



Natural Resources
Canada

Ressources naturelles
Canada

Natural Resources Canada's Selecting Terrestrial Areas Initiative: Prioritizing study areas to conduct cumulative effects (CE) research to support the potential need for science, technical advice, and knowledge in resource development projects

Brian Eddy, Christina Clarke and Alison Milan
October 25, 2023

Canada 

Navigating the complexities of advancing cumulative effects research at Natural Resources Canada: Challenges and Opportunities

- Background
- Key Issues
- Objectives
- Approach
- Identifying Priority Areas
- Cumulative effects research areas mapping tool
- Next steps
- Discussion questions



Natural Resources
Canada

Ressources naturelles
Canada

The wordmark for Canada, with a small red maple leaf above the letter 'a'. The background of the slide features a stylized, geometric pattern of green and yellow lines over a forest scene.

Canada

What are cumulative effects?



Image source: nrcan.gc.ca

- Cumulative effects (CE) generally refers to the combined effects from past, present, and reasonably foreseeable future activities and natural processes.

Example: historical pollution + new and existing development projects + future climate change

- Effects can be adverse (e.g., decreased water quality in a regional river) **Or** positive (e.g., benefits and jobs for a local community).



NRCan and Cumulative Effects Research

- Natural Resources Canada (NRCan) is a science-based department that conducts research on the cumulative effects of natural resource development
- NRCan's broad scientific research portfolio provides a foundation for more comprehensive knowledge generation
- Expertise includes:
 - Geoscience (e.g., minerals, energy, groundwater)
 - Forestry (e.g., forest resources, silviculture, biodiversity)
 - Geomatics (e.g., remote sensing, open geospatial data platform)
 - Interdisciplinary sciences (e.g., climate change, wildlife habitat, sustainability assessments, socio-economic, natural resource development)



Images source: <https://natural-resources.canada.ca/>



Natural Resources
Canada

Ressources naturelles
Canada

Canada

NRCan and Cumulative Effects Research

- NRCan is funded under the horizontal results framework to conduct CE research
 - primarily aimed to support regional assessments (RA) and other impact assessment processes
- Determination of geographic areas to focus CE research was expected to be guided by RAs conducted by the Impact Assessment Agency of Canada
 - implementation of RAs under the *Impact Assessment Act* has not occurred as anticipated
- Therefore, the NRCan CE research community has been working on an alternative approach



Key Issue: Cumulative Effects and Impact Assessment

- Current approach to impact assessments generally focus on a single project over a narrow time period.
- Proponents are required to examine CE in project-level impact assessments
- But this is problematic because:
 - scope is too narrow,
 - the scale is too small, and
 - nearby projects (past, present, and future) are often not fully considered

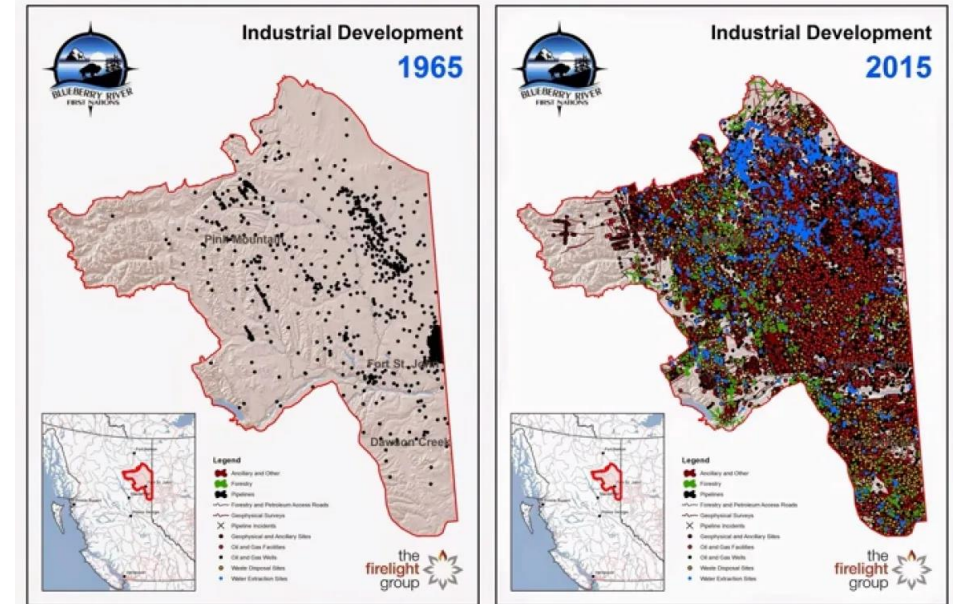


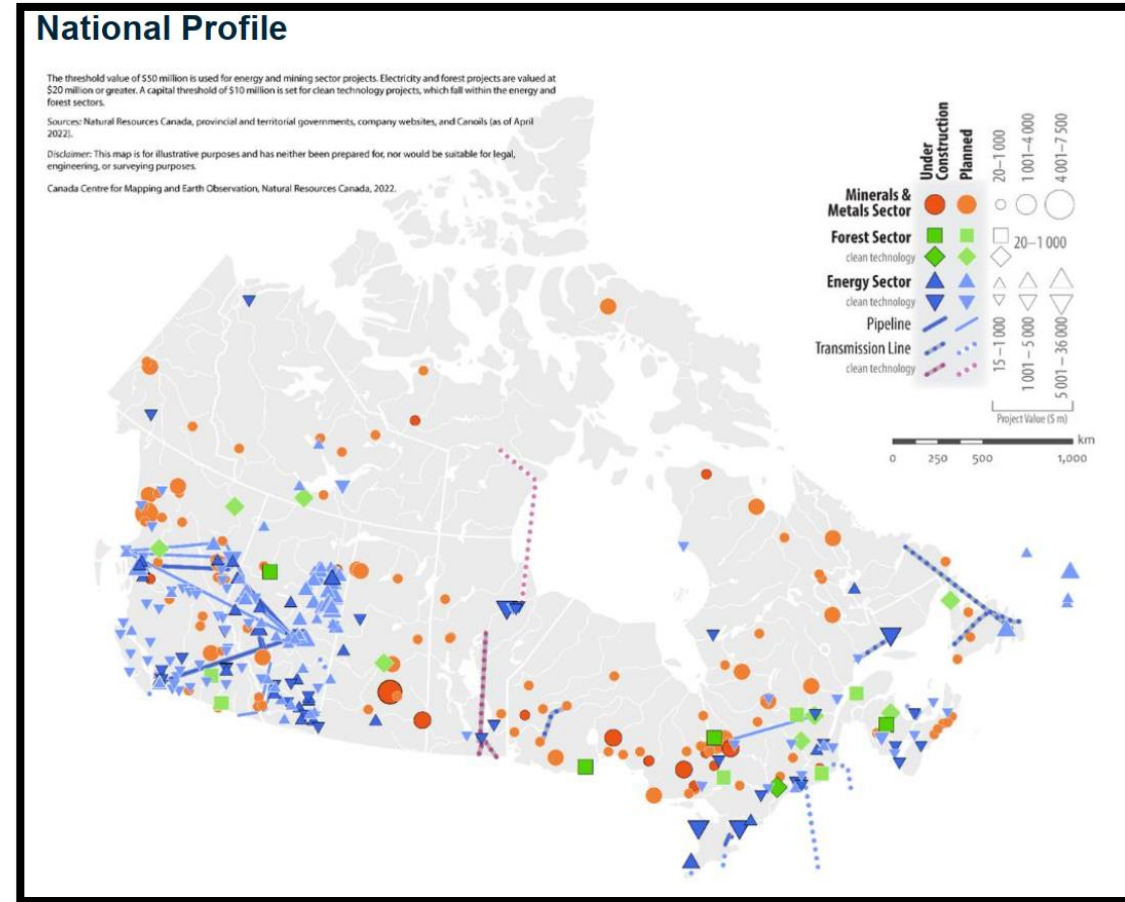
Image source: <https://www.cbc.ca/news/canada/british-columbia/blueberry-river-first-nations-lawsuit-threatens-site-c-fracking-in-b-c-1.2981820>

Note: The image compares the industrial activity between 1965 and 2015 in Blueberry River First Nations' territory.



Key Issue: Cumulative Effects and Future Natural Resource Development

- With the 'Energy Transition' over the coming decade (and beyond), there are anticipated many (> 200) future development of natural resource projects in all areas of Canada:
 - critical minerals, renewable energy and sustainable forestry
 - most future projects will overlap geographically with current, past and other future development areas
- Therefore, there is a growing need to advance research that covers the CE of past, present and future resource projects



Approach to Cumulative Effects Research Study Area Selection

- Initiative started in Summer 2021
- Formed a committee in Fall 2021
- Identified science and policy priorities for CE considering NRCan's mandate and the overarching aim to inform impact assessments and regional assessments
- Initially aimed at developing a list of priority geographic areas to focus NRCan's CE research
- Evolved to consider multi-level support framework for CE research and assessment (...more below)



Committee

- Formation of a committee comprised of OCS staff and researchers from the science sectors:
 - Christina Clarke, Alison Milan, Anica Madzarevic, Sara Ryan, Daniel Silver and Sophie Silwa – Impact Assessment/Office of the Chief Scientist
 - Brian Eddy – Ecosystems Analysis, GIS, Socioeconomics
 - Lisa Vernier – Landscape Ecology, Biodiversity Science
 - Effah Antwi – Risk Assessment, Ecosystem Science
 - Wenjun Chen – Remote Sensing, Biodiversity Science
 - Michael Parsons – Geoscience, Geochemistry
 - Christine Rivard – Geoscience, Hydrogeology



Considerations for Cumulative Effects Research Areas

- ❑ Advance our understanding of baseline conditions, trends, and possible future states of Canada's terrestrial environments in resource development areas
- ❑ Inform impact assessments and regional assessments
- ❑ Assist Indigenous groups better understand impacts of cumulative effects on their communities and territories
- ❑ Advance NRCan science and policy priorities



Identifying Priority Areas

- Promote inter-sectoral, collaborative CE research
- Emulate RA-type setting
- Key science and policy considerations (criteria):
 - Locations of natural resource development
 - Ecosystem sensitivity
 - Indigenous rights
 - Climate change
 - Socioeconomic factors



Image source: <https://www.nrcan.gc.ca/maps-tools-publications/satellite-imagery-air-photos/application-development/land-cover-products/21759>



Image source:
<https://cwfis.cfs.nrcan.gc.ca/datamart/meta/data/nbac?wbdisable=true>

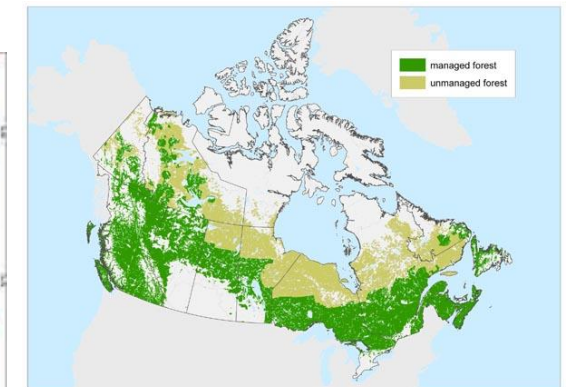


Image source: <https://www.nrcan.gc.ca/climate-change-adapting-impacts-and-reducing-emissions/climate-change-impacts-forests/carbon-accounting/inventory-and-land-use-change/13111>

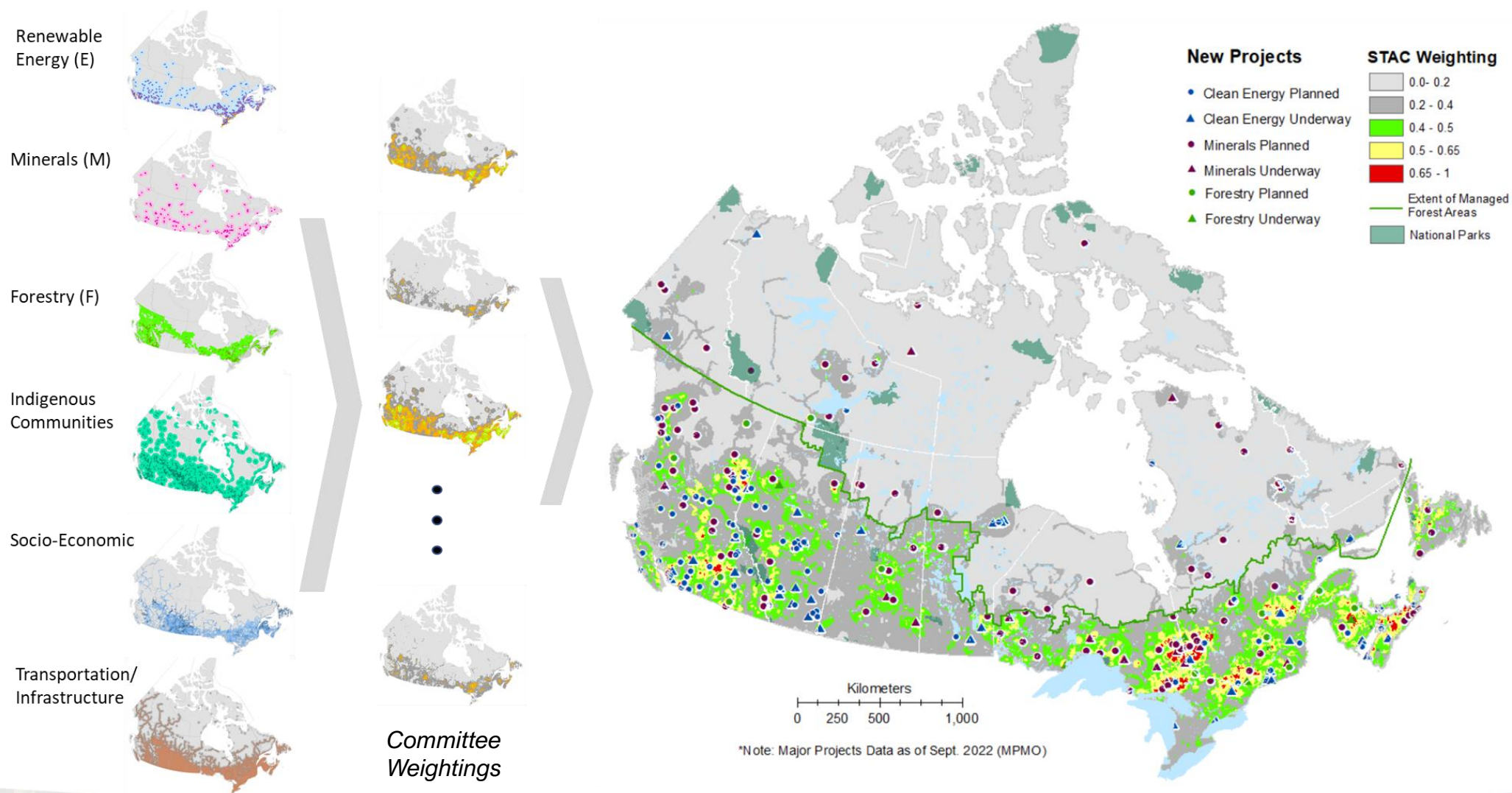


Natural Resources
Canada

Ressources naturelles
Canada

Canada

First iteration: Weighted criteria, GIS overlay

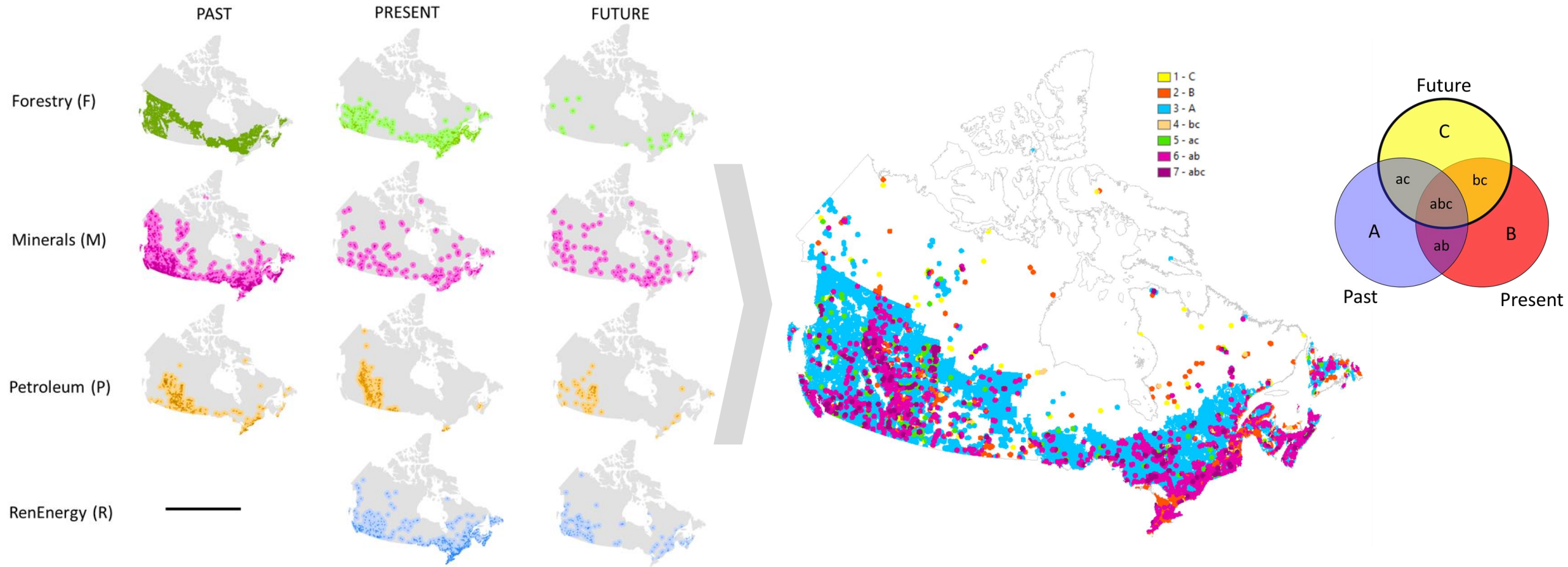


First iteration: Results and Challenges

- Large number of priority areas and limited resources
 - NRCan is a large organization with over 2000 scientific and technical staff spread out across Canada
 - No current 'inter-sectoral' administrative framework
 - Difficult to agree on limited selection of priority areas
- Many scientists remain focused on own areas of expertise
 - Not conducive to broader, inter-disciplinary/inter-sectoral RA type research
- Therefore, committee pursued an alternative approach



Second iteration: CE scenarios (past, present, future)

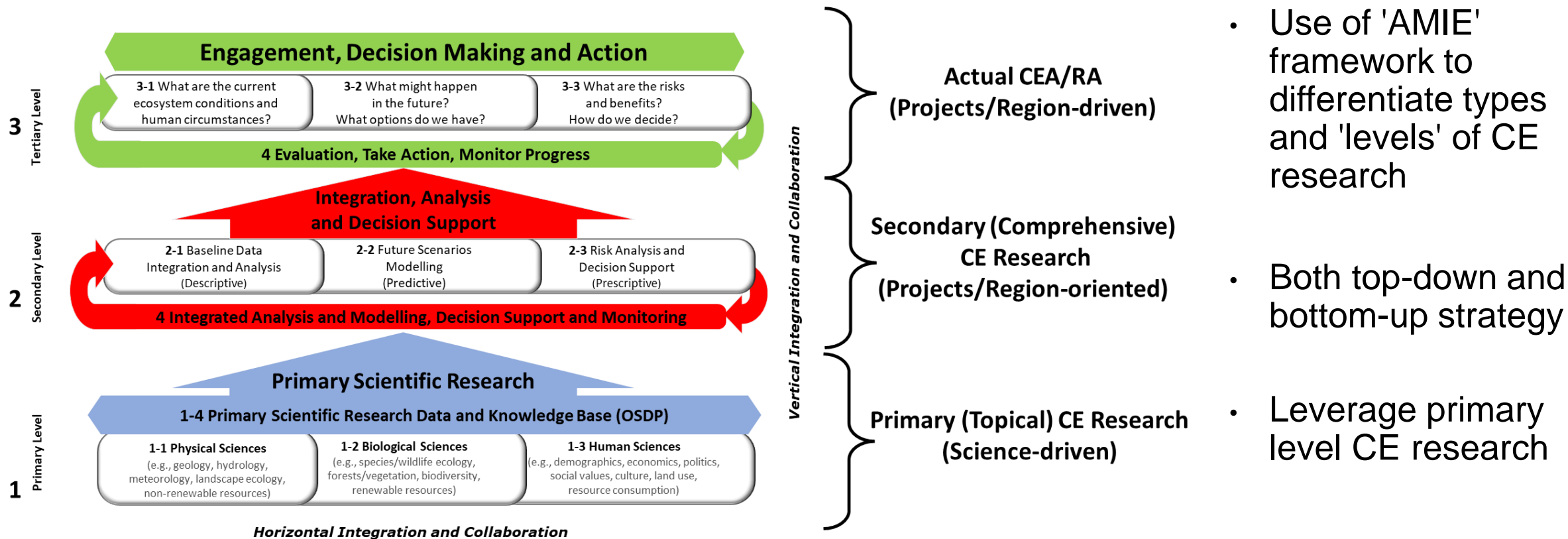


Second iteration: Results and Challenges

- Map was an improvement as it focused on past, present and future based on locations
 - Still difficult to identify priorities areas and researchers have their own nuanced criteria for selecting their study areas
 - The committee felt it was still a useful map to think about where to conduct their research
- Additionally, it became clearer through this mapping exercise that there are different levels of CE research that we need to consider
 - Need to accommodate both top down and bottom-up approaches between foundational CE research and more applied RA-type research, and higher-level policy objectives



Multiple Levels of CE Research/Assessment



Framework based on AMIE (Adaptive Management Information Ecosystem) Eddy, B. G., et al. 2014.

An information ecology approach to science-policy integration in adaptive management of social-ecological systems. *Ecology and Society* 19(3): 40. <http://dx.doi.org/10.5751/ES-06752-190340>



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Objectives of the Cumulative Effects Research Areas Mapping and Decision Tool

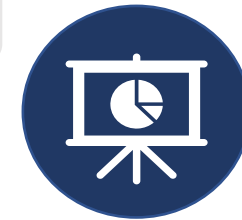
Current Objectives

- Assist CE researchers by providing key considerations and context related to cumulative effects
- Encourage research in areas that favour past, present and future natural resource developments



Expected Outcomes

- Increase in CE Research in locations of highest need
- Ability to visualize, communicate and assess status of CE research and future research needs



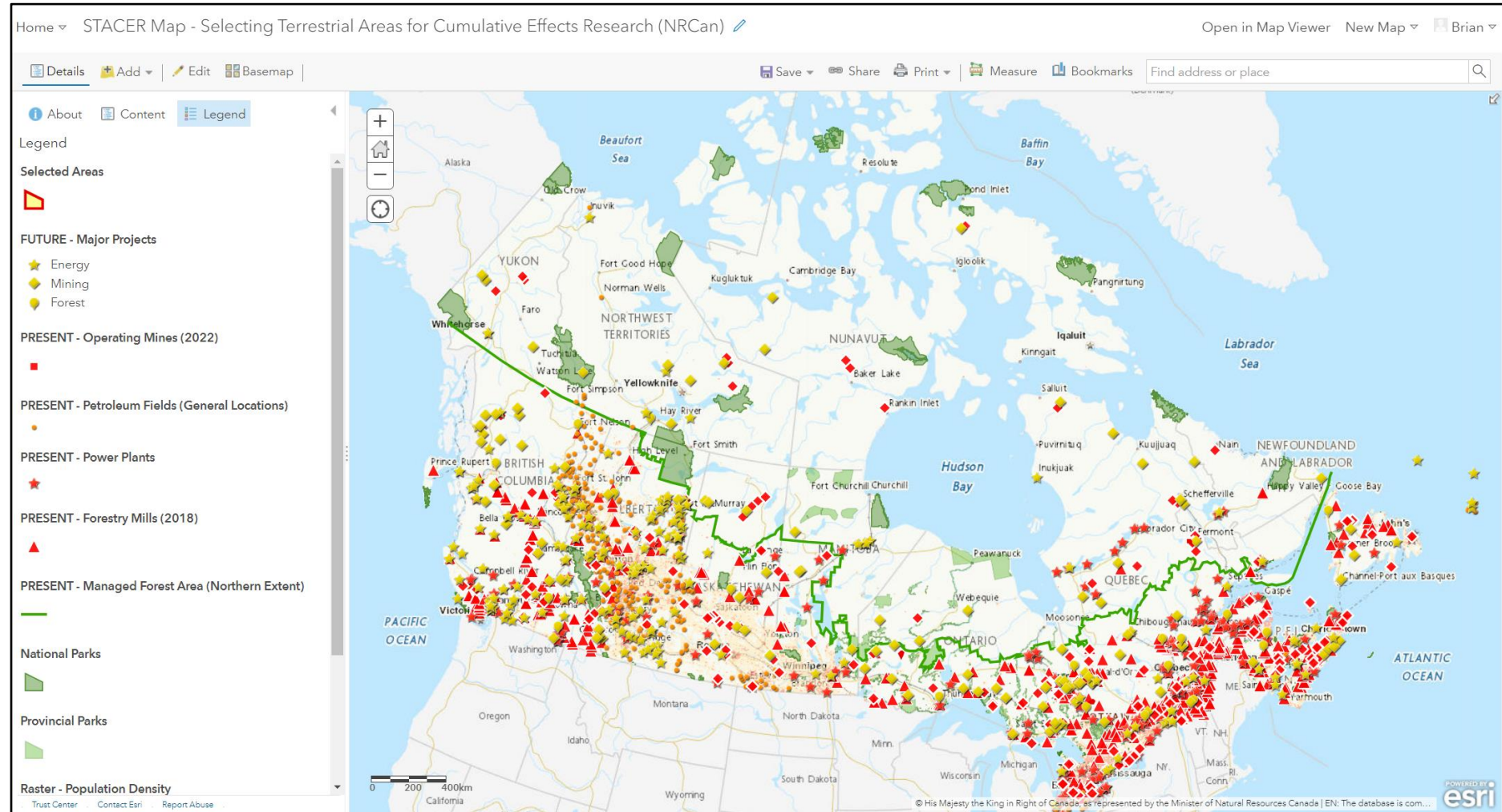
Future Goals

- Encourage inter-sectoral collaboration in NRCan CE scientific research community
- Enable NRCan to better respond to future RA/IA needs (science, technical advice, and knowledge)



Cumulative Effects Research Areas Mapping Tool

- On-line GIS tool with project info (past, present, future)
- Researchers enter project locations
- Link to forms to describe projects according to AMIE criteria

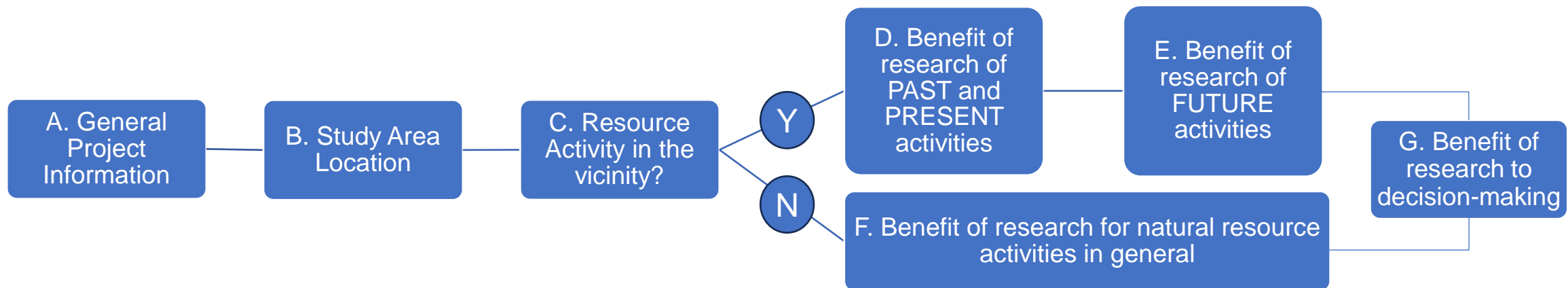


Natural Resources
Canada

Ressources naturelles
Canada

Canada

Cumulative Effects Research Areas Decision Tool



What comes next?

- Publish the map on federal geospatial platform and conduct an internal pilot with the NRCan CE community
 - Promote CE Research in locations of highest need
 - Encourage inter-sectoral multi-disciplinary collaboration
 - Assist in visualizing, communicating and assessing status of CE research and future research needs



Image source: <https://www.nea.org/nea-today/all-news-articles/through-collaborative-practice-schools-take-dual-crises-pandemic-and-racial-inequality>



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Discussion Questions

Seeking to guide CE research to better support IA/RA requirements will require multi-sectoral, collaborative CE research in areas of future natural resource development.

- *What are your thoughts on this approach? What did we potentially miss?*
- *What are other considerations that we should take into account especially if we are thinking of practical applications of research to support impact assessment?*



Canada

© His Majesty the King in Right of Canada, as represented by the Minister of Natural Resources, 2022



Natural Resources
Canada

Ressources naturelles
Canada

Canada