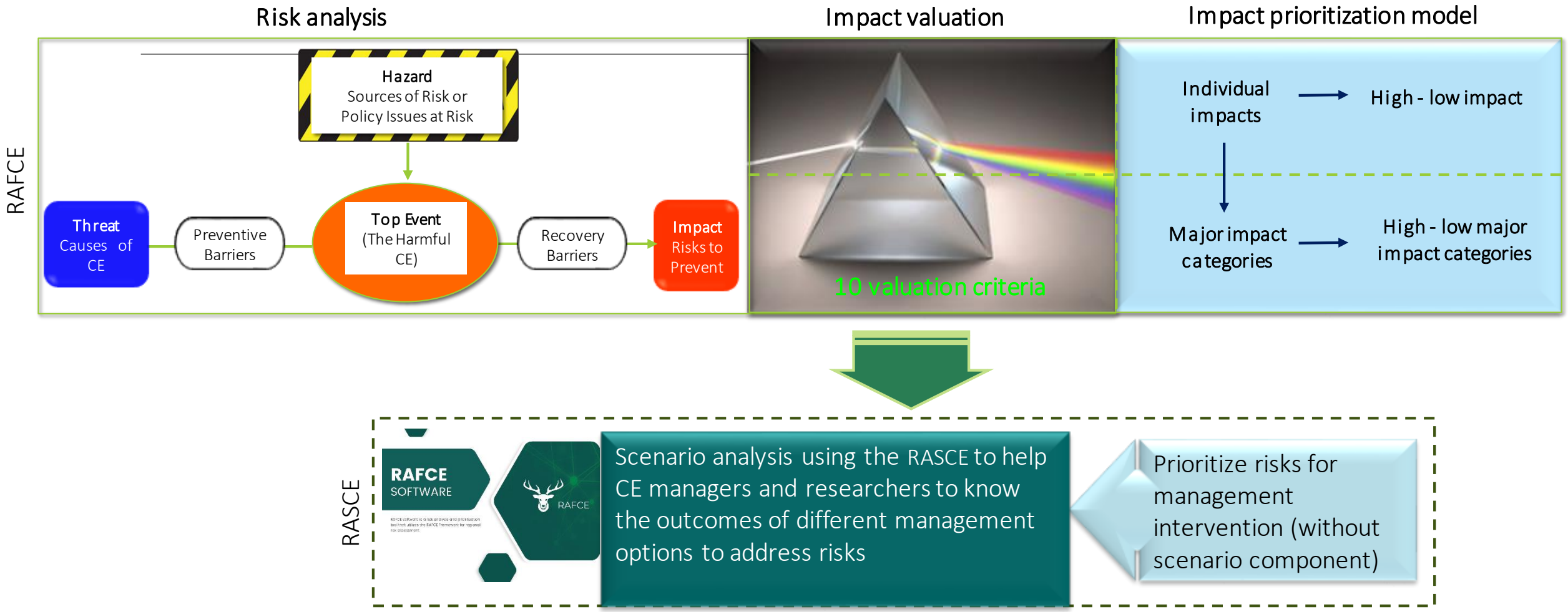
A transformative Framework for Socioeconomic Cumulative Effect Assessment

Effah Kwabena Antwi

Research Scientists, Natural Resources Canada-Canadian Forestry Service Canada

effah.antwi@nrcan-rncan.gc.ca

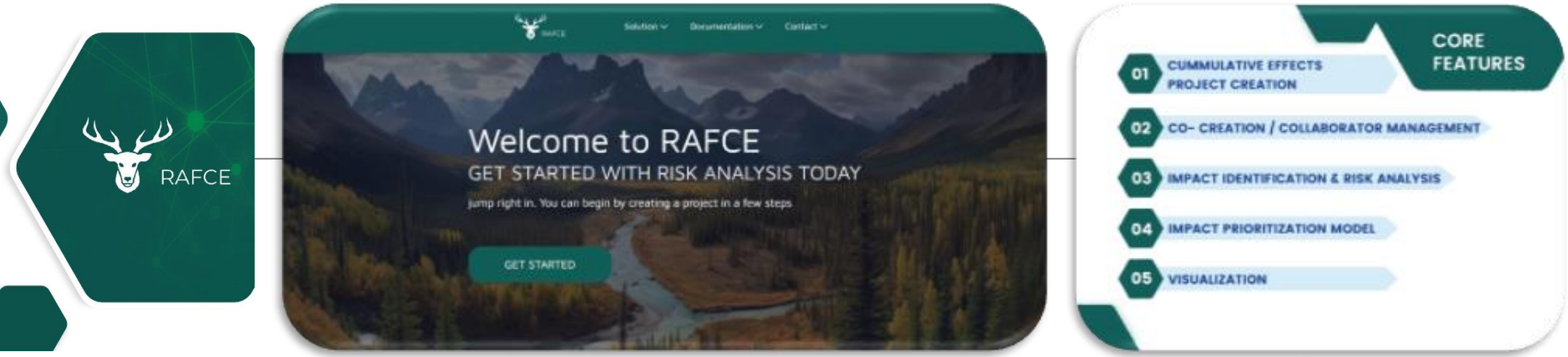
Development of Risk Assessment Framework (RAFCE) and Software (RASCE) for Cumulative Effects Assessment



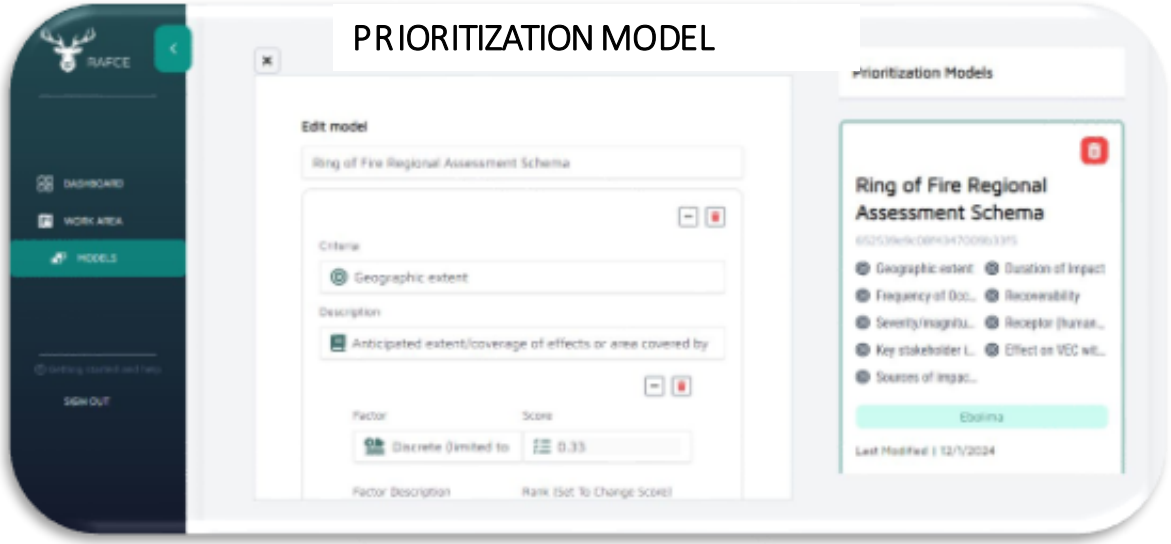
Risk Assessment Software for Cumulative Effects Assessment (RASCE)

RAFCE
SOFTWARE

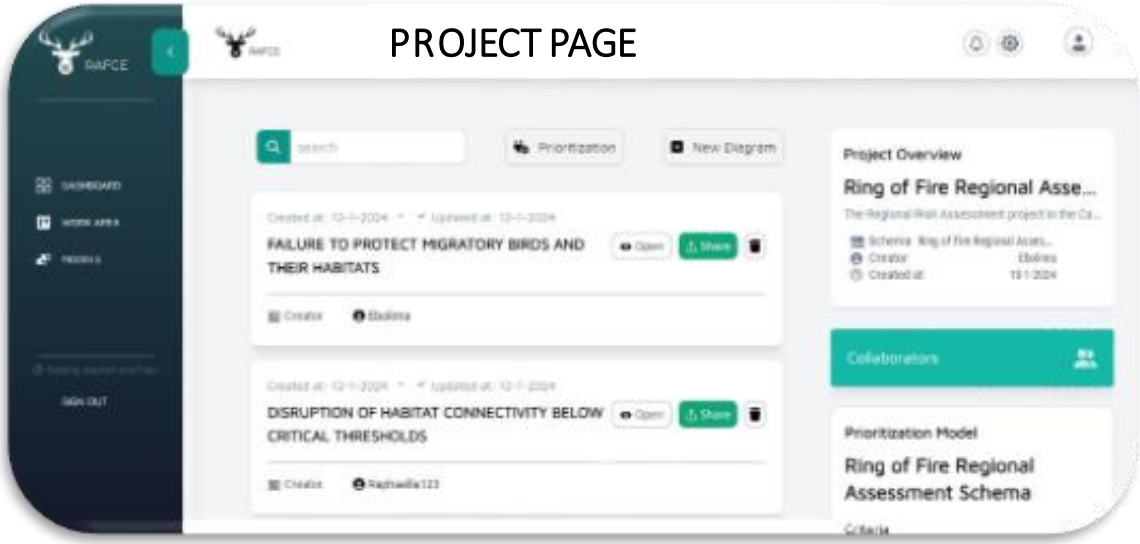
RAFCE software is a risk analysis and prioritization tool that utilizes the RAFCE Framework for regional risk assessment



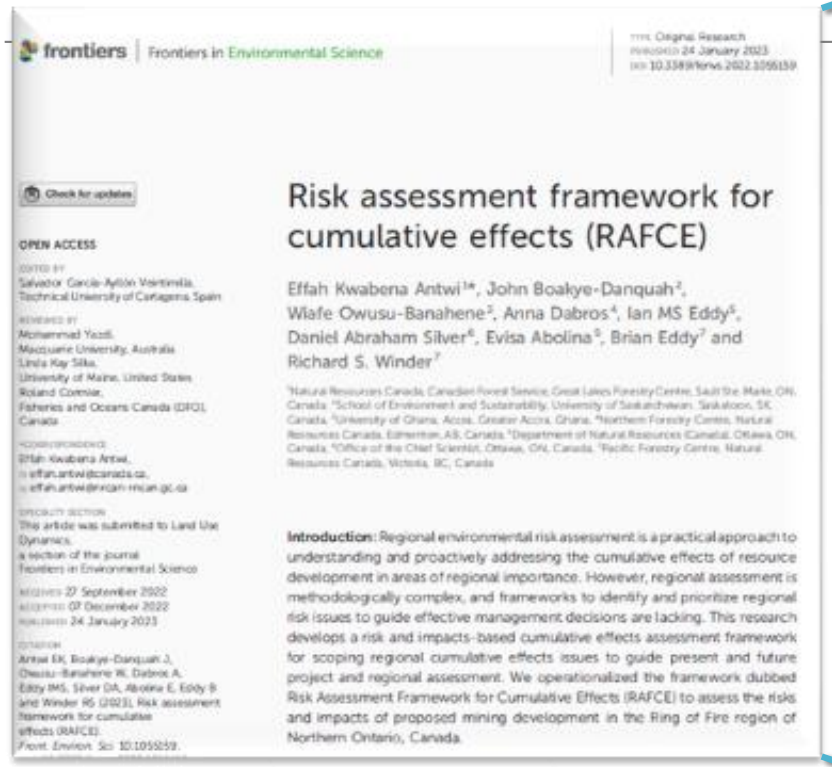
PRIORITIZATION MODEL



PROJECT PAGE



Publication and Submission IAAC Consideration



frontiers | Frontiers in Environmental Science

Original Research
24 January 2023
10.3389/fenvs.2022.1055159

Check for updates

OPEN ACCESS

Risk assessment framework for cumulative effects (RAFCE)

Effah Kwabena Antwi[1]*, John Boakye-Danquah[2], Wiafe Owusu-Banahene[3], Anna Dabros[4], Ian MS Eddy[5], Daniel Abraham Silver[6], Evisa Abolina[5], Brian Eddy[7] and Richard S. Winder[7]

[1]Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, ON, Canada, [2]School of Environment and Sustainability, University of Saskatchewan, Saskatoon, SK, Canada, [3]University of Ghana, Accra, Greater Accra, Ghana, [4]Northern Forestry Centre, Natural Resources Canada, Edmonton, AB, Canada, [5]Department of Natural Resources (Canada), Ottawa, ON, Canada, [6]Office of the Chief Scientist, Ottawa, ON, Canada, [7]Pacific Forestry Centre, Natural Resources Canada, Victoria, BC, Canada

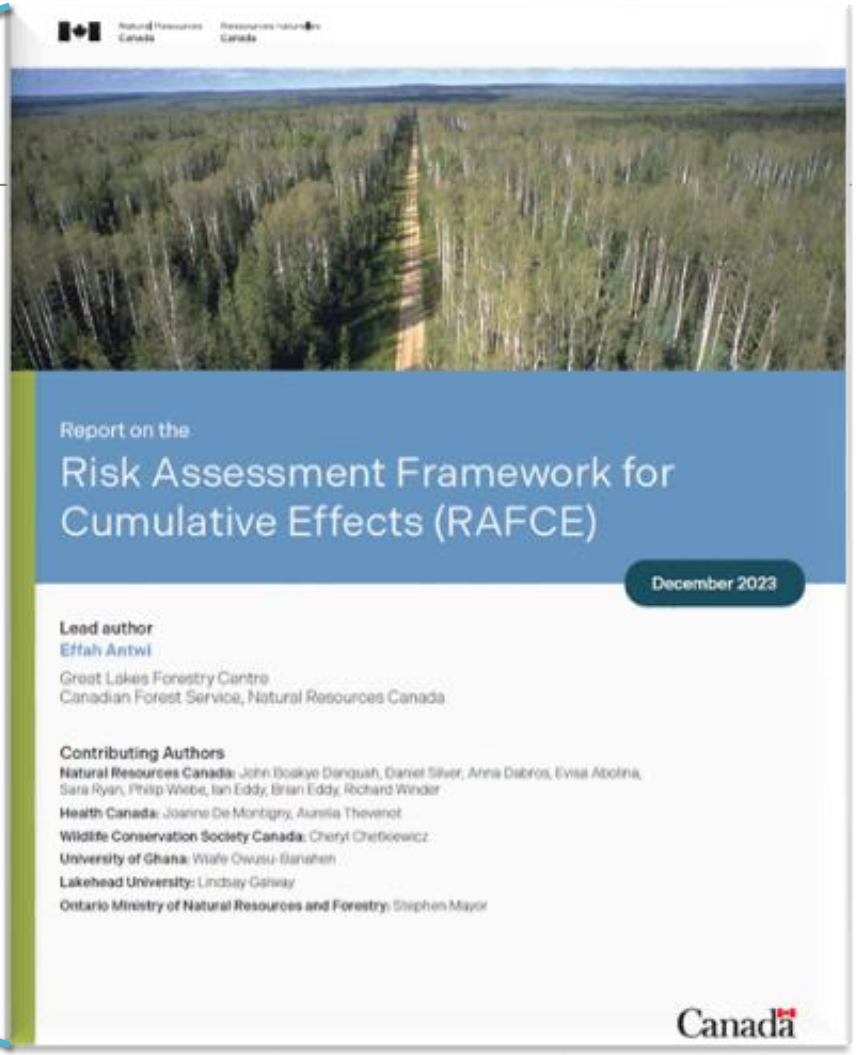
This article was submitted to Land Use Dynamics, a section of the journal Frontiers in Environmental Science

27 September 2022
07 December 2022
24 January 2023

Antwi EK, Boakye-Danquah J, Owusu-Banahene W, Dabros A, Eddy IMS, Silver DA, Abolina E, Eddy B and Winder RS (2023), Risk assessment framework for cumulative effects (RAFCE). Front. Environ. Sci. 10:1055159. doi: 10.3389/fenvs.2022.1055159

Introduction: Regional environmental risk assessment is a practical approach to understanding and proactively addressing the cumulative effects of resource development in areas of regional importance. However, regional assessment is methodologically complex, and frameworks to identify and prioritize regional risk issues to guide effective management decisions are lacking. This research develops a risk and impacts-based cumulative effects assessment framework for scoping regional cumulative effects issues to guide present and future project and regional assessment. We operationalized the framework dubbed Risk Assessment Framework for Cumulative Effects (RAFCE) to assess the risks and impacts of proposed mining development in the Ring of Fire region of Northern Ontario, Canada.

Risk assessment framework for cumulative effects (RAFCE). *Frontiers in Environmental Science* https://doi.org/10.3389/fenvs.2022.1055159



Natural Resources Canada | Ressources naturelles Canada

Report on the

Risk Assessment Framework for Cumulative Effects (RAFCE)

December 2023

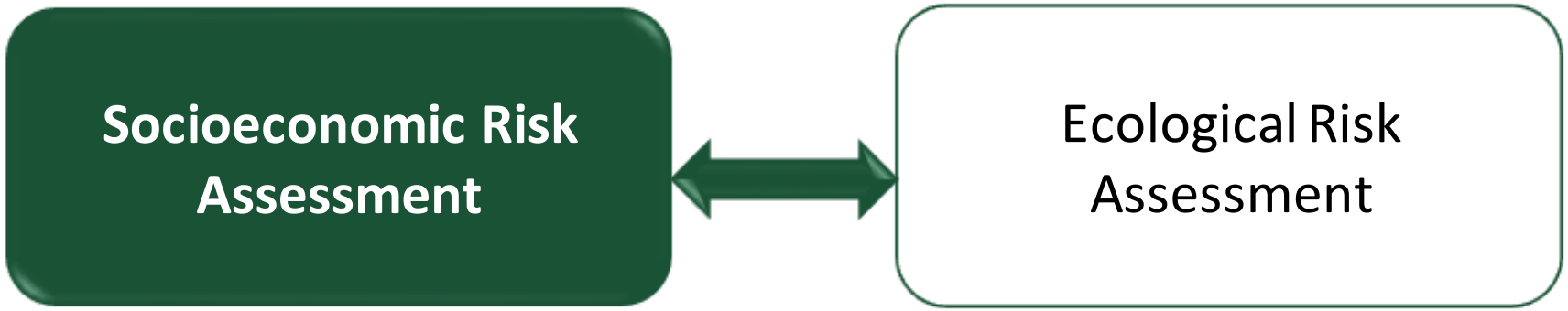
Lead author
Effah Antwi
Great Lakes Forestry Centre
Canadian Forest Service, Natural Resources Canada

Contributing Authors
Natural Resources Canada: John Boakye Danquah, Daniel Silver, Anna Dabros, Evisa Abolina, Sara Ryan, Philip Wiebe, Ian Eddy, Brian Eddy, Richard Winder
Health Canada: Joanne De Montigny, Aurelia Thevenot
Wildlife Conservation Society Canada: Cheryl Chetkiewicz
University of Ghana: Wiafe Owusu-Banahen
Lakehead University: Lindsay Gilway
Ontario Ministry of Natural Resources and Forestry: Stephen Mayor

Canada

Canadian Forest Service Publications | Natural Resources Canada (nrcan.gc.ca) https://cfs.nrcan.gc.ca/publications?id=41206

Cumulative Effects Assessment



Engagements on the Effects of Mining in Garden River FN Community

A collaboration between the Garden River Lands Dept. and Natural Resources Canada

Processes and approaches for developing indicators for socioeconomic CEI – defining a frame of reference

Indigenous peoples tend to have a holistic and interconnected view of the environment and human relations. Drew on two concepts (see below) to select culturally appropriate, sustainable-driven, and regionally relevant socioeconomic domains and indicators for socioeconomic cumulative effects assessment.

Space and place

- Any locality or space made meaningful through human experiences or attachments (Tuan, 1977).
- Places are differentiated by the cultural and subjective meanings through which the place is constructed and understood (Creswell, 2018).
- Places have "intimate, personal and emotional relationships between self and place" (Gregory et al., 2009, p. 676).

Indigenous concept of wellbeing

- The concept of miyupimaatisiiun, translated as "being alive well," is the closest concept to health and wellbeing for Indigenous Peoples (Adelson (2000).
- Miyupimaatisiiun, is "less determined by bodily functions than by the practices of daily living and by the balance of human relationships intrinsic to Cree lifestyles" (Adelson, 2000, p.15).
- To "be alive well" means that one can hunt, pursue traditional activities, eat Cree foods, and keep warm (Adelson (2000).

Processes/approaches for developing indicators for socioeconomic CEI – methodology

Guided by the frame of reference, used the following approach to select indicators

- BRAT workshops with experts to identify risks and impacts of mining on the socioeconomic well-being of Indigenous Peoples
- Targeted review - literature on CEI of mining focused on Indigenous communities
- Data analysis using NVIVO 12 Pro
- Coding and theme identification were performed, focusing on specific domains and indicators relevant to the frame of reference.
- Both inductive and deductive coding approaches were used to build a common themes (Fededay & Muir-Cochrane, 2006).

Emerging Domains and Indicators

Social and community wellbeing

Economic impacts

Human Health

Cultural wellbeing

Governance

An indicative list of culturally appropriate and regionally relevant domains and indicators rooted in the concept of Indigenous wellbeing.

Social and community wellbeing

The social/community well-being domain focuses on **indicators that examine the impacts of mining on the social infrastructure and well-being** of the community.

1. Social /community wellbeing		Type of data & source	Level of analysis	Stage of assessment	Impact – positive / negative
Infrastructure	Investment by government/industry/local business in accommodation, health care centers, child-care centers, etc., as a total or per capita figure.	Quantitative/ Secondary	Community level	Before & during the active mining stage	+/-
Housing	Average rents or purchase prices for a given size house.	Quantitative/ Secondary	Household & community	Before & during the active mining stage	+/-
	Variety of affordable accommodation available for vulnerable groups.	Qualitative/Community survey			
Health	Availability of addiction/suicide prevention programs and assistance to vulnerable people.	Secondary / community survey	Community	Before & during active mining stage	-
	Suicide rate.	Quantitative/ Census	Community	Before & during active mining stage	
Education	Number/per cent of new trainees & apprentices supported by the resource industry.	Industry/Community survey	Household	Active mine stage	+/-
Population growth	Growth of 10–15% suggests the onset of boomtown dynamics.	Quantitative/Secondary	Community	Before & during active mining stage	-
Social services **Safety**	Waiting times for doctors.	Quantitative/ community survey	Household-level & community	Before & during active mining stage	+/-
	Number of child-care places available as a per household.	Quantitative/ community survey	Household-level & community	Before & during active mining stage	+/-
	Crime rate and general perception of safety.	Quantitative/ community survey	Household level & community	Before & during active mining stage	-
	The number of company trucks that travel regional roads	Quantitative/ community survey	Household-level & community	active mining stage	-
	Changes in the frequency, severity and nature of traffic incidents,	Quantitative / community survey	Household level & community	Before & during active mining stage	-
	Extent of road deterioration	Quantitative /community survey	Household level & community	Before & during active mining stage	-

Economic impacts

The economic impacts domain focuses on the **changing economic landscape at the regional and community levels** and the impacts on economic self-sufficiency and sustainability at the community level including opportunities to practice wage economy, benefit from the emerging resource industry, and potential for new local business to emerge as well as other economic factors important to living a dignified life

	Description	Type of data & source	Level of analysis	Stage of assessment	Impact – positive / negative
Employment	The number of residents employed by the resource industry.	Quant/Industry/ community survey	Household level & community	Active mine stage and closure	+/-
	The number of additional mining-related jobs created.	Quantitative/Census	Community	Active mine stage	+/-
	Overall rate of Indigenous workforce participation and unemployment level.	Quant/Census	Community	Before, during and closure of mine	+/-
Direct/indirect economic benefits	Emergence of new locally/Indigenous-owned business.	Quant/Secondary	Community	Active mine and after closure	+
	Income, e.g., individual or household income distribution before and after the mine.	Quant/Census	Household	Active	+/-
	Number of new vehicle registrations	Quant/Secondary	Community	Active	+
Education & training	The percentage of residents and target groups (e.g., women, youth) enrolled and completing training or apprenticeships	Quant/Industry/ community survey	Individual	Active	+/-
Cost of living	Cost of a basket of food for a local household	Quant & Quali/ community survey	Household	Before and Active mine stages	+/-
Regional economic development:	Number of Indigenous companies hired for contract work;	Quant/Company/ Business survey	Community/region	Active	+/-
	Number of Indigenous actors involved in production supply chain	Quant & Company/ Business survey	Community/region	Active	+/-

Human Health

The human health domain focuses on **biomedical indicators of health associated with environmental exposures from mining-related impacts**. The main indicators under the

This domain is different from the cultural domain which includes other health indicators but from an Indigenous conception of health that goes beyond biomedical indicators of health and wellbeing

	Description	Type of data & source	Level of analysis	Stage of assessment	Impact – positive / negative
Noise	Levels and times of noise from traffic and equipment;	Quant/Quali, Community survey	Community	Before and Active mine stages	-
Water quality	Number of households/communities without access to portable water	Quant/Quali, Community survey	Household/ community	Active	-
Occupational heath and safety:	Number of mine related accidents, worker injury rates	Quant/Quali, Industry data	Company level	Before and Active mine stages	-
Air quality	Health hazard from emissions e.g., Human Toxicity Level indicator in life-cycle assessment	Quant, Industry data, external inspectors	Community / region	Before, during and mine closure stages	-
Food quality	Extent of human exposure to contaminated fish/wildlife	Quant/Quali, community observations, formal health records	Community/region	Before, during and mine closure stages	-
	Animal health (fish and wildlife contamination).	Quant/Quali, community observations, formal health records	Community/region	Before, during and mine closure stages	
Health of vulnerable groups	Social and health inequities that are experienced by seniors and aging populations	Qualitative, community data	Community	Before, during and mine closure stages	+/-

Cultural wellbeing

The cultural wellbeing domain focuses on many aspects of day-to-day life of indigenous people and how they are connected to health and wellbeing at the individual, household, and community levels

Cultural sovereignty / maintenance	Description	Type of data & source	Level of analysis	Stage of assessment	Impact – positive / negative
	Number of cultural heritage sites preserved/protected	Quantitative, community data	Community data	Before and mine closure stages	
	Access to traditional/cultural food by households (#/week)	Quant/Quali, community observations	Community/region	Before, during and mine closure stages	-
	Being able to pass knowledge and skillset to younger generation	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Number and attendance at cultural events and practices	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Ability to organise social and cultural activities related to the land	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Ability to perform burial at ceremonial sites	Qualitative, community data	Community/region	Before, during and mine closure stages	-
Closeness to nature	Ability to access spaces/places to connect spiritually with the land	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Ability to find peaceful spaces/places on the land to heal and be free	Qualitative, community data	Community/region	Before, during and mine closure stages	-
Kinship bonds	Number of households who are able to share and receive traditional food	Quantitative, community data	Community/region	Before, during and mine closure stages	-
Livelihoods	Ability to pursue land-based activities - fishing, hunting, trapping, berry-picking, trips to cabin (#/year)	Qualitative, community data	Community/region	Before, during and mine closure stages	-
Protection of traditional rights	Number of agreements achieved on management of land use and indigenous cultural heritage	Quantitative, regional data	Community/region	Before, during and mine closure stages	-
	Level of satisfaction with those agreements	Quantitative, regional data	Community/region	Before, during and mine closure stages	-/+
	Preservation/protection of spaces to access traditional medicinal plants	Qualitative, community data	Community/region	Before, during and mine closure stages	-
Recreation and physical strength	Ability to enjoy land-based recreational activities	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Ability to eat nutritious, healthy and culturally relevant food	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Ability to actively collect bush/traditional food	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Restrictions/improvements on land for camping; travel and traditional routes	Qualitative, community data	Community/region	Before, during and mine closure stages	-
Relationship building	Ability to connect and socialise with other communities	Qualitative, community data	Community/region	Before, during and mine closure stages	-
	Ability to maintain good human-animal relations	Qualitative, community data	Community/region	Before, during and mine closure stages	-

Governance

The governance domain focuses on participation in consultation, provision of information, indigenous capacity, and knowledge to participate and scrutinize project impacts and equity/inclusiveness and transparency in decision-making and governance processes

In broad terms, the governance domain dimension contributes to operationalizing the free, prior, and informed consent (FPIC) being promoted to reshape the suit of governance regimes designed to address the local consequences of extractive industry development in indigenous territory

	Description	Type of data & source	Level of analysis	Stage of assessment	Impact – positive / negative
Community engagement / participation	Numbers of meetings held per year and number of people attending.	Quantitative, regional data	Community/region	Before, during and mine closure stages	-/+
	Representativeness of participants.	Qualitative/ Quantitative, community data	Community/region	Before, during and mine closure stages	-
	Inclusiveness of consultation opportunities provided	Quantitative			
Social acceptance	Relationship between the mining company and communities.	Quantitative, regional data	Community/region	Before, during and mine closure stages	-/+
	Community perceptions of company responsiveness.	Qualitative, community data	Community/region	Before, during and mine closure stages	-/+
Community knowledge and capability	Community capacity to negotiate with external actors.	Qualitative, community data	Community/region	Before, during and mine closure stages	-/+
	Capacity to understand the links between socioeconomic and biophysical attributes	Qualitative, community data	Community/region	Before, during and mine closure stages	-/+
	Availability of community generated resource mapping	Qualitative, community data	Community/region	Before, during and mine closure stages	$-/_{+}$
	Availability of community generated landuse planning	Qualitative/ Quantitative, community data	Community/region	Before, during and mine closure stages	-/+
Information	Public availability of documents that supply information about the community aspirations and impacts on the community.	Qualitative, community data	Community/region	Before, during and mine closure stages	-
Community/regional leadership	Community perceptions that leaders represent their interest in negotiation with resource industry and government.	Qualitative/ Quantitative, community data	Community/region	Before, during and mine closure stages	-/+
	Tension/disagreements related to mine development among leaders within a.	Qualitative/ Quantitative, community data	Community/region	Before, during and mine closure stages	-/+
	Tension/disagreements among different Indigenous communities	Qualitative/ Quantitative, community data	Community/region	Before, during and mine closure stages	-/+

Discussion and next steps

Operationalizing and scaling the RAFCE and RASCE software for CEA in three regions under different problem contexts in Canada and Ghana:

RAFCE workshop within identified Indigenous communities and non-Indigenous to quantify and prioritize the risks identified in the framework.

Canada

- *Alberta Oil Sands Region*
- *The east of Newfoundland and Labrador region*
- *The Abitibi Resource Belt* of *Quebec and Ontario*– is a forest-dominated ecosystem with several ongoing and planned natural resource developments, including NRCan CEA research.

Ghana and Japan

Let’s continue the conversation!

Post questions and comments in the IAIA24 app.

Reach out to me is you want to use our software

Effah Kwabena Antwi

Research Scientists, Natural Resources Canada-Canadian Forestry Service Canada

Effah.Antwi@nrcan-rncan.gc.ca

IAIA24 DUBLINIRELAND

#iaia24