The Measurement Challenge for Environmental Policy:
The Discursive Framing, Development and Usages of "Data for Sustainability"

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SSHRC CRSH

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Background

Accounting for human/environment relationship requires data, indicators, and frameworks that include relationships between:

- Social,
- Economic,
- Health, and
- Ecological systems

While the scope, volume, and availability of data has increased, challenges remain.

Research Questions

How have measurement and data-driven activities, intended to underpin public policy and action driven by the human-environment relationship, emerged?

How is the landscape derived from the policy and political contexts framing sustainability, sustainable development, and anthropogenic ecological change?

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The Concepts

- **Carrying Capacity**: how much can we use the environment without spoiling it?
  - Limits to growth
  - Malthus

- **Sustainability/Sustainable Development**: the ability to meet current needs and aspirations without compromising future needs
  - Brundtland report , UN

The Literature: *Green-Lite*

"reflects the sub-optimal nature of federal stewardship from an environmental perspective and the tendency for other levels of government and the private and not-for-profit sectors to assume greater responsibility for environmental policy in the absence of strong and sustained federal leadership"

"It is also in part a reflection of the gap between federal and environmental discourse and rhetoric on the environment and the influence and impact of federal policies" (Doern, Auld and Stoney 2015, 4)
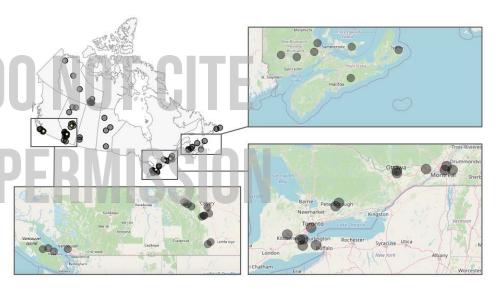
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Scoping Review – Methodology (Arksey & O'Malley 2005)

- 109 English language, academic and grey literature studies.
- Urban and regional bias.
- Gaps in study for rural, remote, and Northern communities.

Carrying Capacity Literature by Subject and Location

	Canadian Studies	Relative Comparator Studies	International Studies
Peer-Reviewed Academic Studies	28 (60.9%)	6 (85.7%)	49 (87.5%)
Non-Academic Studies	18 (39.1%)	1 (14.3%)	7 (12.5%)
Total	46	7	56

Canadian Study Locations

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The literature as a whole…

- Academic literature:
  - Focused on local areas/species.
  - Emphasis upon disciplinary factors rather than Anthropogenic effects.

- Grey literature:
  - Seeks a more integrated approach.
  - Often uses the UN Sustainable Development Goals as a framework.

- Both have a strong ecological bias.
- Intersectoral and integrative work is minimal.

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Results: Numeric Summary

- Majority of the studies (n=33) address the ecological dimension of sustainability, while fewer address:
    - Socio-demographic (n=31)
    - Health (n=23), and
    - Economic (n=16) themes

- Majority of studies (n=20) use ecological themed data, while fewer studies use:
    - Socio-demographic (n=18)
    - Health (n=14)
    - Economic (n=12) themes

Results: Indicator Analysis

- 418 indicators across 6 Canadian studies measuring integrated carrying capacity.
  - Environment,
  - Health,
  - Community,
  - Economy, and
  - Policy.

Results: Indicator Analysis

Canadian Framework Data

Canadian Study	Author/Date	Framework	Sectors	Subsectors	Number of Indicators
Learning From the Census: The Socio-economic Factor Index (SEFI) and Health Outcomes in Manitoba	Chateau et al., 2012	Political ecology	3/5	6/37	11
2019 Our City: A Peg Report on Winnipeg and the Sustainable Development Goals	The Peg, 2019	Political ecology	4/5	16/37	34
Canada 2030: An Agenda for Sustainable Development (Kindornay et al. 2015)	Kindornay et al., 2015	Political ecology	5/5	25/37	137
How Are Canadians Really Doing? The 2016 CIW National Report (UWaterloo 2016)	University of Waterloo, 2016	Political ecology	5/5	25/37	64
Achieving a Sustainable Future: A Federal Sustainable Development Strategy For Canada, 2019 to 2022 (Environment Canada 2019)	Environment Canada, 2019	Political ecology	1/5	9/37	130
2020 State of Our City Report (Sustainable Calgary 2020)	Sustainable Calgary, 2019	Political ecology	5/5	22/37	42

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Results: Indicator Analysis

- o 37 sub-categories, ranging from "democratic processes" to "harmful chemicals present in land, air, sea, and animals".

Number Sub-sectors and Indicators per Sector

Sector	Number of Sub- sectors	Number of indicators
Environment	11	176
Health	7	28
Community	8	106
Economy	7	94
Policy	4	14
Total	37	418

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Results: Indicator Analysis

Number of indicators by Sector and Location

	Local	Regional	National	Other	Total
Environmental	18	19	93	45	175
Health	3	4	14	6	27
Community	18	2	81	4	105
Economy	20	0	60	0	80
Policy	0	1	9	3	13
Total	59	26	257	58	400

Asset vs liability indicators by sector

	Asset	Liability	Neither
Environmental	45	116	15
Health	9	9	10
Community	70	16	20
Economy	54	26	14
Policy	13	1	0
Total	191	168	59

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Results: Indicator Analysis

Number of Single and Aggregated Indicators

	Frequency	Proportion
Single	343	82.1%
Aggregate	75	17.9%
Missing	0	0.00%
Total	418	100.0%

Number of Indicators by Sector and Temporal Measurement

Primary Sector	Hourly	Daily	Monthly	Annually	Every 5 years	Other	Total
Environment	14	3	4	153	1	0	175
Health	0	0	0	20	4	0	24
Community	0	1	0	99	2	3	105
Economy	0	0	0	80	0	0	80
Policy	0	0	0	9	1	1	11
Total	14	4	4	361	8	4	395

- Were data cross-sectional, longitudinal, or time series?
- Majority of indicators collected in yearly increments.
  - Dates for collection range from 1948-2020. Most data was collected in the last 25 years.

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Results: Overview

- Several indicators were found multiple times throughout the 418:
    - 27 indicators were labelled "self-reported" or "self-assessed" - usually survey responses in health sector
    - Indicators assessing aid (ie. ODA) occurred 8 times
    - Indicators measuring income (demographic-based low-income measures) occurred 4 times
    - Emissions data were all present in 4 data sets
    - Measurement of body-mass index (BMI) occurred 3 times

- Most studies remain ecological
- Minimal overlap in terms of indicators
- Clear emphasis on single measures
- Minimal level of intersectoral and integrative work
- Majority of data is drawn at the national level and measured annually

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Audit: Sustainable Development Goals

SDG Audit – 245 indicators, with 485 measures.

o   In Canada, about 53% of indicators have reported data.

o   In several instances data was shown as being reported, but no number was available.

o   Most indicators were reported in just one year, providing only snapshot data

Almost half of all indicators are not being reported to the UN by Canada.

Reporting?	Count	Percentage
Yes (1)	260	53.3%
No (0)	228	46.7%

These data issues contribute to an incomplete picture of Canada's progress toward the SDGs.

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Conclusions

- Academics and organizations are measuring what they want, how they want

- No model or consensus about how these ideas fit together

- The terms carrying capacity & sustainability are used inconsistently

- Ecological Bias

- There are few examples of systems-based approaches to data, indicators, and frameworks

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Implications: Why does it matter?

- It is incredibly difficult if not impossible to compare indicators and data across jurisdictions

- Inconsistent use of terminology results in a wide-ranging literature that is not interconnected

- The ecological bias means that we know far less about the socio-demographic, health and economic impacts

- Little is known about best practices regarding the measurement of the relationship between the environment and society

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Discussion

- These findings are consistent with the green-lite green-washing theses.

- Progress on environmental policy "is still very much a struggle because of complexity in the overall Canadian environmental policy and governance system" (Doern, Auld and Stoney 2015, 341)

- Challenges with jurisdiction, industry, and leadership

- Existing measurement approaches, indicators, and data sets are so disparate and fragmented that they are largely useless as tools for public policy.

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Additional Slides for Reference

- Literature vs. Dataset themes in Canada
- Literature vs. Dataset themes internationally
- Citation Network Analysis
- Expert Consultations
- Recommendations moving forward to address gaps

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Results: Thematic analysis of data utilization in Canada

Literature and Dataset Themes Present in Canadian Studies

- Most studies measured ecological variables.

- More themes are accounted for within the studies than is actually being measured.

Primary Sector	Number of Studies by Literature Theme	Percentage of Studies by Literature Theme	Number of Studies by Dataset Theme	Percentage of Studies by Dataset Theme	Ratio of Literature Theme to Dataset Theme
Ecological	33	32.1%	20	31.2%	165.00%
Health	23	22.3%	14	21.9%	164.29%
Socio-demographic	31	30.1%	18	28.1%	172.22%
Economic	16	15.5%	12	18.8%	133.33%
Total	103	100.0%	64	100.0%	

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Results: Thematic analysis of data utilization Internationally

Literature and Dataset Themes Present in International Studies

- Discrepancies between what the literature was purporting to measure and what the data was actually measuring

- 22 studies claim to examine economic dimensions, yet only 10 items actually include economic data

Primary Sector	Number of Studies by Literature Theme	Percentage of Studies by Literature Theme	Number of Studies by Dataset Theme	Percentage of Studies by Dataset Theme	Ratio of Literature Theme to Dataset Theme
Ecological	51	43.6%	27	40.3%	188.89%
Health	22	18.8%	18	26.9%	122.22%
Socio-demographic	22	18.8%	12	17.9%	183.33%
Economic	22	18.8%	10	14.9%	220%
Total	117	100.0%	67	100.0%	

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Citation Network Analysis

Papers Cited-By Canadian Articles

Papers Citing Canadian Articles

Citation Network Analysis

Papers Cited-By International & Relative Comparator Articles

Papers Citing International & Relative Comparator Articles

Results: Citation Network Analysis

- There are minimal connections between the literature.

- Many studies stand alone.

- The literature is largely compartmentalized and well referenced is not linked into other similar research.

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Results: Consultations

- Participants agreed that:
    - ecological indicators and measures are well-developed
    - good social indicators are lacking
    - there is a lot of rhetoric about the need for integration, but a lack of operationalization

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Recommendations

Moving towards a sustainable post-pandemic recovery, will require that we:

(1) address data gaps from marginalized populations;

(2) establish consistency across data collection and the design and use of national targets and indicators, that complement international goals; and,

(3) make explicit linkages and integrated measurements across sectors.

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