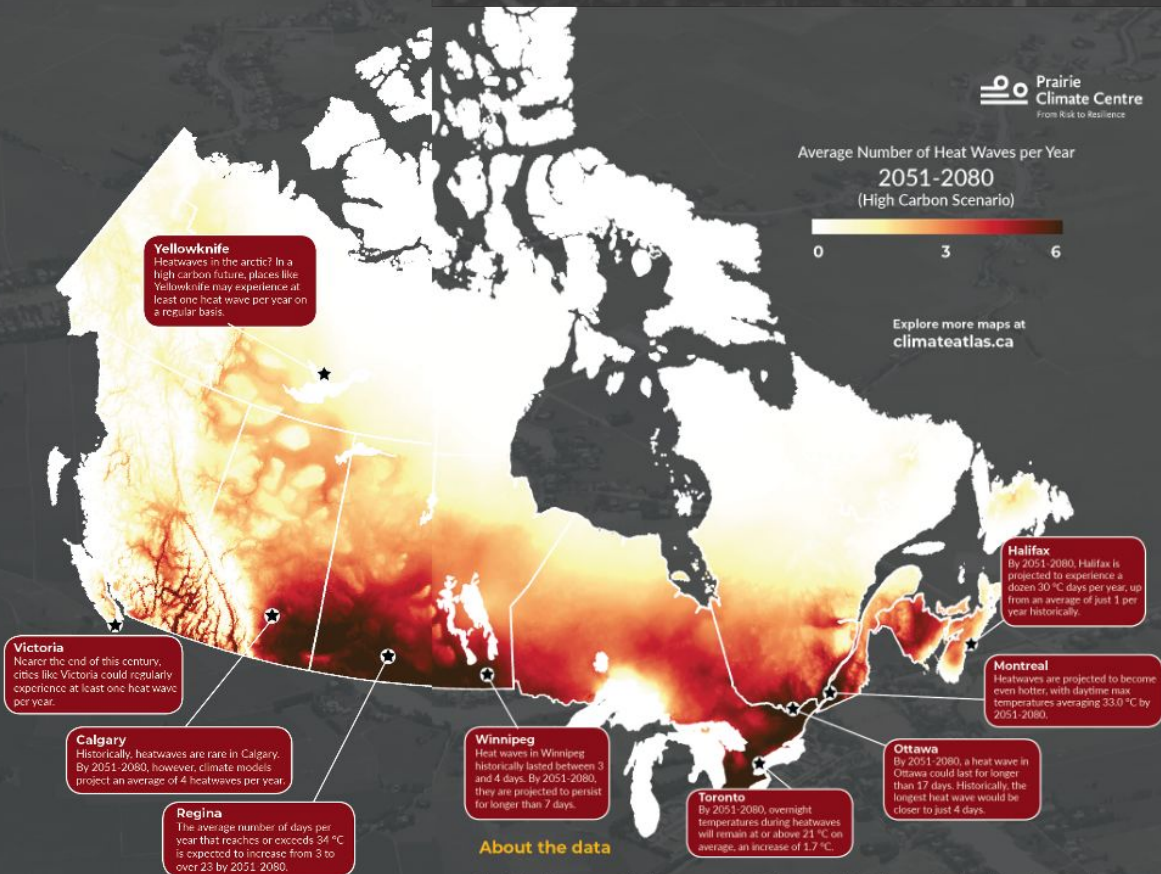
This map shows that heat waves are likely to happen frequently in the coming decades—if the current pace of greenhouse gas emissions is allowed to continue.

The daytime and night-time average temperatures during heat waves are both projected to rise almost everywhere across the country, meaning that heat waves are expected to get hotter as well as more common.

And worryingly, these future heat waves are projected to last much longer than the ones we've experienced in the recent past. Many of these heat waves linger for more than just three days, and some are projected to last for weeks in the hotter parts of the country.

Urban heat islands

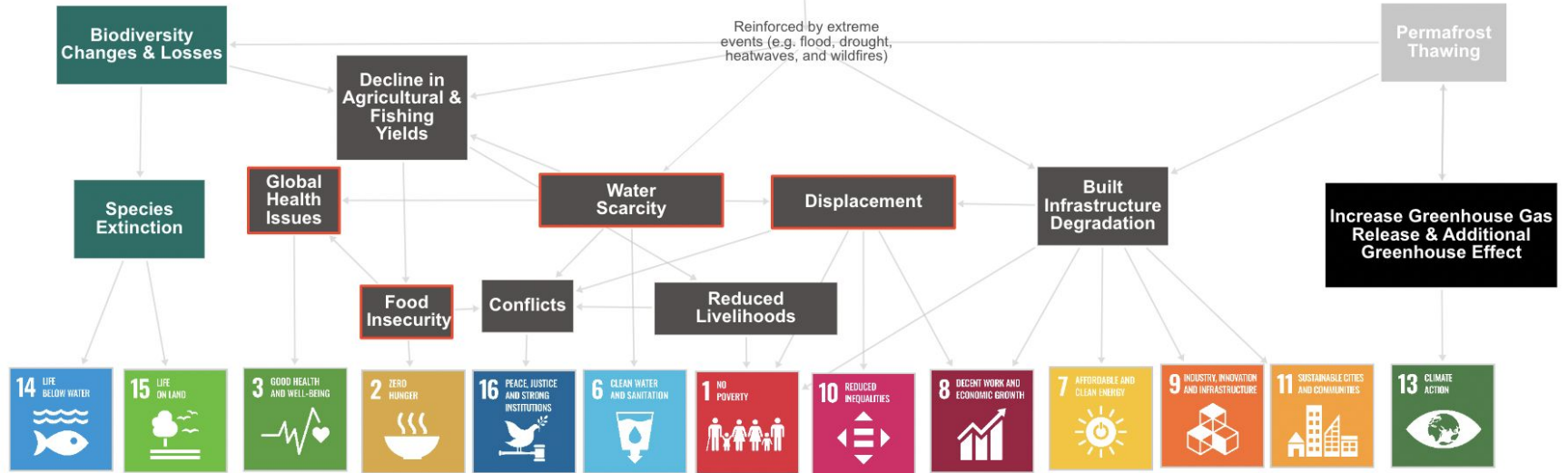
The effects of heat waves will be especially severe in our cities and towns, because they tend to be much warmer than the surrounding countryside. This is called the 'urban island effect.' It happens because the closely packed buildings and paved surfaces that make up our cities amplify and trap heat.



About the data

The data in this report are derived from an ensemble of 24 downscaled global climate models obtained from the Pacific Climate Impacts Consortium (PCIC; pacificclimate.org). Values and comparisons use ensemble averages across the 30-year periods 1976-2005 and 2051-2080 under the High Carbon (or RCP8.5) emissions scenario that assumes greenhouse gas emissions will continue to increase at current rates throughout this century. This latest-generation model data has been made available thanks to a partnership with Environment and Climate Change Canada, PCIC, Ouranos, and the Computer Research Institute of Montréal. See the Climate Atlas at climateatlas.ca to explore more data and to see what happens if the world reduces its greenhouse gas emissions and slows the pace of global warming.

Global Mean Surface Temperature



Legend

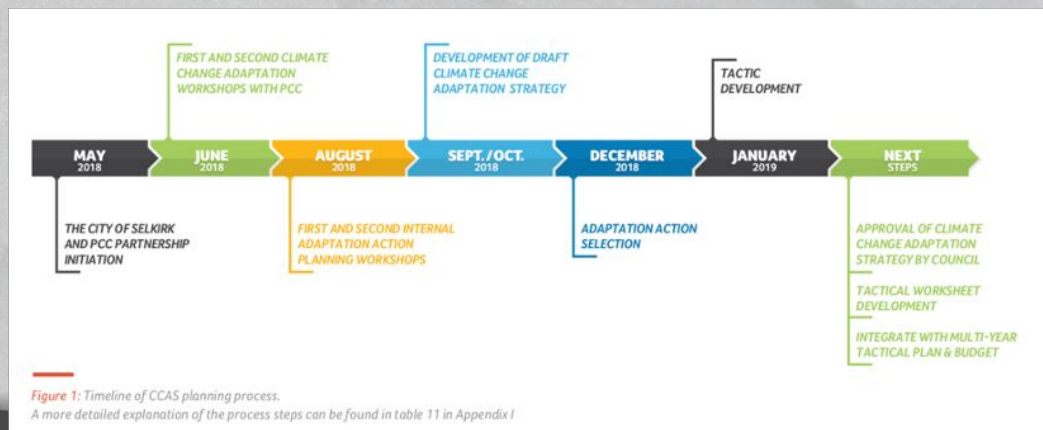
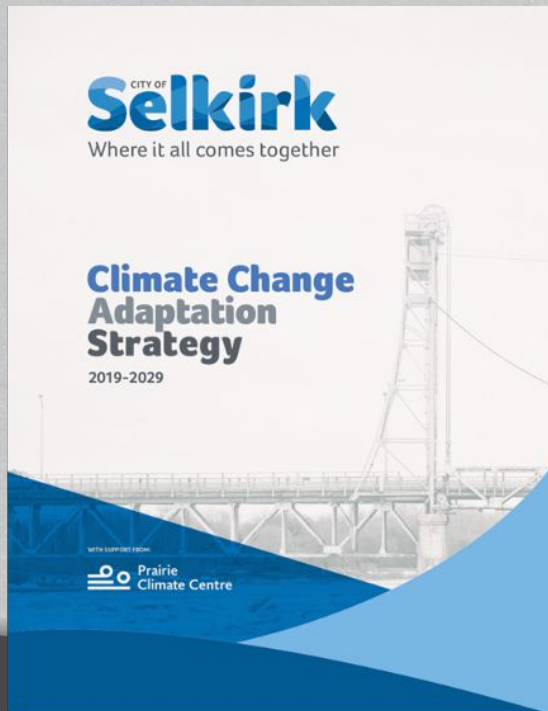
- Change in the Climate System
- Ecosystem Services Degradation
- Impact on Human Societies
- Feedback Loop



**WORLD
METEOROLOGICAL
ORGANIZATION**

Weather · Climate · Water

ADAPTATION PLANNING



ADAPTATION PLANNING



Risk Evaluation Matrix

Public Climate Centre

Magnitude of Consequences

Likelihood of Consequences Occurring

	Very Low	Low	Moderate	High	Very High
Very High			Aquifer reaches critical low level	Urban fire	Vulnerable population health issues
High			Greater water demand	City workers experience health problems	Physical heat stress
Moderate			Power outage due to electric grid overload (excess AC use)	Public pool reaches capacity	Air conditioning equipment fails to maintain acceptable level of service
Low					
Very Low					

Notes: Increase in the frequency/intensity of heat waves. Damage caused by strong wind events. Extra demand on city call centres.

Municipal Service Area

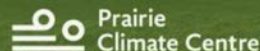
Risk	Consequence	Fire	Water	Health	Environment	Infrastructure	Transportation	Energy	Other
Physical heat stress									
Vulnerable population health issues									
City workers and firefighters experience health problems									
Urban fire									
Breakdown of building heating equipment									
Heating equipment fails to maintain acceptable levels of service									
Ice develops on roads and sidewalks									
Aquifer reaches critical low level									
Greater water demand									
Air conditioning equipment fails to maintain acceptable level of service									
Grass and brush fire									
Sewer backups if river is also high, storm water must be pumped out									
Uncontrolled sewage discharge event									
Power interruption									
Debris on roads									
Water damage to flat roofed buildings									
Basement flooding									
Impacts on river ice formation, breakup and jamming potential									
Significant heavy, wet snow accumulation on ground									
Significant heavy, wet snow accumulation on roofs									
Increased urban wildlife activity									
Shutdown of roads									
Damage caused by high winds									
Elderly population unable to access services due to cold/icy conditions									
Shutdown of bridge									
Public pool reaches capacity									
Safety concerns related to fast moving overland water flow									
Unable to manage citizen expectations of services									
Interruptions to parks and trails operations									
Issues related to standing water									
Power disruption due to ice accretion/freezing rain									
Disrupted winter ice fishing season									
Culverts get plugged with ice after thaw									
Fire hydrants freeze at base due to melt water accumulation/freeze									
Fleet experiences breakdowns and repairs									
Firetruck equipment experiences issues due to freezing temperatures									
Power outage due to electric grid overload (excess AC use)									
Extra demand on city call centres									
Damage to athletic fields									
Erosion of parking lots and trails									
Increased stress on recreation complex ice plant									



CLIMATE CHANGE 101

November 4th, 2021
1Pm CDT/3PM ADT

A primer for professionals, practitioners and decision-makers to understand the science and mechanisms of climate change



Indigenous Knowledges & Two-eyed Seeing

November 10th, 2021
1PM CDT/3PM ADT

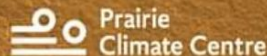
An in-depth conversation with Elder Albert Marshall, about connecting Indigenous knowledges and western science to address climate change.



Climate Change & Indigenous Communities

December 8th, 2021
1PM CT

An examination of climate risks and impacts on indigenous communities as well as a discussion around how climate change is defined across cultures.



WITH GUEST SPEAKER
KNOWLEDGE KEEPER
LESLIE SPILLETT

Indigenous Mapping and Climate Change: *Using the Climate Atlas to Evaluate and Understand Climate Risks*

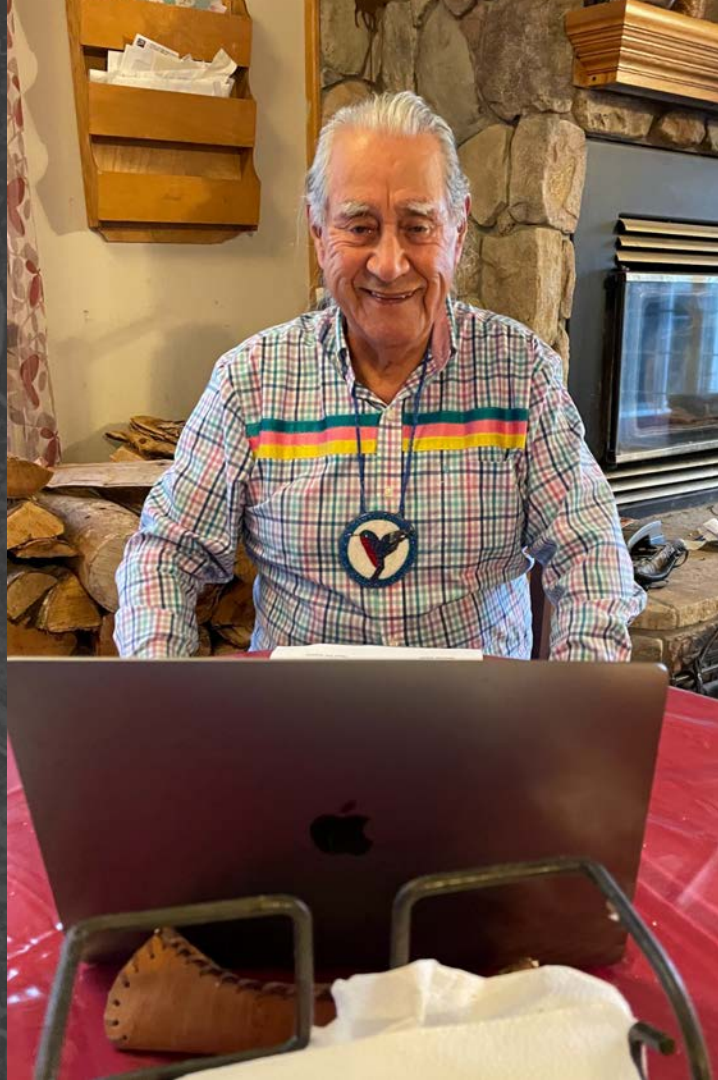
January 20th, 2022
1PM CST

Indigenous mapping, climate change, and how to evaluate and understand climate risks facing Indigenous communities.




Albert Marshall defines Two-Eyed Seeing as “learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of mainstream knowledges and ways of knowing, and to use both these eyes together, for the benefit of all.”

TWO-EYED SEEING



Coming Out is Part of the Life Cycle: A Qualitative Study using Two-Eyed Seeing to Understand A Two-Spirits Coming Out Process

John R. Sylliboy 

Department of Integrated Studies in Education, McGill University, Montreal, Canada

GLOBAL PUBLIC HEALTH
<https://doi.org/10.1080/17441692.2021.1993953>

TWO-EYED SEEING

Using two-eyed seeing to bridge Western science and Indigenous knowledge systems and understand long-term change in the Saskatchewan River Delta, Canada

Razak Abu^a, Maureen G. Reed^a, and Timothy D. Jardine^b

INTERNATIONAL JOURNAL OF WATER RESOURCES DEVELOPMENT
2020, VOL. 36, NO. 5, 757-776
<https://doi.org/10.1080/10807008.2018.1508050>

PLOS ONE

RESEARCH APPROACHES

Medical Education. 2020;54:217–224.

Two-eyed seeing: A useful gaze in Indigenous medical education research

Andrea McKivett¹  | Judith N. Hudson¹  | Dennis McDermott² | David Paul³

RESEARCH ARTICLE

How is *Etuaptmumk*/Two-Eyed Seeing characterized in Indigenous health research? A scoping review

Sophie I. G. Roher^{1,2*}, Ziwa Yu^{3†}, Debbie H. Martin^{4‡}, Anita C. Benoit^{5,6,7‡}

PERSPECTIVE | BRIDGE: INDIGENOUS AND SCIENTIFIC KNOWLEDGE

“Two-eyed seeing” supports wildlife health

SUSAN KUTZ AND MATILDE TOMASELLI

SCIENCE • 21 Jun 2019 • Vol 364, Issue 6446 • pp. 1135–1137 • DOI: 10.1126/science.aau6170


Science

Original Research Report

Using Two-Eyed Seeing to Explore Interagency Collaboration

Canadian Journal of Nursing Research
2018, Vol. 50(3) 133–144
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DOI: 10.1177/0844562118766176
journals.sagepub.com/home/cjn



Cheryl Whiting¹ , Stephanie Cavers², Sandra Bassendowski³, and Pammla Petrucka³

ORIGINAL ARTICLE



“Two-Eyed Seeing”: An Indigenous framework to transform fisheries research and management

Andrea J. Reid^{1,2}  | Lauren E. Eckert^{3,4}  | John-Francis Lane¹  | Nathan Young⁵  | Scott G. Hinch² | Chris T. Darimont^{3,4}  | Steven J. Cooke¹  | Natalie C. Ban⁶  | Albert Marshall⁷

Envisioning indigenized geography: a two-eyed seeing approach

Lynn Moorman ^a, Julia Evanovitch^b, and Tolu Muliaina^c

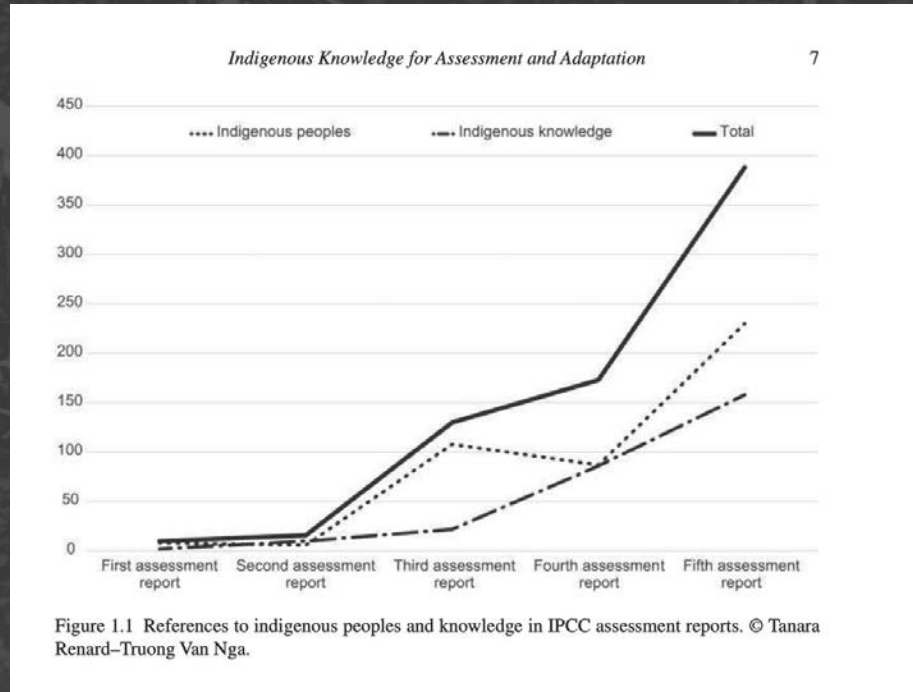
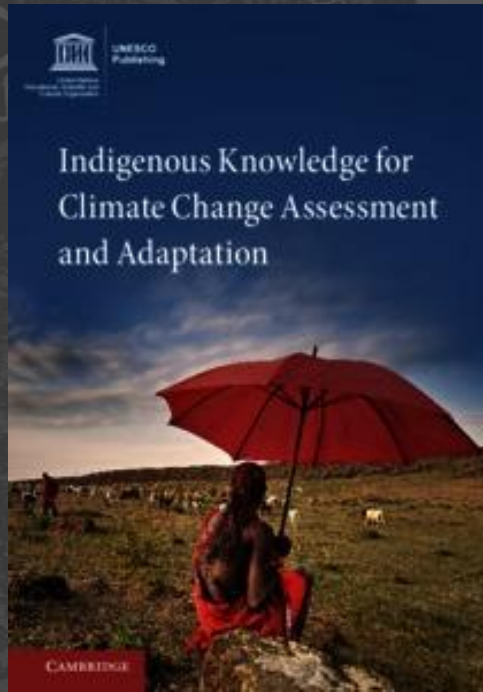
JOURNAL OF GEOGRAPHY IN HIGHER EDUCATION
2021, VOL. 45, NO. 2, 201–220
<https://doi.org/10.1080/0308285.2021.1872060>

Confronting the contradictions between Western and Indigenous science: a critical perspective on Two-Eyed Seeing

Lee-Anne Broadhead  and Sean Howard

AlterNative
2021, Vol. 17(1) 111–119
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DOI: 10.1177/177180121996326
journals.sagepub.com/home/an

Importance of Indigenous Knowledge in climate change assessment, adaptation, and ability for ‘anchoring or scaling down’ global climate scenarios at the local scale (Nakashima et al. 2018)



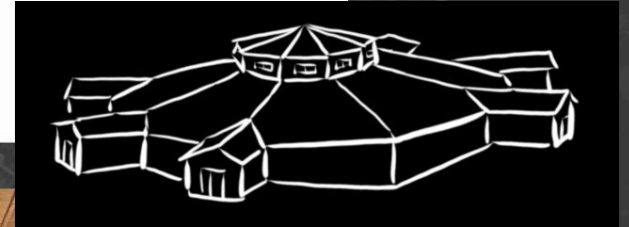
Open Access | Published: 15 February 2021

‘A change of heart’: Indigenous perspectives from the Onjisy Aki Summit on climate change

[Laura Cameron](#) , [Dave Courchene](#), [Sabina Ijaz](#) & [Ian Mauro](#)

[Climatic Change](#) **164**, Article number: 43 (2021) | [Cite this article](#)

746 Accesses | **12** Altmetric | [Metrics](#)



‘A change of heart’: Indigenous perspectives from the Onjisy Aki Summit on climate change

Laura Cameron , Dave Courchene, Sabina Ijaz & Ian Mauro

Climatic Change **164**, Article number: 43 (2021) | [Cite this article](#)

746 Accesses | 12 Altmetric | [Metrics](#)



Fig. 1

From: ‘A change of heart’: Indigenous perspectives from the Onjisy Aki Summit on climate change



The Elders described elements of the human condition and values, which motivate human behaviours and activities, which cause the impacts that we are facing today

‘A change of heart’: Indigenous perspectives from the Onjisay Aki Summit on climate change

Laura Cameron , Dave Courchene, Sabina Ijaz & Ian Mauro

Climatic Change **164**, Article number: 43 (2021) | [Cite this article](#)

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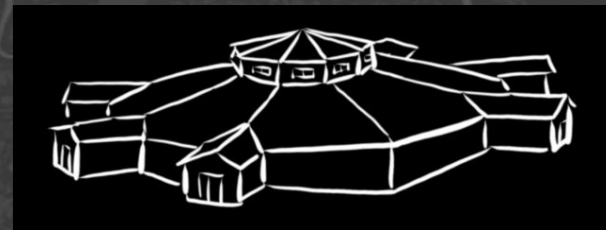
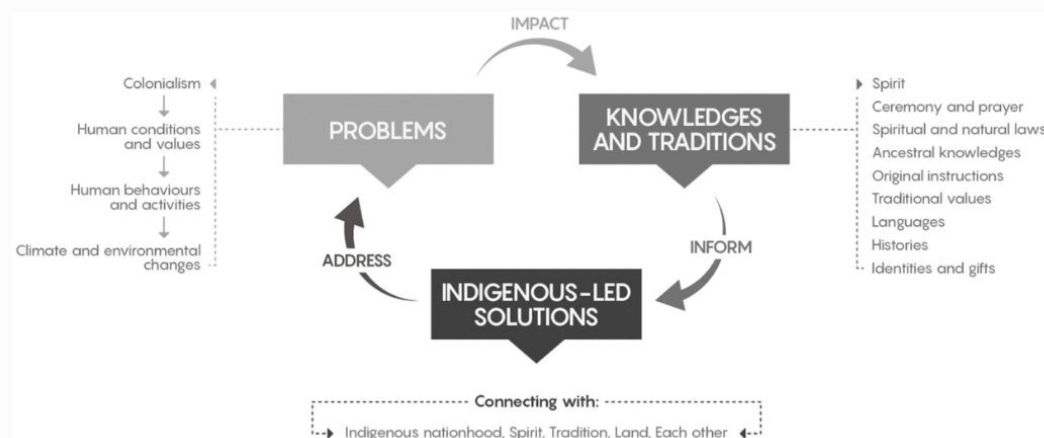


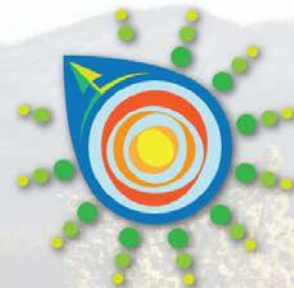
Fig. 2

From: ‘A change of heart’: Indigenous perspectives from the Onjisay Aki Summit on climate change



The major themes from analysis of the Onjisay Aki Summit discussions. Participants discussed the problems underlying climate change, which have impacted their knowledges and traditions. At the same time, the latter were considered sources of strength to inform solutions to climate change that address the underlying societal problems

NEW CONTENT **ON THE CLIMATE ATLAS**



**INDIGENOUS
Knowledges**

Please join us for a major release of Indigenous-focused data, knowledge, and resources developed by, with, and for Métis, First Nations, and Inuit communities. Special guests include **Cassidy Caron**, **Kluane Adamek**, and **Siila Watt-Cloutier**.

Register on eventbrite. ****1PM Eastern**** ****12PM Central**** ****10AM Pacific****

**March 15th
2022**

 Read about

Indigenous Knowledge on Climate Change

Since time immemorial, Indigenous Nations have existed in North America. They developed rich knowledges and stories through experience and observation over thousands of years of living with and adapting to changing climates and environments.

This land-based knowledge is integral to the survival of Indigenous cultures, languages and identities. Because of this, Indigenous leaders, Elders and youth have worked tirelessly to give a voice to the lands and ecosystems they belong to.

[Read More >](#)

 Explore

First Nations

First Nations is a term used to describe the Indigenous peoples who have been placed into reserves in Canada. There are over 600 First Nations Communities in Canada.

Every community will have a chief and council, however, some groups of communities still govern themselves using their hereditary system as a Nation or within a larger governance council. The Indigenous peoples of these lands carry many distinct languages, traditions, governance systems and all are connected by the great reverence they have for their relationship to the land.

[Explore First Nations Content >](#)

 Explore

Inuit

Canada's climate has changed in ways that are effectively irreversible, with disproportionate impacts for Arctic communities.

Many Inuit elders, hunters, and community members are concerned by the impacts of climate change to land-use and access, community activities and well-being, and animal populations. Inuit Qaujimajatuqangit and local knowledge of changing landscapes are essential in understanding climate change in the Inuit Nunangat.

[Explore Inuit Content >](#)

 Explore

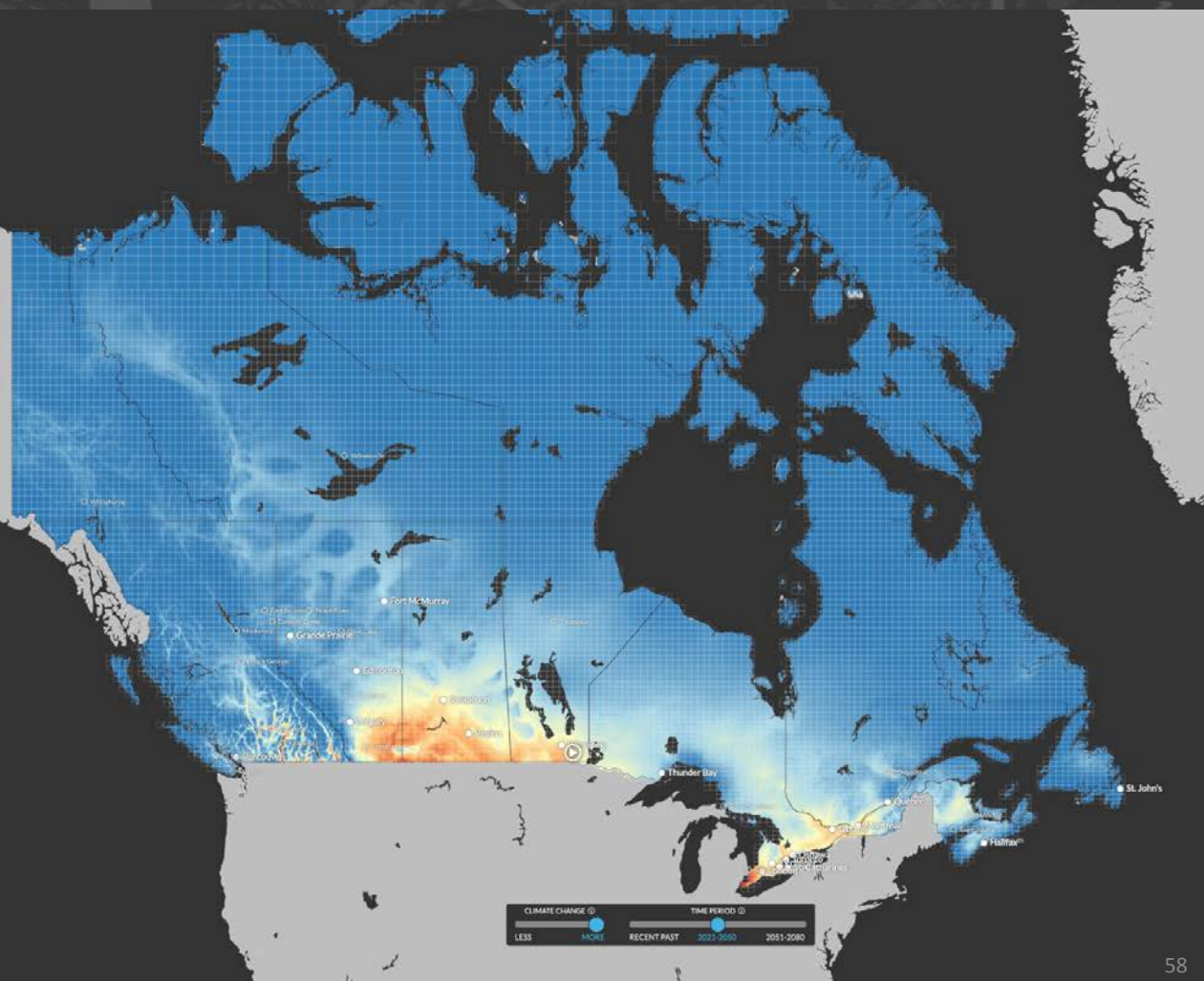
Métis

With homelands at the heart of the continent, the Metis Nation has a rich history of adaptation.

Metis culture has evolved through deep connection to the land, and offers wisdom of stewardship that can help face the changes to come.

[Explore Métis Content >](#)

- Small grid
- Average
- Cities and Municipalities
- Indigenous
- Settings





Small grid



Average



Cities and Municipalities



Indigenous



Settings



Indigenous



First Nations Communities



Inuit Communities

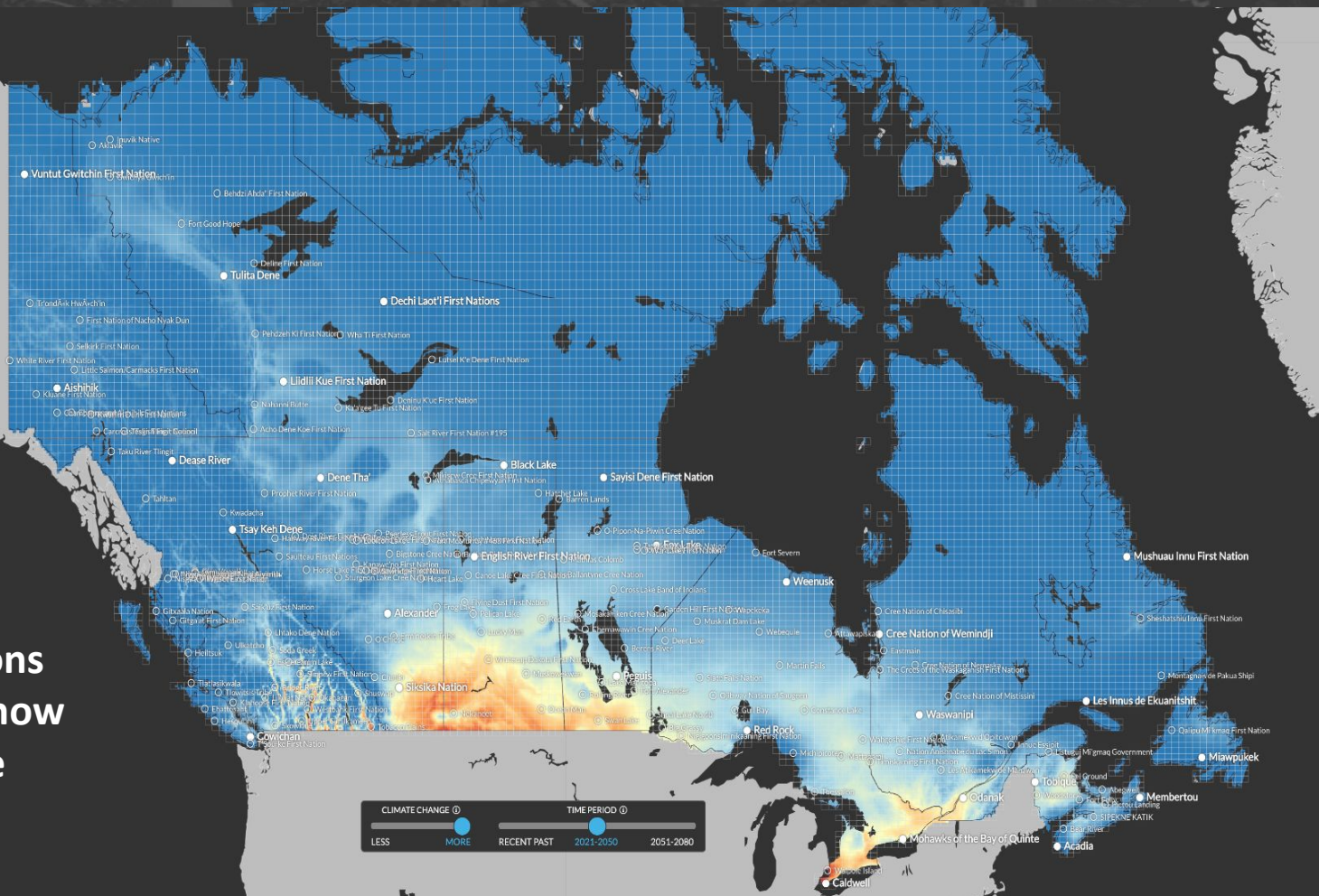


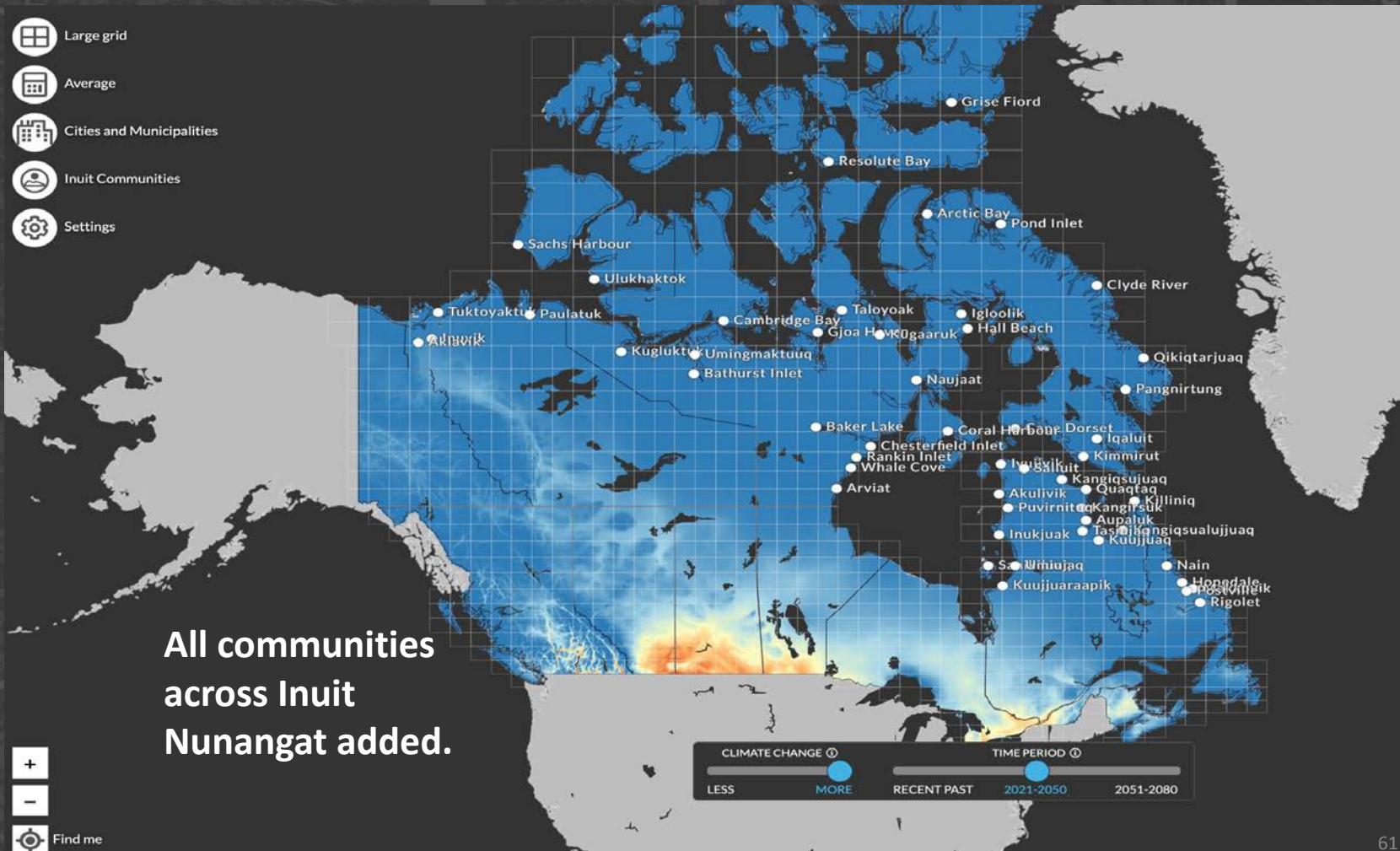
Métis Projects

- Small grid
- Average
- Cities and Municipalities
- First Nations Communities
- Settings

- +
-
- Find me

634 First Nations communities now on the Climate Atlas.







Large grid



Average



Cities and Municipalities



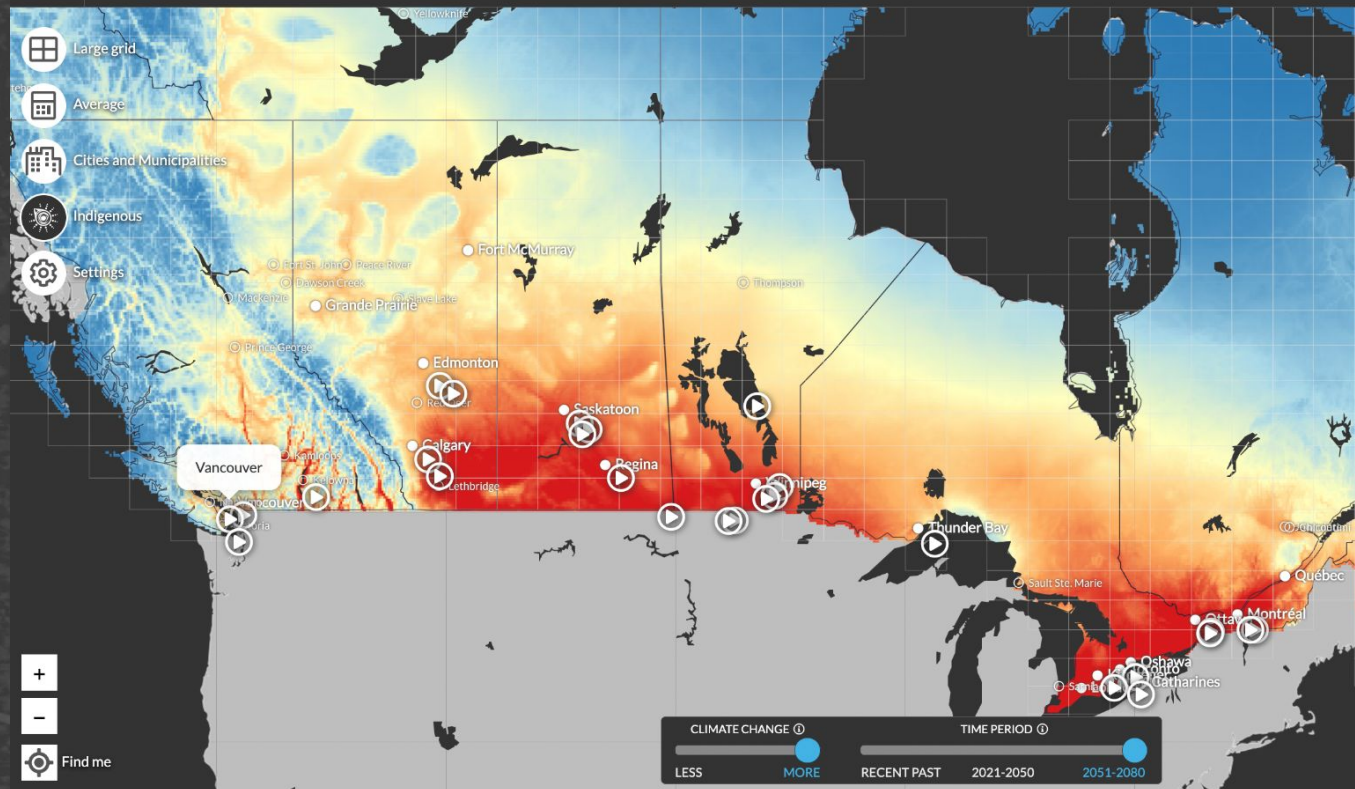
Indigenous



Settings



Find me



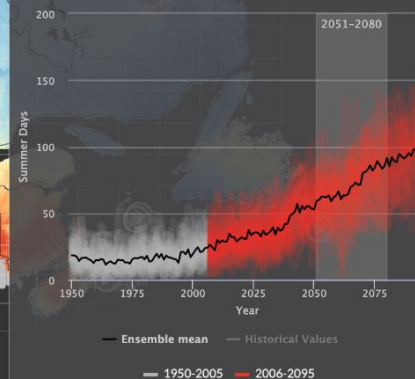
Municipality VANCOUVER

Projected change in mean Summer Days

High Carbon → More climate change

1976-2005 2051-2080

18.2 → 72.1

Up Δ
+53.8

This graph shows values from 24 climate models as well as their yearly mean (average) values.



Hot Weather



Cold Weather



Temperature



Precipitation



Agriculture

MENU

MAP

Average value (mm)

0

100

Precipitation (Dec)

High Carbon → More climate change • 2051-2080

HELP

TOUR

SHARE

Fr



Large grid



Average



Cities and Municipalities



Indigenous

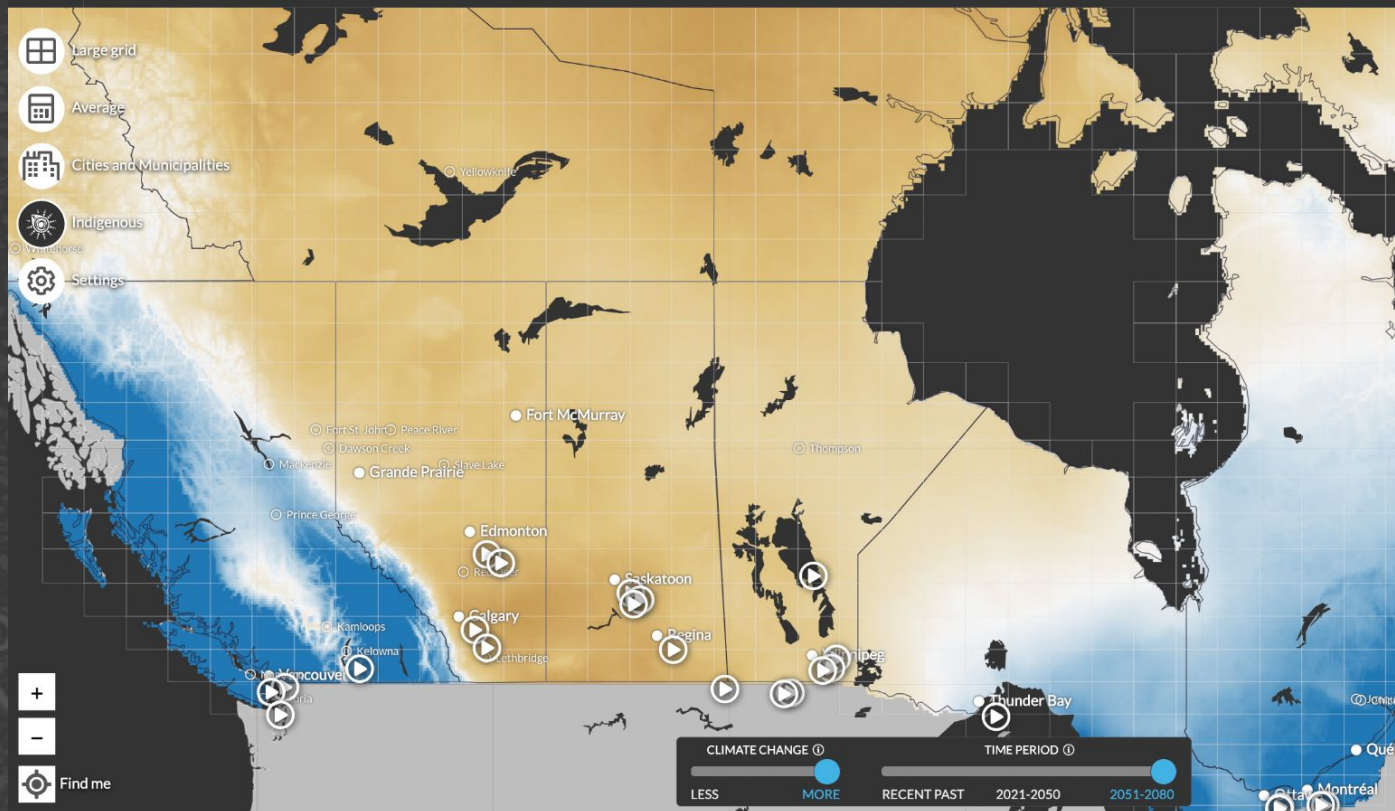
© WeatherSense



Settings



Find me



CLIMATE CHANGE ①

LESS

MORE

RECENT PAST

TIME PERIOD ①

2021-2050

2051-2080

Municipality VANCOUVER

Projected change in mean Dec Precipitation

High Carbon → More climate change

1976-2005

238 mm

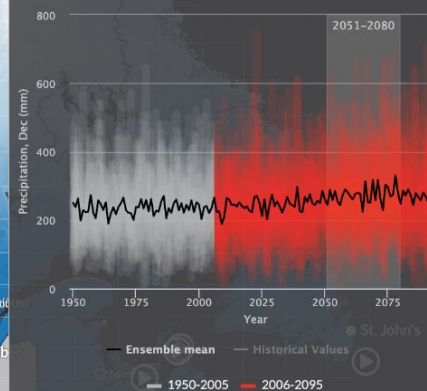
→

2051-2080

274 mm

Up

+15%



This graph shows values from 24 climate models as well as their yearly mean



Hot Weather



Cold Weather



Temperature



Precipitation



Agriculture

v2.0



Large grid



Average



Cities and Municipalities



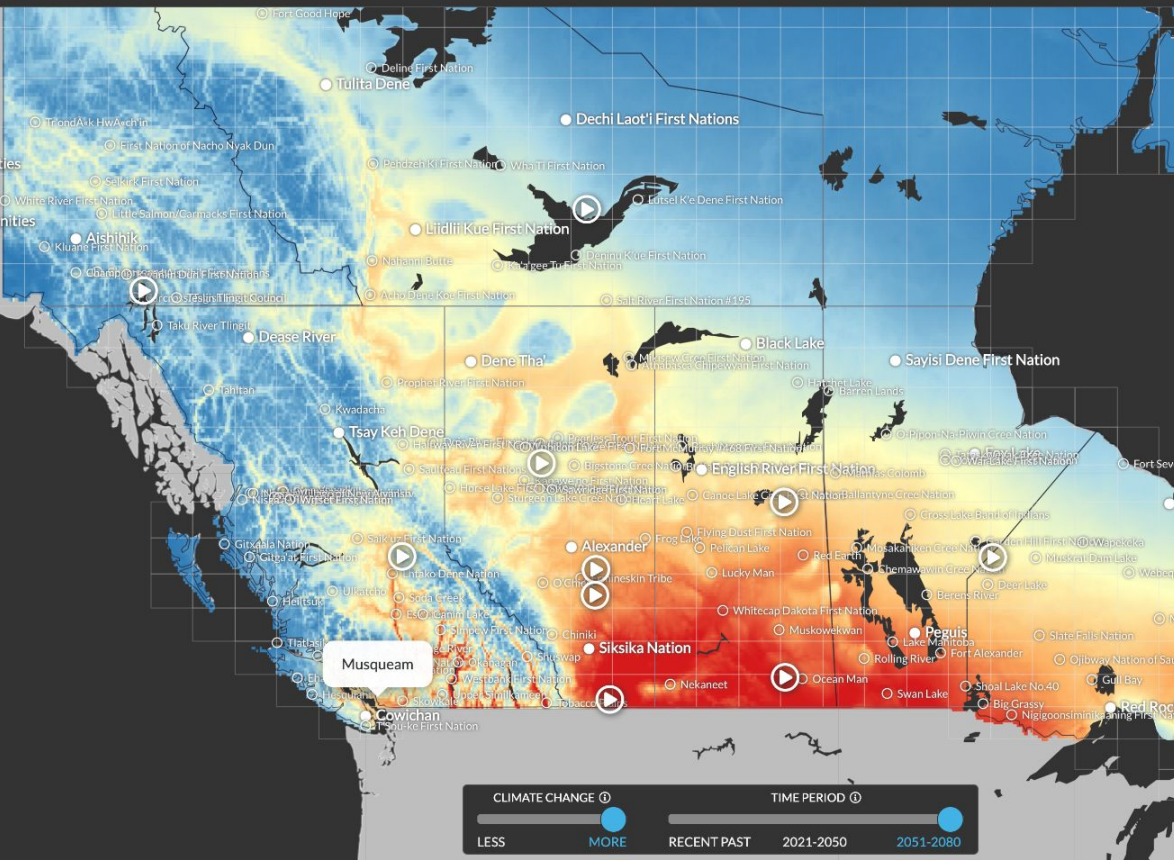
First Nations Communities



Settings



Find me



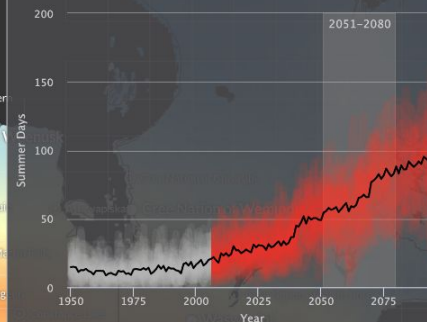
Municipality MUSQUEAM

Projected change in mean Summer Days

High Carbon → More climate change

1976-2005 2051-2080

14.6 → 67.9

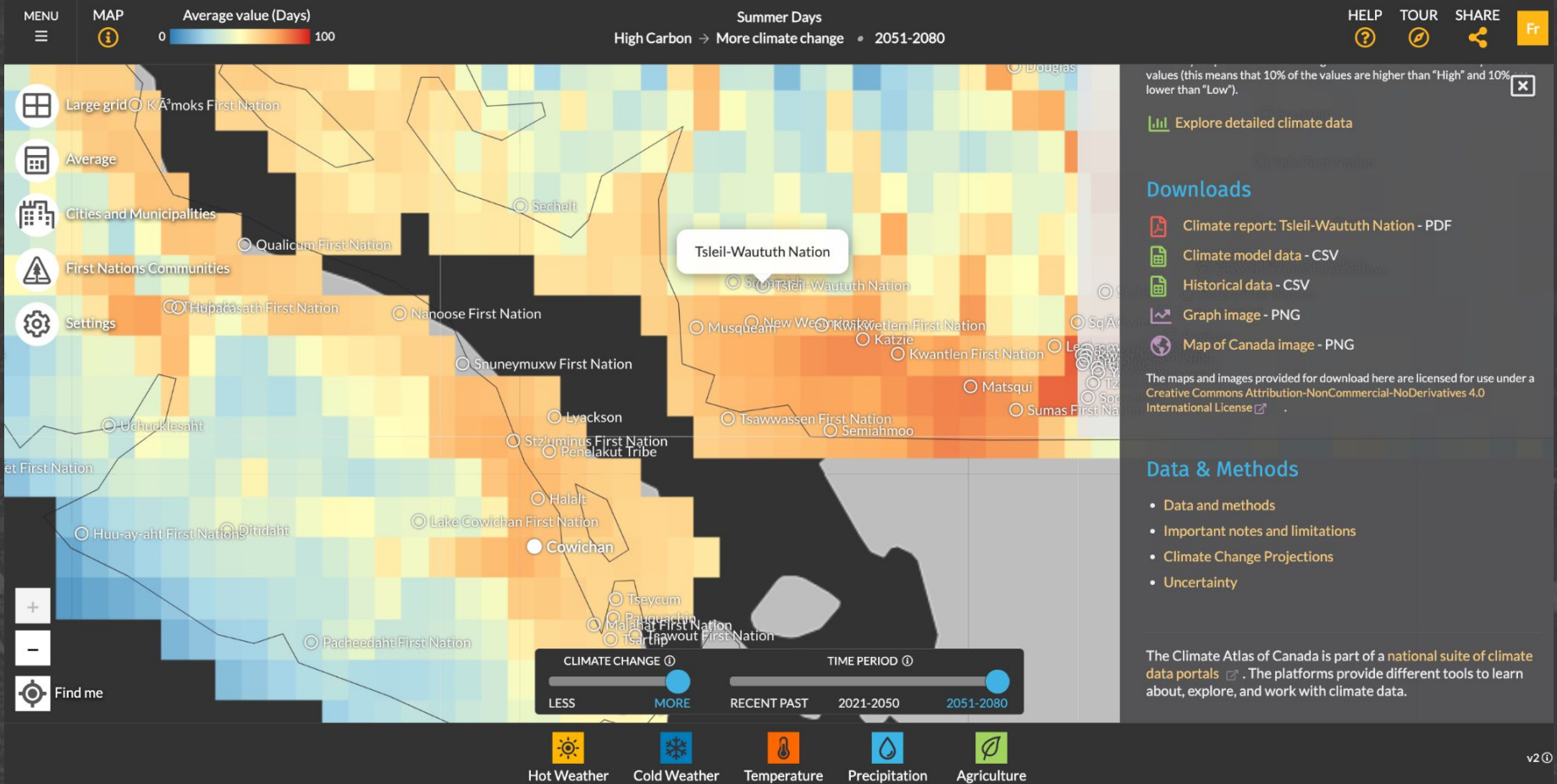
Up ▲
+53.2

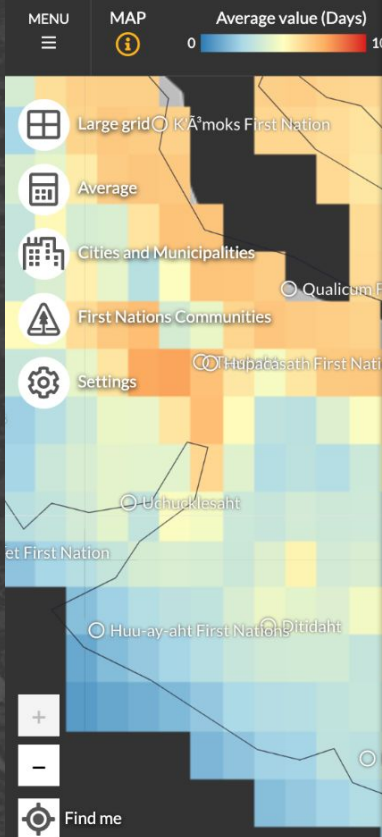
— Ensemble mean — Historical Values

— 1950-2005 — 2006-2095

This graph shows values from 24 climate models as well as their yearly mean (average) values.

☒ Show historical values





Climate Atlas Report

First Nations: Tsleil-Waututh Nation

RCP 8.5: High Carbon climate future

GHG emissions continue to increase at current rates

Variable	Period	1976-2005				2021-2050			2051-2080		
		Mean	Low	Mean	High	Low	Mean	High	Low	Mean	High
Precipitation (mm)	annual	1926	1552	1963	2434	1593	2082	2597			
Precipitation (mm)	spring	407	257	424	616	269	436	627			
Precipitation (mm)	summer	196	77	188	317	72	181	320			
Precipitation (mm)	fall	584	332	589	876	359	629	926			
Precipitation (mm)	winter	738	507	780	1075	548	837	1154			
Mean Temperature (°C)	annual	10.2	10.9	12	13	12.4	13.8	15.2			
Mean Temperature (°C)	spring	9.4	9.3	11.1	12.9	10.8	12.7	14.6			
Mean Temperature (°C)	summer	17	17.5	18.9	20.5	19.2	21	22.9			
Mean Temperature (°C)	fall	10.5	10.8	12.3	13.7	12.3	14.1	15.8			
Mean Temperature (°C)	winter	3.8	3.5	5.6	7.3	5.2	7.3	9.2			
Tropical Nights	annual	0	0	1	2	0	7	20			
Very Hot Days (>30°C)	annual	3	1	9	20	6	22	42			
Very Cold Days (<30°C)	annual	0	0	0	0	0	0	0			
Date of Last Spring Frost	annual	March 15	Jan. 2	Feb. 12	March 23	N/A	Jan. 23	March 5			
Date of First Fall Frost	annual	Nov. 18	Nov. 4	Dec. 4	Dec. 29	Nov. 16	Dec. 16	Dec. 30			
Frost-Free Season (days)	annual	244	244	292	343	277	326	363			

RCP 4.5: Low Carbon climate future

GHG emissions much reduced

Variable	Period	1976-2005				2021-2050			2051-2080		
		Mean	Low	Mean	High	Low	Mean	High	Low	Mean	High
Precipitation (mm)	annual	1928	1552	1989	2457	1584	2021	2486			
Precipitation (mm)	spring	406	259	416	591	269	428	613			
Precipitation (mm)	summer	196	77	183	314	67	176	315			
Precipitation (mm)	fall	583	367	616	872	362	617	877			
Precipitation (mm)	winter	740	488	776	1069	517	799	1105			
Mean Temperature (°C)	annual	10.2	10.7	11.7	12.7	11.5	12.7	13.8			
Mean Temperature (°C)	spring	9.4	9.3	11	12.6	10.2	11.9	13.7			
Mean Temperature (°C)	summer	17	17.4	18.7	20.1	18	19.8	21.4			
Mean Temperature (°C)	fall	10.5	10.6	11.9	13.1	11.3	12.7	14			
Mean Temperature (°C)	winter	3.8	3.3	5.2	6.9	4.5	6.3	7.9			
Tropical Nights	annual	0	0	0	2	0	1	5			
Very Hot Days (>30°C)	annual	3	1	8	18	2	13	26			
Very Cold Days (<30°C)	annual	0	0	0	0	0	0	0			
Date of Last Spring Frost	annual	March 14	Jan. 5	Feb. 14	March 22	N/A	Jan. 31	March 11			
Date of First Fall Frost	annual	Nov. 18	Nov. 3	Dec. 2	Dec. 27	Nov. 8	Dec. 9	Dec. 30			
Frost-Free Season (days)	annual	245	240	288	336	259	309	357			

values (this means that 10% of the values are higher than "High" and 10% lower than "Low").

Explore detailed climate data

Downloads

- Climate report: Tsleil-Waututh Nation - PDF
- Climate model data - CSV
- Historical data - CSV
- Graph image - PNG
- Map of Canada image - PNG

The maps and images provided for download here are licensed for use under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License

Data & Methods

- Data and methods
- Important notes and limitations
- Climate Change Projections
- Uncertainty

The Climate Atlas of Canada is part of a national suite of climate data portals. The platforms provide different tools to learn about, explore, and work with climate data.

The Meechim Project

Le projet Meechim

Garden Hill First Nation



Atlas climatique Climate Atlas
du Canada of Canada

Watch on YouTube



Lubicon Cree Culture Camp

Camp culturel de la Lubicon Cree Nation

Lubicon Cree Nation, Alberta



Atlas climatique Climate Atlas
du Canada of Canada

Watch on YouTube



Adapting to Sea Level Rise

Adaptation à l'élévation du niveau de la mer

Indian Island FN, New Brunswick



Atlas climatique Climate Atlas
du Canada of Canada

Watch on YouTube



Métis Wildland Firefighters

Pompier Métis des 'Wildland'

Alberta



Atlas climatique Climate Atlas
du Canada of Canada

Montana First Nation & Community Solar

Premières Nations de Montana et communauté solaire

Montana First Nation, Alberta



Atlas climatique Climate Atlas
du Canada of Canada



World out of Balance

Monde en déséquilibre

Prince George, British Columbia



Atlas climatique Climate Atlas
du Canada of Canada

Watch on YouTube



First Metis owned solar project in Canada

Premier projet solaire appartenant à des Métis au Canada

Northern Village of Green Lake



Atlas climatique Climate Atlas
du Canada of Canada

Watch on YouTube



Renewables in the heart of the Tar Sands

Les énergies renouvelables au cœur des sables bitumineux

Lubicon Lake First Nation



Atlas climatique Climate Atlas
du Canada of Canada



Atlas climatique Climate Atlas
du Canada of Canada



Watch on YouTube

CONTRIBUTORS

OPINION

At last, an atlas of Indigenous knowledge



By **Stephen Bede Scharper** Special to the Star
Tue., March 22, 2022 | 2 min. read

Article was updated 24 hrs ago

Noting that UN Secretary-General António Guterres recently spoke of climate change as a story of tragedy, vulnerability, and suffering, Mauro states that this atlas is a story of “resilience, community-building, and hope.”

Innovative atlas puts Indigenous knowledge on the map – literally – to help tackle climate crisis



Project shares cross-Canada climate data and lessons from Inuit, Métis and First Nations communities



Jaela Bernstein · CBC News · Posted: Mar 15, 2022 1:00 AM PDT | Last Updated: March 15, 2022



Hetxw'ms Gyetxw said he hopes a new Indigenous Knowledges section of the Climate Atlas of Canada will help show what Indigenous people have been fighting for all along — climate change resiliency and adaptation, and to make sure there's a future for all people. (Tyson Koschik/CBC)

News

Decolonizing Canada's climate atlas through 'two-eyed seeing'

New initiative adds videos and resources to support Indigenous communities across the country that are confronting climate change.

New Mapping Connects Indigenous Knowledge to Climate Impacts, Solutions








March 16, 2022 · Reading time: 4 minutes

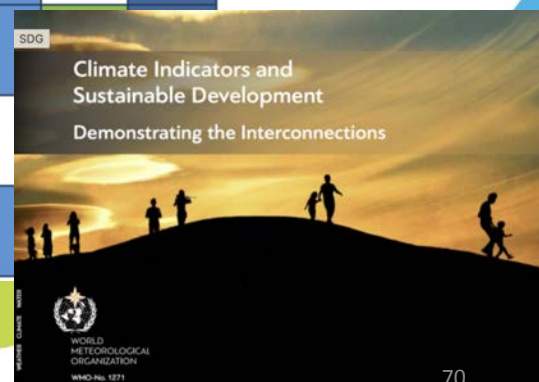
CANADA

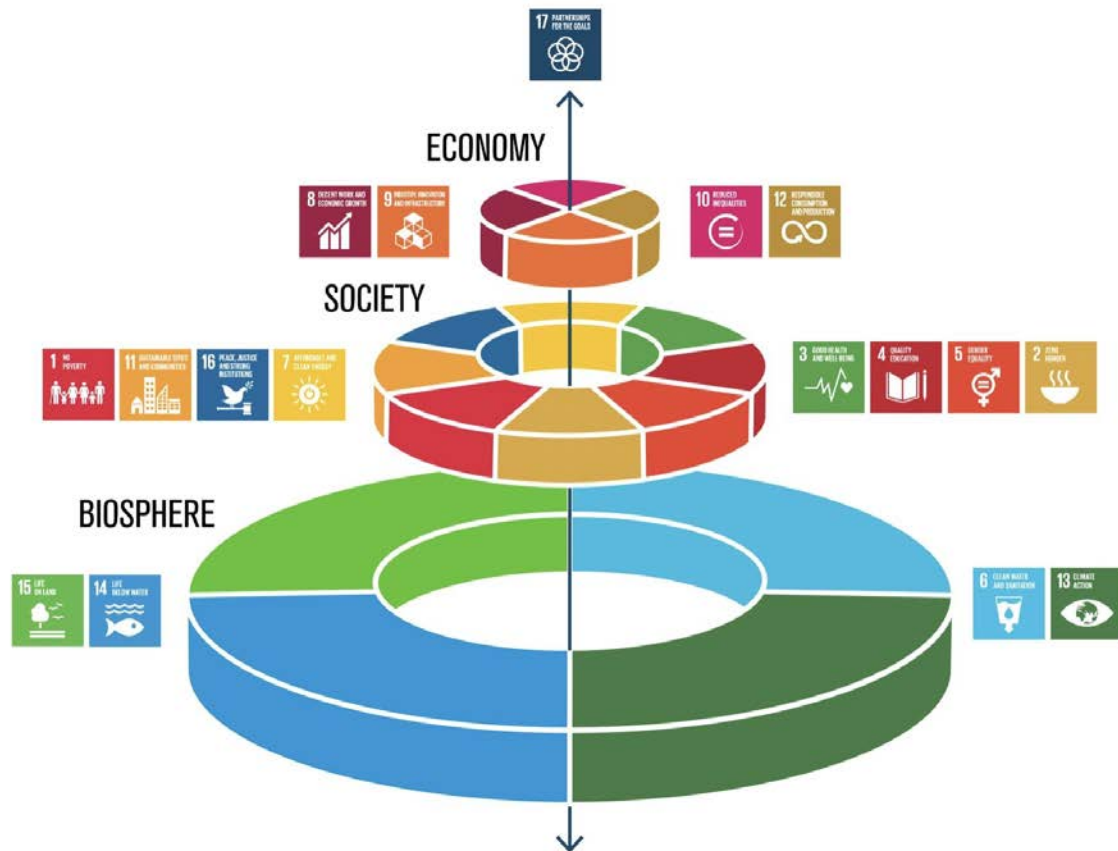
A decolonised climate atlas to inspire action and change

Nathan M Greenfield 07 May 2022

Climate indicators and relevant Sustainable Development Goals

		1 NO POVERTY	2 ZERO HUNGER	3 GOOD HEALTH AND WELL-BEING	6 CLEAN WATER AND SANITATION	7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH	9 INDUSTRIAL INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES	11 SUSTAINABLE CITIES AND COMMUNITIES	13 CLIMATE ACTION	14 LIFE BELOW WATER	15 LIFE ON LAND	16 PEACE, JUSTICE AND STRONG INSTITUTIONS
		SDG 1	SDG 2	SDG 3	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 13	SDG 14	SDG 15	SDG 16
	CO ₂ concentration													
	Ocean acidification													
	Global mean surface temperature													
	Ocean heat content													
	Sea-ice extent													
	Glacier mass balance													
	Sea-level rise													





Graphics by Devika Lakshmi/Ram

The SDGs of life on land (15), life below water (14), clean water and sanitation (6) and climate action (13) are the base of the "wedding cake", illustrating how nature connects and is the basis for all other SDGs (Source: [Rockström and Sukhdev, 2016](#); Science for Environment Policy, 2021).

"We must rise higher to rescue the Sustainable Development Goals – and stay true to our promise of a world of peace, dignity and prosperity on a healthy planet."

— ANTONIO GUTERRES
SECRETARY-GENERAL OF THE UNITED NATIONS

**AMNESTY
INTERNATIONAL**



**she
connects**



**Canadian
Red Cross**

**AUNT
LEAH'S
place**



**F O O D
S T A S H
FOUNDATION**



**VANCOUVER
HOLOCAUST
EDUCATION
CENTRE**



**OCEAN
WISE**





THANKS!

Ian Mauro | Executive Director | Pacific Institute for Climate Solutions | picsdir@uvic.ca