



Regional Assessment Progress, Resources & Tools

Prepared for the Ring of Fire Regional Assessment Working Group (RAWG)

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June 26, 2025

Land Acknowledgement

I live and work in Saskatoon on *Treaty Six Territory* and the *Homeland of the Métis*. I want to pay my sincere respects to the Indigenous ancestors of this area and all Indigenous people across Turtle Island.

I am a descendant of two European settler families that established farms and traplines in the Treaty 6 region.

My work is done in the spirit of reconciliation.



My Background; Contributions to RA and CEA

2005-2009	<i>Principles and methodological framework for regional strategic environmental assessment (PhD dissertation, four reports for CCME & DFO)</i>
2014	<i>Canada-wide definitions for cumulative effect, cumulative effects assessment and cumulative effects management (report - CCME)</i>
2015	<i>Framework for regional strategic environmental assessment for the South Athabasca Oil Sands region (report - Alberta Environment)</i>
2017	<i>International cumulative effects assessment definitions and best practice (FasTip - IAIA)</i>
2020	<i>Regional Assessment in Canada: Scope of Practice (Knowledge Synthesis Grant - SSHRC & IAAC)</i>
2021	<i>Handbook of Cumulative Impact Assessment (edited volume – Edward Elgar Publishing Ltd., UK)</i>
2022	<i>In Our Backyard: Keeyask and the Legacy of Hydroelectric Development (UM Press)</i>
2025	<i>Big Decisions: Mega-Projects and Impact in Indigenous Territory (edited volume – UBC Press, in press)</i>
2025	<i>Cumulative effects assessment, monitoring and management: Global state-of-the-art (journal special issue - Environmental Management)</i>
2025	<i>Analytical methods for regional assessments (Report to IAAC, release date soon)</i>
2025	<i>Evaluative criteria for good practice regional assessment (journal article - forthcoming)</i>



Ring of Fire Regional Assessment

Indigenous partners and the Impact Assessment Agency of Canada are co-leading a regional assessment under the *Impact Assessment Act* 2019.

RAWG Terms of Reference issued in January 2025

- interim report within 12 months
- complete mandate and submit final report within 30 months

- * Cumulative effects are a major focal point of the assessment.
- * Scenario exploration is important.



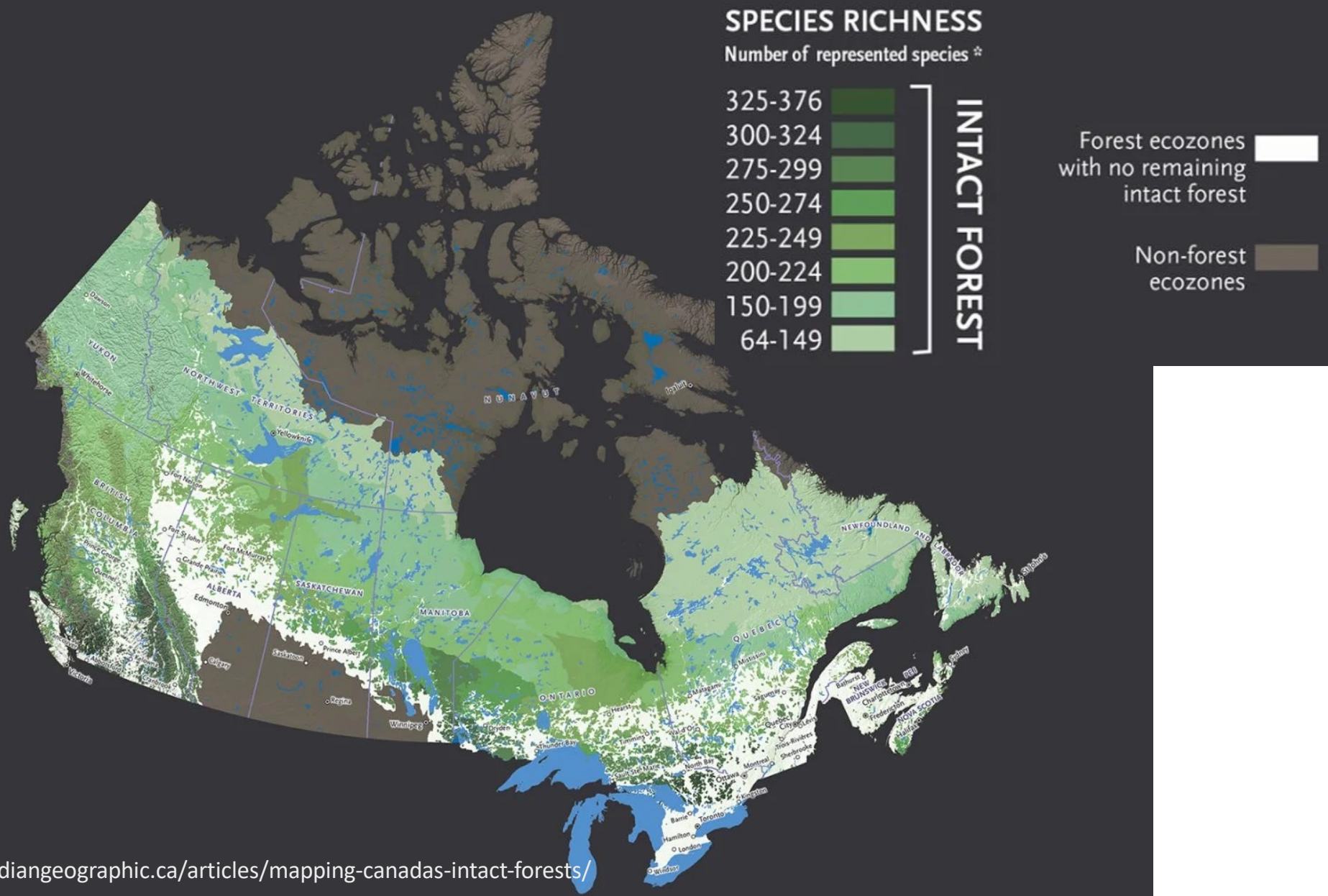
Key Priorities

community well-being
cultural and spiritual well-being
social and economic equity
healthy environment relationships



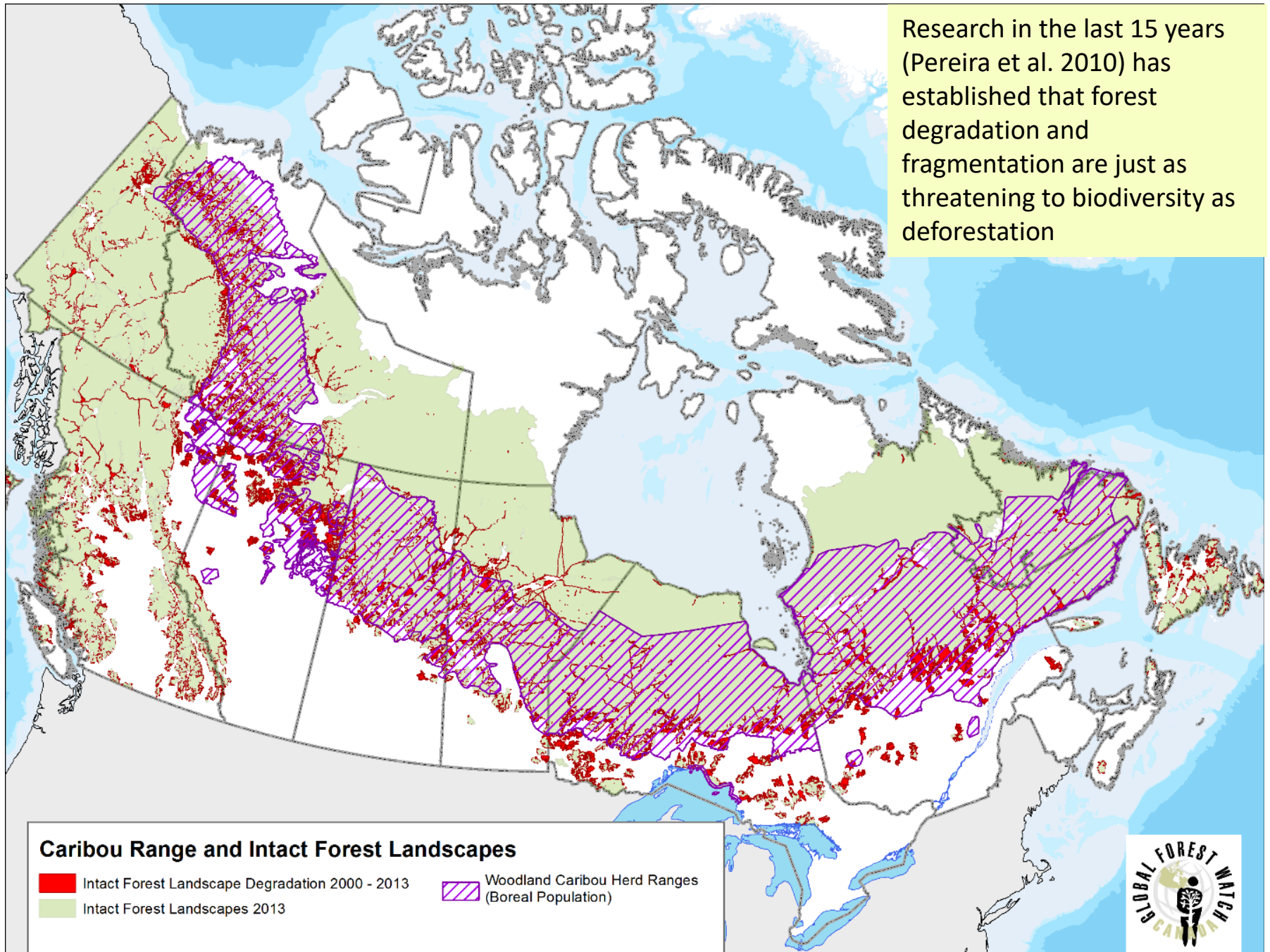
Cumulative Effects - Forest

Canada now ranks 3rd globally with respect to rate of loss of 'intact forest landscape' (intact forest block is 50,000+ hectares), behind only Brazil and Russia (Sims et al. 2022)



Intact Forest Landscape (IFL) degradation and boreal woodland caribou ranges.

Research in the last 15 years (Pereira et al. 2010) has established that forest degradation and fragmentation are just as threatening to biodiversity as deforestation

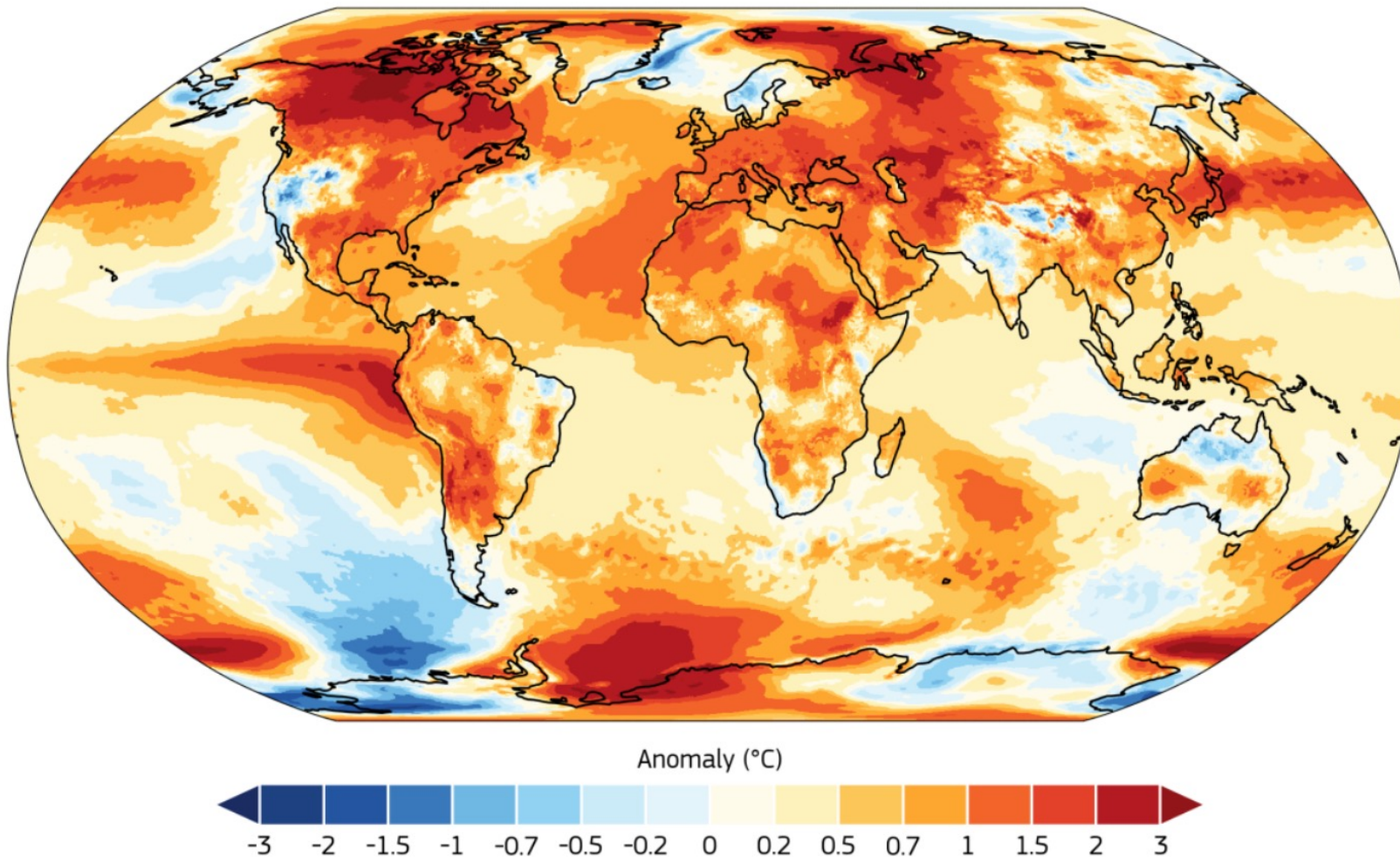


<https://www.globalforestwatch.org/blog/data-and-tools/partner-post-five-percent-of-canadas-pristine-forests-are-fragmented-or-degraded-affecting-up-to-six-endangered-species/>

Cumulative Effects - Climate

Anomalies in surface air temperature in 2023

Data: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF

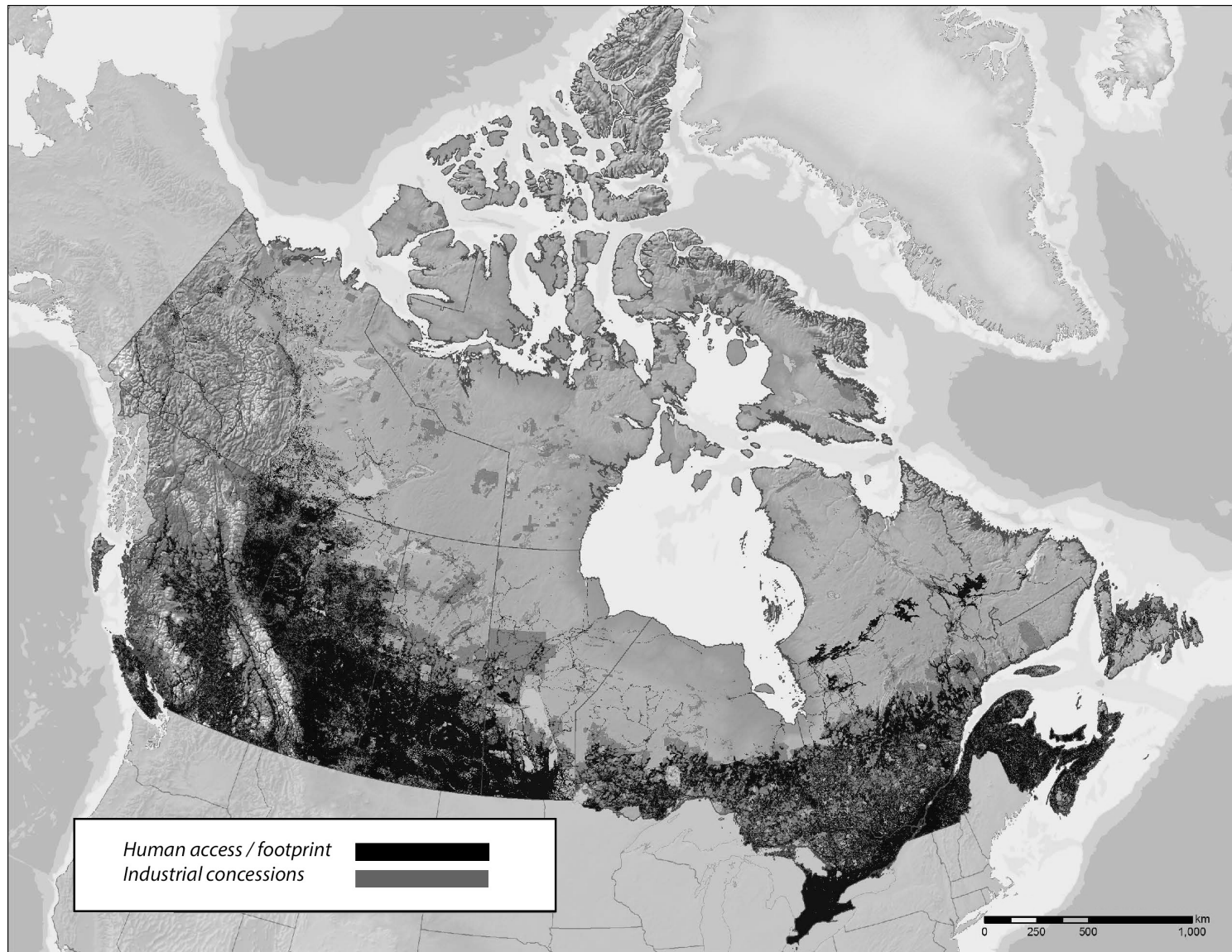


Canada is warming faster than anywhere on earth (McBean 2024)

The Ring of Fire mineral mining region is located within the James Bay Lowlands which is part of the larger Hudson Bay Lowlands. The HBL have experienced, and is projected to continue to experience dramatic rates of climate change in the coming decades, impacting terrestrial and freshwater ecosystems in a non-linear fashion (Morison et al. 2023)

Many of the changes are preceded by and related to **Human Access**.

The 'Human Access' metric estimates the combined land surface disturbance caused by industrial activities (eg. pipelines, roads, mines, clear-cuts, agricultural clearings).



Source: Compiled using Data Basin, Conservation Biology Institute, based on data provided by Global Forest Watch Canada, current to 2017.



Stressors in the Hudson Bay Bioregion

6. CONCERNS

 IDENTIFICATION OF CONCERNS.....

 Agriculture.....

 Forestry

 Mining.....

 Oil and Gas.....

 Pulp and Paper Manufacturing

 Diversions

 Hydroelectric Development

 Transmission Corridors.....

 Air, Shipping, Road, Rail, and Construction Site Activities ..

 Off-Road Transport.....

 Tourism and Recreation.....

 Settlements

 Long Range Transport of Atmospheric Pollutants.....

 Global Warming.....

 UNDERSTANDING THE PRINCIPAL CONCERNS.....

 Reservoir Development

 Wildlife Use, Harvest, and Loss of Habitat.....

 Long Range Transport of Atmospheric Pollutants.....

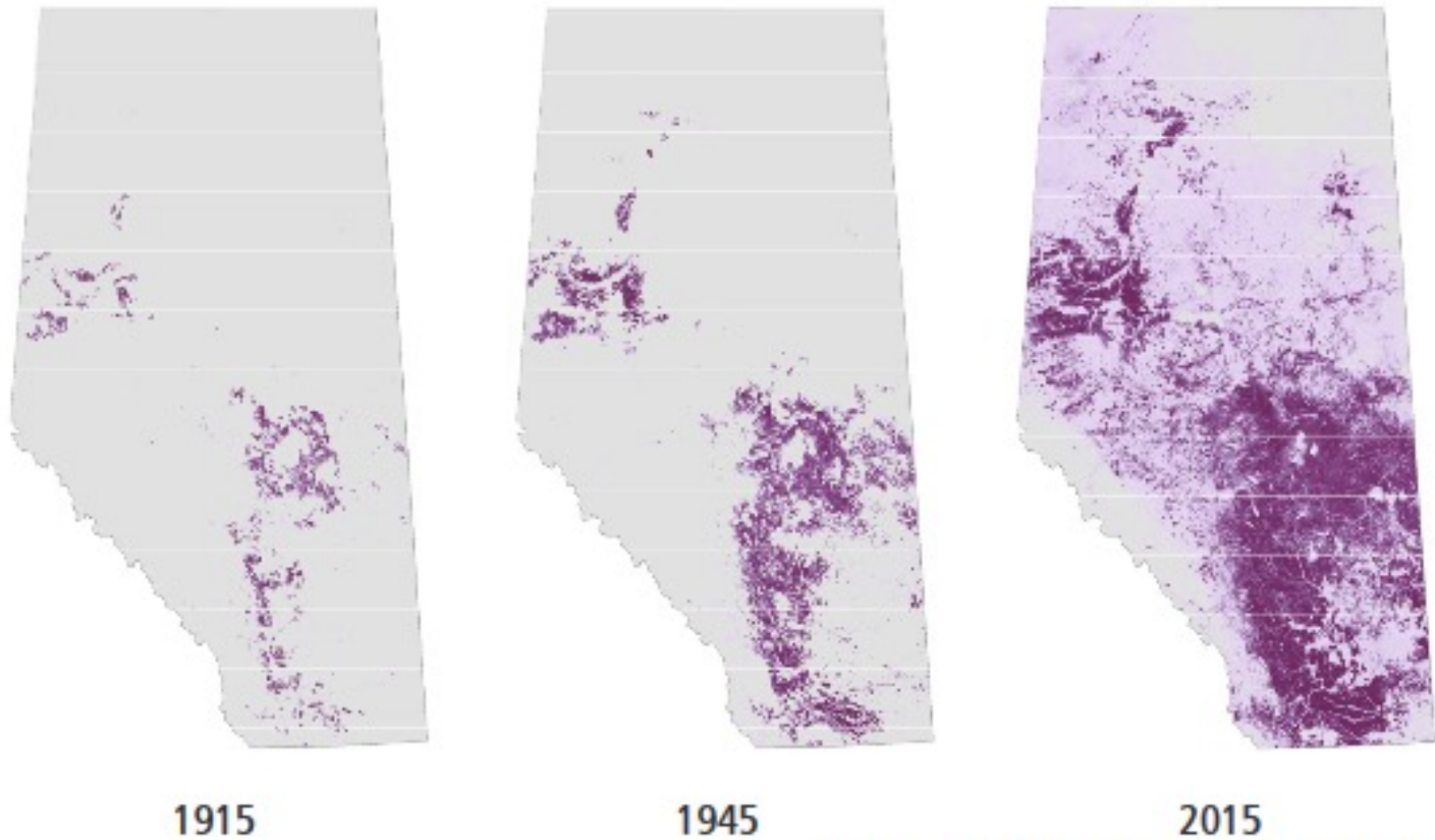
Resulting in:

- Nutrient stress
- Thermal stress
- Radiation stress
- Toxic stress
- Habitat stress
- Exploitation stress
- Etc.



Pace of change can be quick!

Example: Anthropogenic footprint in Alberta, 1915-2015

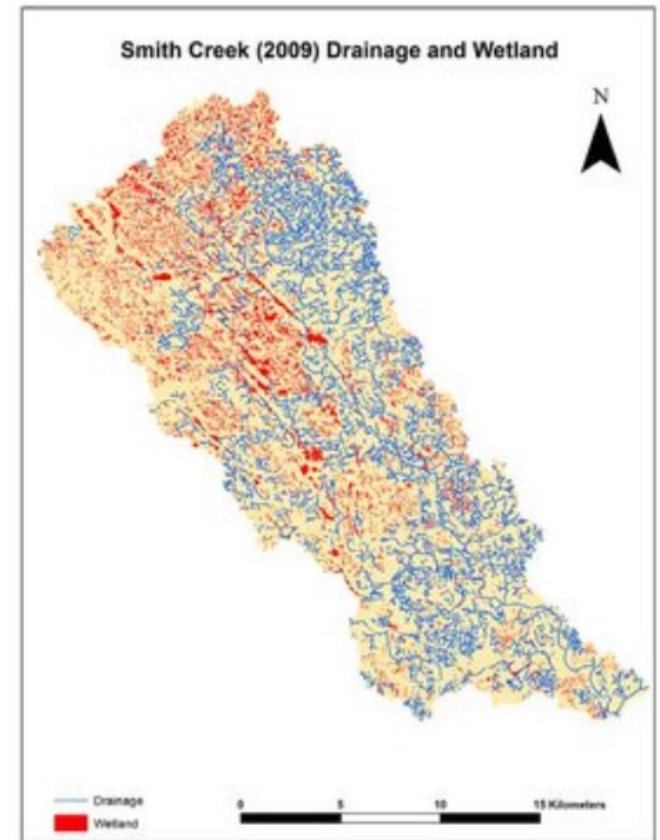
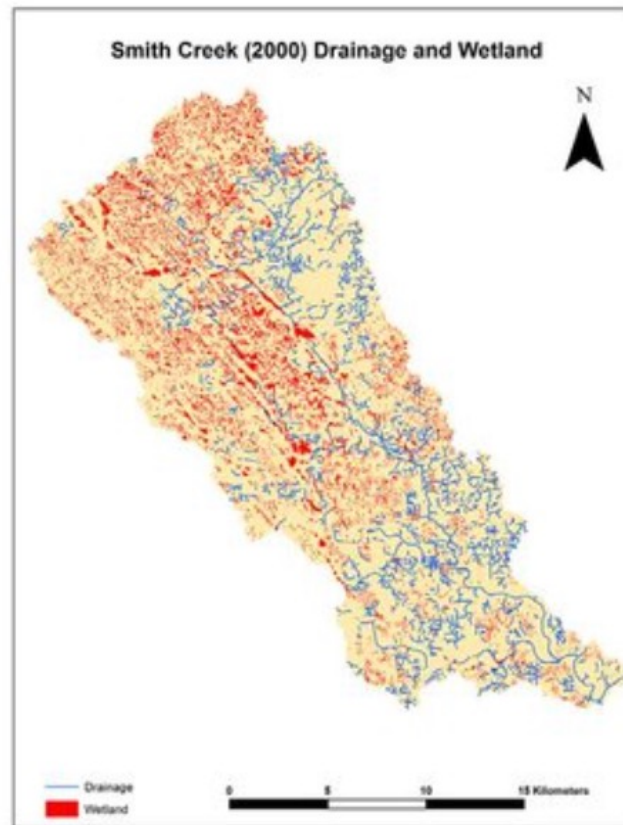
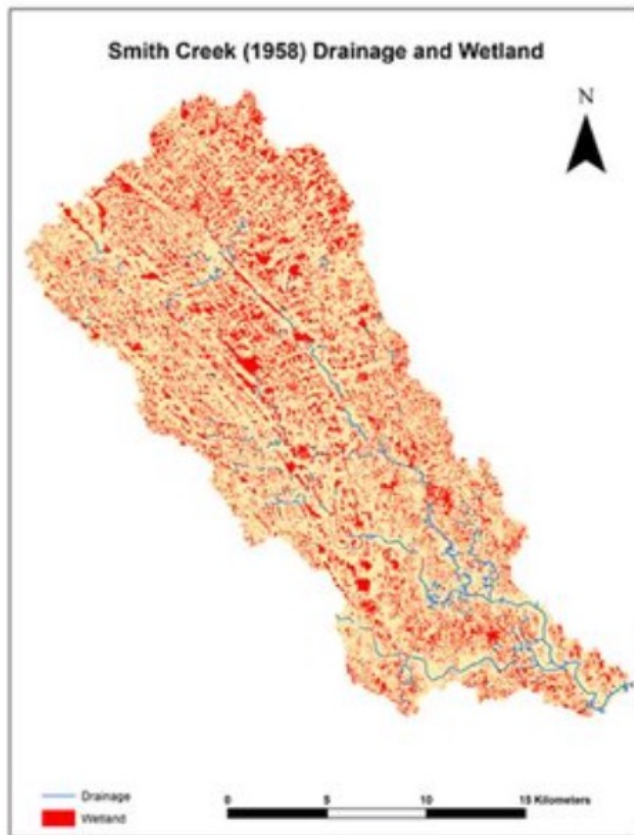


Source: Council of Canadian Academies 2019



And even quicker!

Example: Smith Creek Watershed wetland loss in Saskatchewan, 1958-2009



Source: Pattison-Williams, et al. 2018



'Growth-Induced' Cumulative Effects of Road Building

Many large-scale infrastructure projects, such as major energy projects, mining projects and transportation corridors begin with road building and are followed by a range of future expansion and ancillary developments. This typically leads to long-lasting social and environmental impacts: some positive, some not so positive! **Many impacts cannot or will not be reversed. Roads and other forms of human access 'induce' regional transformation.**



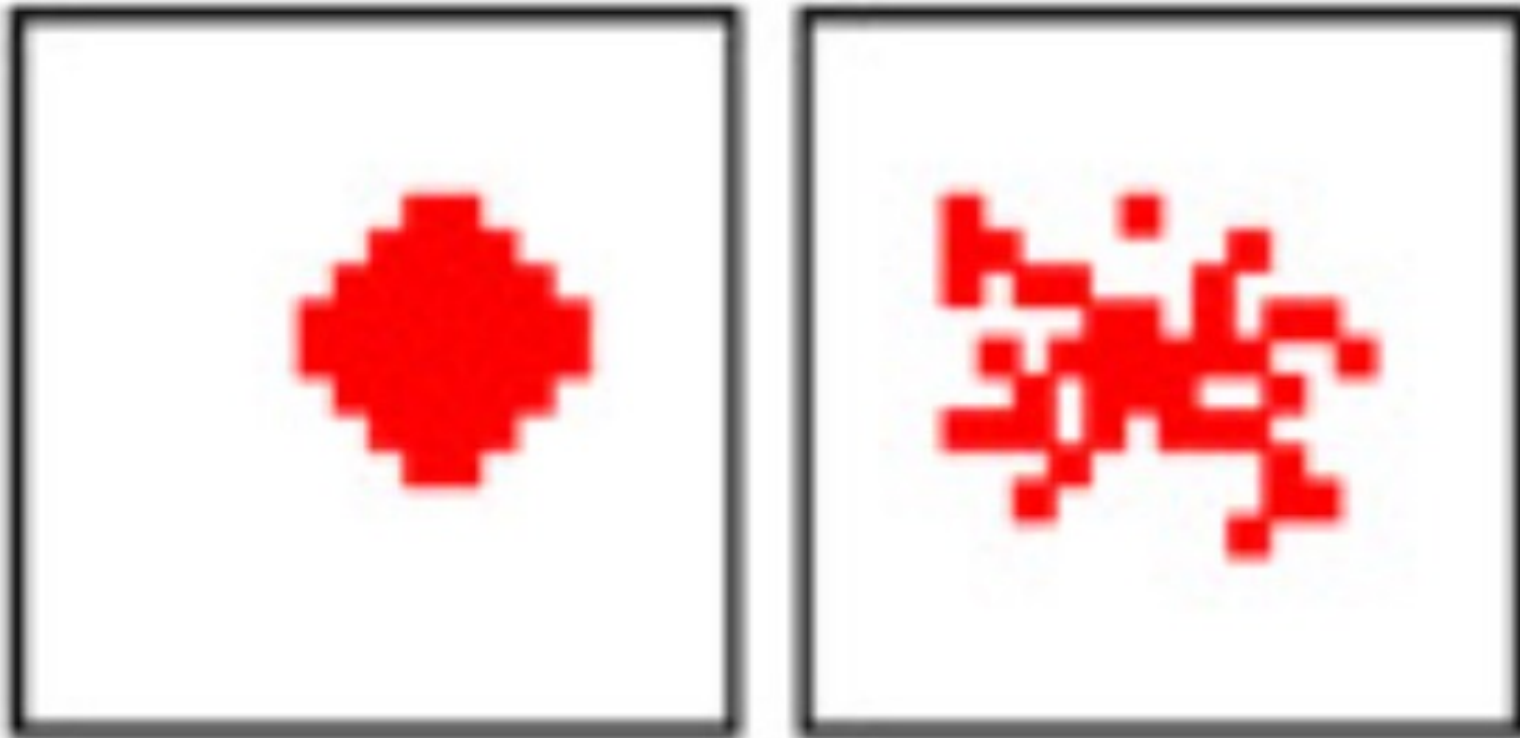
New highway construction near French River, ON.

Photo source: <https://news.ontario.ca/en/bulletin/43522/making-highways-safer-in-northeastern-ontario>



Linear Edge Density is Arguably the Most Important Metric in Predicting Cumulative Effects

The linear edge density (ED) metric quantifies the amount of edge or boundary length within a landscape, relative to the total area of that landscape. It is a measure of landscape fragmentation and configuration, often used in ecology and spatial analysis. The ED increases as the landscape becomes patchier and often human access increases. Source: Wan et al. 2023



Regional Assessment Progress

52 cases in Canada 2000-2020 & many more internationally

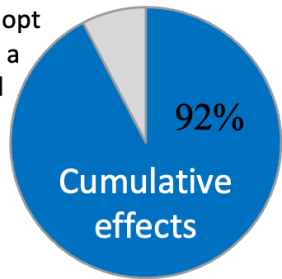
	PROFILE		PROONENT					REGION TYPE			SECTOR					IMPETUS			COMMON METHODS				
	Final Report Released	Cumulative Effects Focused? Strategic/Proactive?	Government Initiative	Indigenous Initiative	Non-government Initiative	Conglomerate	Land-Based/Terrestrial	Water shed/Freshwater	Coastal/Sea/Ocean	Land Use Planning/Multi-sectoral	Forestry Activity	Agriculture/Aquaculture	Transportation (Land & Marine)	Mining	Renewable Energy**	Non-Renewable Energy*	Legislation/Regulation	Government Policy-Related	United Nations Prompted	Scenario Comparison	Heuristic frameworks/Experts	Remote Sensing	Public Engagement
British Columbia																							
Assessing Road Decommissioning in the Adams River Watershed and Kamloops Timber Supply Area	2020	Y Y		X			X X			X							X		X	X	X	X	X
An Assessment of the Cumulative Effects of Land Use and Management in the Adams River Watershed	2019	Y Y		X			X X		X								X		X	X	X		
An Assessment of the Cumulative Effects of Land Use and Management in SSN	2016	N Y		X			X		X								X		X	X	X	X	X
The Baynes Sound Coastal Plan for Shellfish Aquaculture	2002	N N	X					X			X					X				X			X
A Broad Scale CIA Framework for the Cariboo-Chilcotin	2015	N Y	X				X		X							X			X				
Cortes Island Coastal Plan for Shellfish Aquaculture	2003	Y N	X					X			X					X						X	X
Cumulative Effects Assessment for the Merritt Operational Trial	2015	N Y	X				X			X							X		X	X		X	
Current Condition Report for Grizzly Bear in the Northeast Region	2018	N Y	X				X		X								X		X	X		X	X
Eight Peaks Winter Recreation Sustainable Resource Management	n.d.	Y N	X				X		X								X					X	
Elk Valley Cumulative Effects Assessment and Management	2018	Y Y		X	X		X		X								X		X	X	X	X	X
Howe Sound Cumulative Effects Project	2018	N Y	X					X				X					X			X			
The Johnstone-Bute Coastal Plan	2004	Y Y	X					X	X								X					X	
The Kyuquot Sound Coastal Plan	2003	Y Y	X					X	X								X					X	X
Metlakatla Cumulative Effects Management Program	2019	Y Y		X				X	X					X			X		X	X	X	X	X
Robson Valley Enhanced Forest Management Pilot Plan	2003	Y Y	X			X	X			X							X		X	X			X
Salmon Threat Index - Adams Lake Indian Band	2019	Y Y		X			X		X								X		X	X	X	X	X
Trans Mountain Pipeline and Wildlife Habitat - North Thompson Watershed	2019	Y Y		X			X							X			X		X	X			
Alberta																							
Chief Mountain Cumulative Effects Study	2011	Y Y				X	X		X								X		X	X			X
Cumulative Effects Assessment of the North Saskatchewan River Watershed	2009	Y Y			X		X		X								X		X	X	X		X
Lower Athabasca Regional Plan	2012	Y Y	X				X		X								X			X		X	X
South Saskatchewan Regional Plan	2018	Y Y	X				X		X								X		X	X		X	X
Terrestrial Ecosystem Management Framework for the RM of Wood Buffalo	2008	Y Y				X	X		X								X		X	X		X	X
Wood Buffalo Strategic Environmental Assessment	2018	Y Y	X	X			X			X								X	X				X
Saskatchewan																							
The Great Sand Hills Regional Environmental Study	2007	Y Y	X				X		X								X		X	X	X	X	X
Manitoba																							
Manitoba Hydro Regional Cumulative Effects Assessment - Phase II Report	2014	N Y	X				X							X			X		X		X	X	
Ontario																							
Greenbelt Plan	2017	Y Y	X				X		X										X		X	X	
Lake Simcoe Protection Plan	2009	N Y	X				X		X								X			X		X	X
A Place to Grow: Growth Plan for the Greater Golden Horseshoe	2019	Y Y	X				X		X								X		X		X	X	
Quebec																							
Gulf of St. Lawrence SEA - Offshore Oil and Gas Exploration and Development	2009	Y Y	X					X						X			X			X		X	X

Continued...

	PROFILE			PROONENT					REGION TYPE		SECTOR					IMPETUS			COMMON METHODS												
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Nova Scotia																															
Eastern Scotian Shelf and Slope - Middle and Sable Island Bank	2012	Y	Y	X						X							X				X						X				X
Eastern Scotian Slope (Eastern Portion) and Laurentian Fan (Western Portion)	2013	Y	Y	X						X							X				X					X				X	
Eastern Scotian Slope Strategic Environmental Assessment	2012	Y	Y	X						X							X				X					X				X	
Fundy Tidal Energy Strategic Environmental Assessment	2008	Y	Y	X				X		X							X		X		X					X				X	
Middle Scotian Shelf and Slope Strategic Environmental Assessment	2019	Y	Y	X						X							X				X					X				X	
Misaine and Banquereau Banks (draft report)	2013	Y	Y	X						X							X				X					X				X	
Sydney Basin and Orpheus Graben Offshore Cape Breton	2016	Y	Y	X						X							X				X					X				X	
Western Scotian Shelf	2014	Y	Y	X						X							X				X					X				X	
Newfoundland and Labrador																															
Regional Assessment of Offshore Oil and Gas Exploratory Drilling	2020	Y	Y	X				X		X							X		X						X			X	X	X	
Strategic Environmental Assessment of Gros Morne National Park Management Plan	2019	Y	Y	X					X	X		X								X						X	X		X	X	
Strategic Environmental Assessment of Terra Nova National Park Management Plan	2019	Y	Y	X					X	X		X								X						X	X		X	X	
Northwest Territories																															
Cumulative Effects Assessment, Monitoring and Management Framework	2015	Y	Y	X					X		X									X						X			X	X	
Thcho Wenek'e Land Use Plan	2013	Y	Y			X			X		X									X			X		X		X		X	X	
Northwest Territories Cumulative Impact Monitoring Program 2016-2020 Action Plan	2015	N	Y					X	X		X									X										X	
Nunuvut																															
Keewatin Regional Land Use Plan	2000	Y	N	X				X	X		X										X								X	X	
Strategic Environmental Assessment in Baffin Bay and Davis Strait	2019	Y	Y			X		X		X							X		X										X	X	
Yukon Territory																															
Beaufort Regional Environmental Assessment	2020	N	Y	X				X		X							X			X			X		X	X	X	X	X	X	X
North Yukon Regional Land Use Plan	2009	Y	Y	X		X			X		X									X						X			X		
Peel Watershed Regional Land Use Plan	2019	Y	Y	X				X		X										X						X	X		X		
Canadian Arctic																															
IRIS 1 An Integrated Regional Impact Study of Climate Change and Modernization in the Western and Central	2015	N	Y				X		X	X	X										X				X	X	X	X	X	X	X
IRIS 2 An Integrated Regional Impact Study of Climate Change and Modernization in the Eastern Arctic	2018	N	Y				X		X	X	X										X		X		X	X	X	X	X	X	X
IRIS 3 An Integrated Regional Impact Study of Climate Change and Modernization in Hudson's Bay	2019	N	Y				X			X	X										X		X			X	X	X	X	X	X
IRIS 4 An Integrated Regional Impact Study of Climate Change and Modernization in the Eastern Sub-Arctic	2012	N	Y				X		X	X	X										X		X	X	X	X	X	X	X	X	X
International																															
Anatec Navigation Impacts Review, Thames Estuary Dredging Areas (UK)	2009	Y	Y		X					X					X						X		X	X	X	X	X	X	X	X	X
GEO-6 Regional Assessment for North America (United Nations Environment Programme)	2016	Y	Y	X					X	X	X	X										X									X
Great Barrier Reef 2050 Long-Term Sustainability Plan (AUS)	2015	Y	Y	X						X	X											X					X	X			
Great Barrier Reef 2050 Water Quality Improvement Plan (AUS)	2018	Y	Y	X						X	X										X								X	X	
The IPBES Regional Assessment Report on Biodiversity and Ecosystem Services for Africa	2018	Y	Y	X					X		X										X			X	X	X	X	X	X	X	X
Programmatic Environmental Assessment Rural Energy Program in Georgia (USA)	2006	Y	N	X					X								X		X												X
Scientific Inquiry Into Hydraulic Fracturing in the Northern Territory (AUS)	2018	N	Y	X													X		X							X	X	X			X
Strategic Environmental Assessment of the Selous Game Reserve (Tanzania)	2019	N	N	X					X		X											X									X
Third Regional Development Project (World Bank)	2016	Y	Y		X				X		X										X				X	X					X
The Western Greenland Sea Strategic Environmental Assessment (Denmark, Greenland)	2012	Y	Y	X						X							X				X				X						X
An Assessment of the Impacts of Climate Change on the Great Lakes	c.2018	N	Y				X			X		X									X		X	X	X	X	X	X	X	X	X

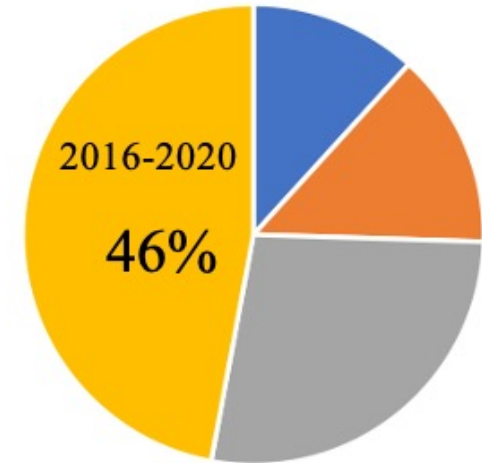
Regional Assessments - Attributes

Almost all RAs adopt CEA as a central focus.



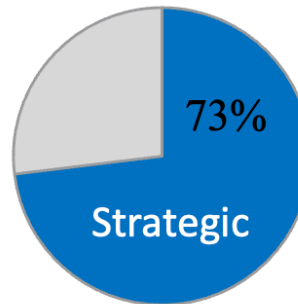
■ Cumulative Effects Focus ■ Does Not Include

Most RAs completed very recently.

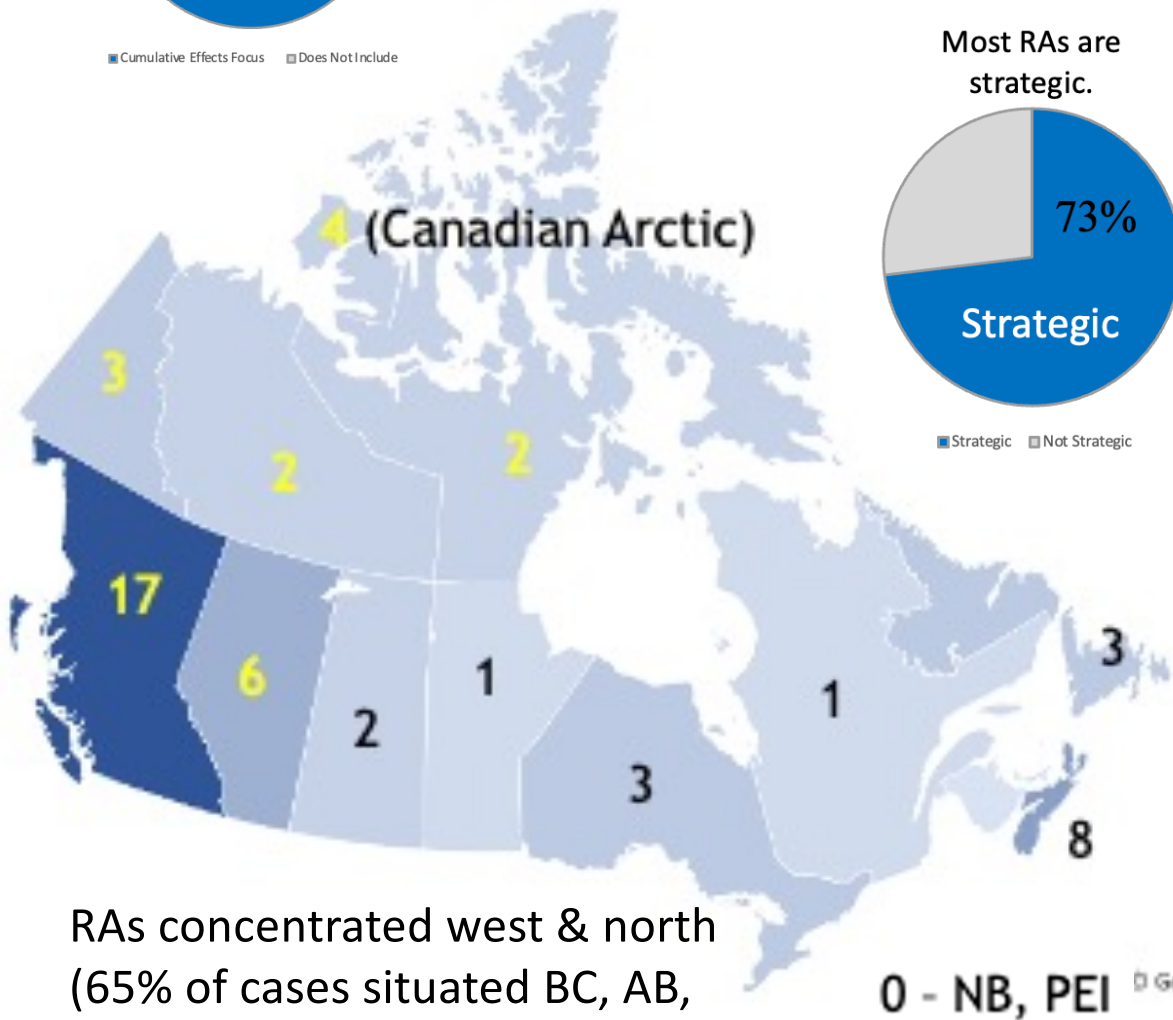


■ 2000-2005 ■ 2006-2010 ■ 2011-2015 ■ 2016-2020

Most RAs are strategic.

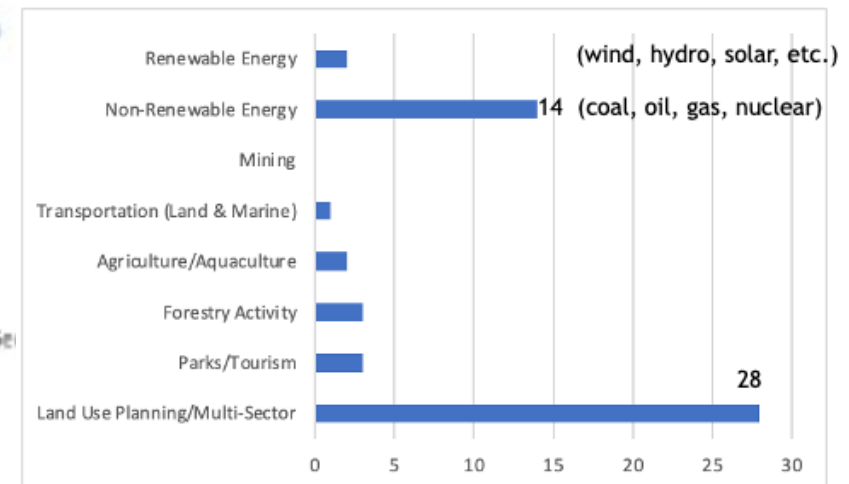


■ Strategic ■ Not Strategic



RAs concentrated west & north (65% of cases situated BC, AB, territories, Arctic)

Most RAs are multi-sectoral



Increased Emphasis on Social & Cultural Priorities

In RAs, bio-physical study priorities are most common but there are good examples of cases that also evaluate...

Socio-economic and cultural 'study priorities' 'valued components'

Land dispossession and tenure
Community economic diversification
Cultural Identity
Economic prosperity
Outdoor recreation
Historic/heritage resources
Regional demographics
Regional and community change
Community infrastructure and services

Wellbeing and health
Archaeological resources
Traditional activities
Community knowledge
Food security
Land access
Education and training
Employment contracting
Quality of life



Tłıchǫ Wenek'e Land Use Plan



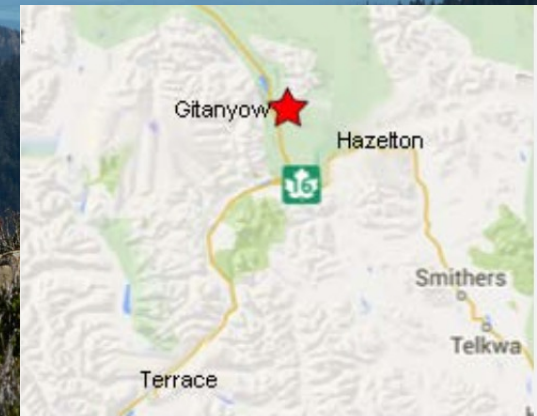
Metlakatla Cumulative Effects Management Program



An Integrated Regional Impact Study (IRIS) of Climate Change and Modernization



Gitanyow Regional Strategic Assessment Process



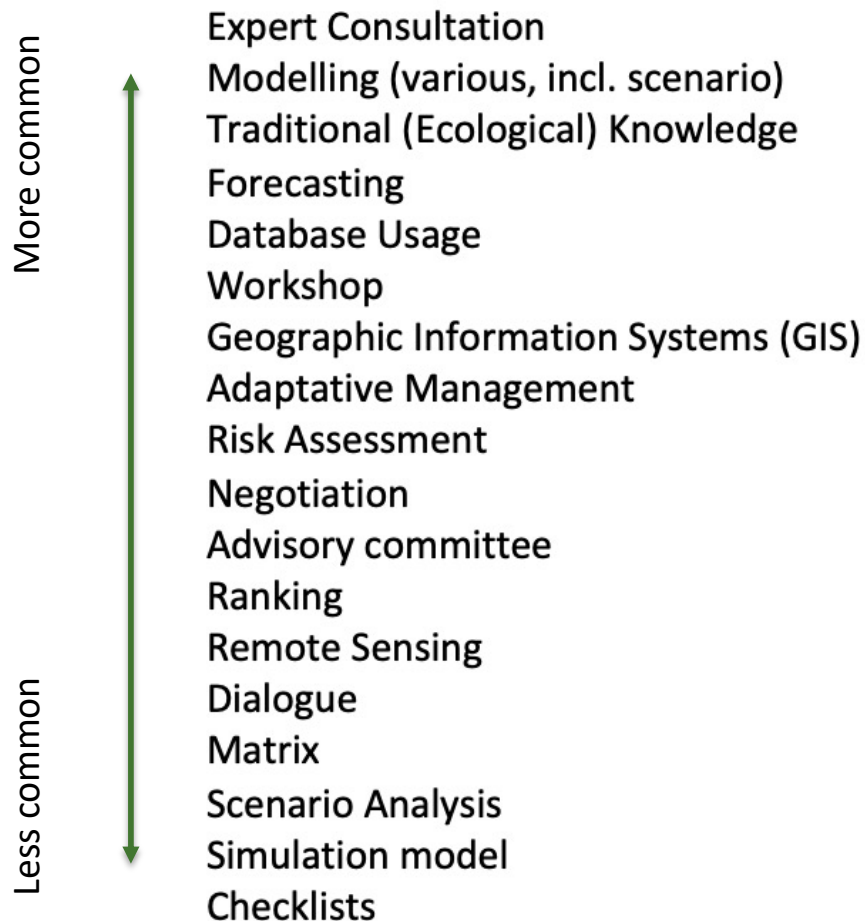
Location: 140 km northeast of Terrace



'Fit-for-Purpose' Methodology

Regional assessment methodology is always 'fit-for-purpose'. Each initiative is unique.

The KSG team identified more than 90 methods used across the cases examined.



New Resource: *'Analytical Methods to Support RAs'*

Impact Assessment Agency of Canada commissioned a report detailing analytical methods to support RAs under the IAA 2019, release date soon.

Reviews available methods for five environmental domains: terrestrial, aquatic, marine, atmospheric, socio-economic.

Example: 4.1 Terrestrial

- 4.1.1 Domain description
- 4.1.2 Case examples
- 4.1.3 Literature review trends
- 4.1.4 Typical valued components and indicators
- 4.1.5 Method options
- 4.1.6 Community of practice

Other Highlights:

Options to define regional boundaries
Inventory of environmental modelling options
Guidance for method selection



AND...

Table 11: Analytical methods for socio economic environments.

Method	Description
Economic modelling	input-output analysis
Distributional modelling	Gini Coefficient
Demographic modelling	population pyramid
Rights-based approaches	assessing effects to population segments based on rights
Cultural mapping ²⁹⁶	recoding connection to landscapes
Case studies	in depth examination of situation
Frameworks ²⁹⁷	pre-defined structure that guides ideas and procedures
Literature review/document analysis ²⁹⁸	critical analysis and synthesis of existing knowledge, usually scholarly sources but also 'grey' literature
Community census ²⁹⁹	survey or data collection process
Storytelling ³⁰⁰	cultural narrative transmission
Interviews ³⁰¹	gathering information from targeted subjects
CalEnviroScreen ³⁰²	
Conceptual frameworks ³⁰³	pathways analysis; rights based approach
Blishen-Lockhart model	socioeconomic impact model for understanding community resilience
Equity assessment framework	structured approach to evaluating potential equity implications of an action, policy or initiative; investigates harms and benefits to different groups
Gender-based analysis ³⁰⁴	assessing effects to population segments based on personal characteristics
Resource community cycle and cumulative social impacts	assessing recurring patterns of economic growth and decline, population shifts, and social impacts that occur in communities heavily reliant on a single resource industry or sector
Community-based ethnography	involves active participation and systematic observation within a community, with a goal to understand social dynamics and cultural practices
Scenario modelling	creation of different plausible future scenarios based on assumptions about potential events and trends, in order to prepare for various outcomes and chart a course to a desired future state



Another New Resource

'Evaluative Criteria for Good Practice Regional Cumulative Effects Assessment'

Blakley, Wilson and Noble, forthcoming

PHASE 1

Scoping

Identify what will be included in the RA and set boundaries

PHASE 2

Historical Trend Analysis

Evaluate changes between the baseline historical state and present accumulated state

PHASE 3

Futures Exploration

E.g. Scenario exploration of the future

PHASE 4

Significance, Mitigation, Management

Measured against historical baseline and not accumulated present state



Scenario Development

Scenario analysis is often key in RA because it allows decision makers to explore potential future conditions and make choices.

How do you develop scenarios appropriate for the Ring of Fire RA? Cannot explore all permutations and combinations of development or non-development. Therefore, we must narrow options.

'Base Case' (control)

If we keep doing what we've been doing. Or in the case of a pristine region, includes build out of reasonably foreseeable projects based on known location and nature of deposits – commitments on capital can be used as a basis for reasonably foreseeable projects. Includes all land uses (roads, energy, transport including air space, forestry, tourism, climate change, aggregate mining, etc.). Assume no innovations, no market change. You need to limit the number of variables, or you won't know what a management strategy does because you have too many moving parts. Base case is measuring stick for alternatives.



NEXT.....Test some other scenarios...

Learning Scenarios

Not expected to happen, used to manipulate the system, perhaps pushing hard in one direction or another to see how VCs respond and at what point they 'disappear' or reach a break point (OR DON'T, as this indicates resilience).

E.g. **'Conservation Emphasis'** - restrict area and rate of growth forecasted in the basecase: i.e, keep critical minerals mining activity to a very low level with objective of preserving conservation values, e.g. 95% intact ecosystems at all times. This will likely slow down the mining so much, the projects become economically unviable. Then adjust downward – how much does the industry need to be able to extract to make it economically viable?

E.g. **'Mega-Mining'** - maximize extraction over the shortest period (e.g. 30 years). Maximize the area and rate of growth forecasted in the base case: no conservation at all, see how system responds. Here perhaps caribou disappear in 10 years. Again, we can pull back to see how much development can be tolerated and still maintain species protection.



All answers come from observing valued component responses. Exploring scenarios creates room for discussion about the real drivers/stressors affecting a VC like caribou. We might learn the key driver of VC decline is not mining, per se, but seems to be the additional access created by exploration access: i.e., seismic lines/access roads/other linear features. Off-road vehicle use and other traffic leads to increased noise, dust, hunting pressure; creates access for predators like wolves; creates creates forage for white tailed deer, which feeds wolves, etc., all of which creates more pressure on caribou....



Alternate Learning Scenario

E.g. **'Access Management'** - What if we control/limit/manipulate access?

We might get more core area or intactness, which leads to better survival for a VC like caribou and at the same time not have to limit mine production.

Addressing **uncertainties** about VC responses is important: **sensitivity analysis** can be used to reduce uncertainty by exploring how VC responses change under different conditions (or don't). Some VCs are sensitive, others are not. Knowing this will help inform mitigation and management strategies and priorities for action.



LEARNING SCENARIOS can lead to better outcomes and management interventions and better understanding among the assessment partners. New ideas come out. **Together all can progress to a final acceptable scenario that reflects “best combinations” of development projects, conservation and social values.** Promotes win/win/win futures.

BUT RA conductors must build in enough time/resources to do this collaborative learning.



THANK-YOU!

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Guest Editor: Special Issue: Cumulative Effects Assessment, Monitoring & Management: State-of-the-Art.

Environmental Management, <https://link.springer.com/collections/dfcdahgecc>

Lead author: "Forum: Cumulative effects assessment state-of-the-art" <https://rdcu.be/eH3O2>

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