A case study on metrics | Biodiversity

A contributing paper to the Benchmarking Canada's Agri-Food Sustainability Leadership Project

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ABOUT THIS PROJECT

A diverse coalition of twenty-two partners (see cover page) came together in 2020 to consider the need for developing a national sustainability benchmark for Canada's agri-food sector.

The final report of the project's phase one was published in January 2021, *Benchmarking Canada's Agri-Food Sustainability Leadership – A Roadmap*. This work focuses on why better benchmarking is needed, how it can be expressed and what value it confers to society, sector competitiveness and policy-making. The report is to be used to engage even more Canadian agri-food stakeholders, setting the stage for phase two to proceed, index development.

ABOUT THIS CASE STUDY

Two case studies were conducted in support of this work and separately published, on GHGs/sequestration and on biodiversity. Case studies are seen as a way to bring diverse players together to work pre-competitively to assess and develop potential priority indicators to use in a national sustainability index. While not meant to be exhaustive, these high level overviews portray the global, national and marketplace context for benchmarking these specific matters, including the current state of metrics, the opportunities to better reflect Canada's performance and the gaps. As well, the cases identify what might enable or hinder metric development and implementation. The "case study model" is imbedded in the final report as an important part of the process to consider other indicators in future national index work.

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DMci Strategies

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SUMMARY

a) SWOT summary of issue: Biodiversity

Metric strength	Weakness
• Canada's abundance of agricultural land, clean water and wildlife. • Global-leading continuous improvement among Canada's producers (supported by research and adoption of new technologies, data and science innovation) enhance productivity, resiliency, crop values and benefit habitats and protecting species.	• Global indices' assessments of Canada's environmental performance does not often score well – raising the question about indicators' relevance. • Canada's current metrics (i.e., AAFC's Agri-Environmental Indicators) reveal only "moderate" progress on biodiversity. • Challenge of measuring biodiversity given its complexity. "Proxy" metrics can help but face limitations (not fully reveal impacts and progress). • Limited availability and coordination of well characterized natural genetic biodiversity.
Metric opportunity	**Threat**

• With global biodiversity in crisis, Canada's management of its ecosystems and productive land and seascapes presents an opportunity with additional indicators (see also 1b, below):
  ○ Genetic diversity
  ○ Habitat change, farmland birds and wild insect pollinators
  ○ Marginal land changes
• Preserving biodiversity creates a win-win for society at large and conserving eco-systems, and, when responsibly used or managed, can add value in terms of increasing food production productivity and enhancing resilience.
	• Global biodiversity loss is urgent and under severe threat.
	• With global agri-food seen as a major contributor of environmental impacts, attention to food production practices and externalities are rising.
	• New global goals are bringing even more visibility to the issue, pressuring countries to act. This is shaping market access approvals (such as in the EU). It is also prompting greater scrutiny of supply chain risks which may impact access to capital.
	• The pressure to respond here and abroad can create conflicts between producers, companies and regulators.

b) Elaborating on priority metrics to enhance/use

As part of a suite of agricultural sustainability indicators developed by Agriculture and Agri-Food Canada, currently two biodiversity indicators are being tracked: a weighted average of Soil Cover Days and Wildlife Habitat Availability on Farmland. Plans are in the works to revisit insect habitat availability and an improved soil microbiology indicator. Additional indicators could be considered:

- **Improving measurement of "below ground biodiversity"**
  - Tracking genetic diversity within crops will have increasing dual importance. Greater root biodiversity enables carbon sequestration and productivity, such as nutrient use efficiency.
- **"Above ground biodiversity"**
  - Given the complexity of measuring biodiversity, proxy metrics are needed, such as for habitat change, farmland birds and wild insect pollinators.
  - Precision agriculture and related productivity improvements on farms (improving yields on highly-productive land) is enabling a greater proportion of marginal or unproductive farmland to be returned to nature which promotes biodiversity health. Measuring marginal land changes is a key indicator of viable and sustainable production systems.
- **"Water biodiversity"**
  - Given the limitations of this paper, biodiversity in water systems – fresh water and oceans – has not been considered (and would need to be included).

IMPORTANCE OF METRIC

Why does measuring biodiversity impacts and progress matter?

a) Biodiversity is a key global agri-food (and societal/planetary wellness) indicator

- Global agriculture is responsible for 50% of habitable land use, 80% of biodiversity loss, 80% of deforestation and 70% of freshwater use.[1] In short, how food is grown and harvested impacts biodiversity and its visibility is rising among food consumers.

- The landmark 2020 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report has documented the unprecedented decline of nature, declaring that "transformative changes [are] needed to restore and protect nature."[2] Agriculture was flagged as a contributor to biodiversity loss. FAO's first global assessment of food and agriculture (2019) declared that biodiversity is declining, urgent and a "severe threat." The report also emphasizes the importance of inter-connected systems and components of biodiversity that support agriculture, such as pollination, soil formation and soil sequestration, and habitats for beneficial species.[3]

- In the face of climate change, ecosystem resiliency is at the heart of calls to transform agriculture and food systems, including from food companies and business organizations. For the first time, the top five risks facing business and governments identified by the World Economic Forum are environmental, including biodiversity loss.[4] A global dialogue is underway to better account for the costs of environmental degradation from the standpoint of mitigating business risks.[5] More and more countries are assessing how to value ecosystem services.[6]

- With Covid-19, attention to biodiversity loss has heightened. Habitat loss (notably in tropical forests and from the wildlife trade) is cited for facilitating infectious diseases, including Covid-19, SARS and Ebola, as 75% of emerging infectious diseases are zoonotic-related.[7]

- Managed well, preserving biodiversity and promoting sustainable use of biodiversity generates benefits for the environment, such as mitigating and adapting to climate change, and for society, notably by maintaining productive land and seascapes and enhancing food security. Finding the right ways to measure these positive relationships presents opportunities for win-win outcomes.

b) Canada's leadership opportunity

- Canada has long been a sustainable agriculture leader. Good environmental stewardship, innovation and technology adoption and continuous improvement have made significant environmental improvements across many commodity sectors, often placing Canada as a global leader or among the best.[8] For instance,

1 Data point on habitable land, The State of Food Security and Nutrition in the World, 2020, FAO: http://www.fao.org/3/ca9692en/CA9692EN.pdf; other data points, Food Systems Summit 2021, UN: https://www.un.org/sustainabledevelopment/food-systems-summit-2021/

2 *Global Assessment Report on Biodiversity & Ecosystem Services*: https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/

3 *The State of the World's Biodiversity for Food and Agriculture*, 2019, FAO (p. xix): http://www.fao.org/state-of-biodiversity-for-food-agriculture/en/

4 *Global Risks Report*, World Economic Forum, 2020

5 *Nature Risk Rising*, World Economic Forum, Jan. 2020: http://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf

6 The State of the World's Biodiversity for Food and Agriculture, FAO (p. 415).

7 UNEP: https://www.unenvironment.org/news-and-stories/story/coronaviruses-are-they-here-stay

8 Examples: Canadian chicken has the lowest carbon footprint globally. Canada's egg industry reduced its environmental footprint by 50% and increased egg production by 50% over the past 50 years (1962-2012). Work in 2018 showed that the Canadian pork footprint was among the lowest in the world and subsequent life-cycle assessment (LCA) research is now underway in that sector for completion in 2021. Beef production in Canada is among the most efficient globally, with GHG emissions less than half of the global average. With the benefit of no-till or minimum till farming, grain farmers do not have to pass over their fields as frequently which has reduced fuel use in Canada by over 170 million litres annually. Innovative greenhouse growers are recycling the carbon they produce as food grade CO_2 for their plants. In the fisheries sector,

Canada performs better on pesticide use (per unit of agricultural land) relative to a host of other countries, including the EU.[9]

- Canadian agricultural land also has a rich supply of wildlife habitat, a strength to leverage in the domestic and global marketplace. But, Canada is struggling with demonstrating positive performance (see section 4). Positioning Canada as a leader in improving outcomes for biodiversity requires well-managed agricultural grasslands, including grazing pastures and hay lands. Producers recognize that doing so provides important ecological goods and services, such as helping to regulate the flow and quality of water, protect fragile soils from erosion, recycle nutrient content, and support the protection of wild animal and plant biodiversity. Producer organizations are implementing and managing programs to enhance these positive outcomes.

- Federal-provincial-territorial government programs exist to raise producer awareness of environmental risks and accelerate the adoption of on-farm technologies and practices that can provide co-benefits for biodiversity, including adoption of shelterbelts, cover crops, converting marginal cropland to grass and treed areas, and restoring and improved management of wetlands and riparian areas.

- New techniques for genetic analyses of crop and livestock biodiversity opens new opportunities to pinpoint and use beneficial natural traits to enhance agricultural productivity, reduce inputs and environmental impacts and deliver economic gains. Canada is world leader in developing this capability. Microbial biodiversity also has a significant impact on crop performance. Garnering a better understanding of microbial communities is opening additional approaches to more resilient and sustainable agricultural production and is a promising route to help deliver on the UN SDGs, such as encouraging sustainable agriculture and ensuring food security.[10]

- With global scrutiny of biodiversity rising, selecting relevant metrics that reflect Canada's agricultural situation is imperative both to present its sustainability credentials and acknowledge areas for improvement.

c) Scope definition & effectively assessing biodiversity

- Biodiversity is defined as the variability among all living organisms, including diversity within species, between species and ecosystems.[11] Another term that is used in the agricultural setting is *agrobiodiversity*, which is the variety of domesticated cultivars of crops and breeds of livestock. It is proposed that this national index appropriately accommodate both perspectives.

- Given the breadth of biodiversity, lack of a complete inventory of species and because Canada's agricultural regions are diverse, it would be too ambitious to fully measure biodiversity. It is proposed to use proxies to report on biodiversity gains and efforts to improve on biodiversity conservation.

- While deeper analysis is required (such as assessing the pros and cons of indicator choices), potential initial proxies:

  - *Habitat* is the most used proxy to represent biodiversity because all species respond to habitat. Specific habitats important to a large variety of species on the agricultural landscape occur primarily on the

Fisheries and Oceans Canada determined that 96% of Canadian fisheries harvest fish sustainably. Sources: https://www.eggfarmers.ca/2017/04/canadas-eco-friendly-eggs/; https://www.cpc-ccp.com/sustainability; https://www.cpc-ccp.com/uploads/userfiles/files/GroupeAGECO_LCApork_FINAL%20updated%20report.pdf; https://crsb.ca/sustainability-benchmark/2020-interim-report/; http://sustainablecrops.ca/metrics-platform; http://www.canfishmagazine-digital.com/fcca/annual_2019/MobilePagedReplica.action?pm=2&folio=12#pg10

[9] *Clean Growth in Agriculture*, CAPI, 2019: https://capi-icpa.ca/wp-content/uploads/2019/03/2019-03-22-CAPI-CEF-Final-Report_WEB-1.pdf

[10] "Plant genetic resources for food and agriculture: opportunities and challenges emerging from the science and information technology revolution," *New Phytologist*, 23 Jan. 2018: https://nph.onlinelibrary.wiley.com/doi/full/10.1111/nph.14993

[11] Convention on Biological Diversity: https://www.cbd.int/convention/articles/?a=cbd-02, article 2. The FAO defines biodiversity as "the variety and variability of animals, plants and micro-organisms at the genetic, species and eco-system levels that sustain the ecosystem structures, functions and processes in and around production systems, and that provide food and non-food agricultural products" (*The State of the World's Biodiversity for Food and Agriculture*).

non-cropped landscape, including forest patches, hedgerows, riparian habitat, perennial crops, wetlands, and native grasslands. Thousands of species of Canadian wildlife use these habitats for breeding, foraging, breeding, and migration. An index that includes trends in these habitats over time would offer a meaningful metric to a national index on agri-food performance.

- Selecting *groups of species that are sensitive to agricultural production* could be relevant. For example, farmland birds are a good choice because they mirror the influence of factors that shape biodiversity at a landscape scale. There is also a significant body of knowledge on bird habitat and population trends. A farmland bird index exists for the EU.[12]

- *Insect pollinators* could be another indicator. Some of the crops grown in Canada directly rely on insect pollination such as most of our fruits and vegetables and forage crops such as clover and alfalfa. Other crops that are self-fertile such as soy and canola experience greater yields in the presence of insect pollinators. The focus for designing metrics would be on wild pollinators, of which Canada has thousands of species, including wild bees, flies, moths, butterflies, wasps and beetles – and not the packaged bee business that relies mainly on non-native species, originating from outside Canada, to support large-scale pollinating services to farmers around the world. Pollinator habitat trends could be used as a proxy rather than measuring population trends.

[12] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_bio2&lang=en

REQUIREMENTS & EXPECTATIONS

What is prompting this matter to be benchmarked?

a) Regulatory and/or global obligations

- The UN's global 2050 Vision for Biodiversity, to live in harmony with nature,[13] is spurring global action. For instance, a group of over 360 scientists from 42 countries is urging that the post-2020 Global Biodiversity Framework[14] should be shaped by agroecological principles to transform agricultural methods in order to reduce biodiversity threats.[15] In May 2021, new global biodiversity targets will be agreed at the Convention on Biological Diversity (CBD) in China.[16] Also in 2021, the UN Decade on Ecosystem Restoration will be launched. Biodiversity will be a pillar of the 2021 UN Food Systems Summit which is premised on the belief that "Better food systems create a world with rich biodiversity and ecosystems…."[17]

- Concerns over unsustainable cultivation practices can hinder market access. The EU has voted to ban palm oil biodiesel by 2030 given the extent of deforestation in south-east Asia and has decided that this feedstock should not be a means to achieve the EU's renewable transport targets.[18]

- The EU's 2030 climate and energy framework includes EU-wide targets and policy objectives, including a Nature Restoration Plan to restore degraded member state ecosystems and address biodiversity loss by 2030. As part of this effort, the EU announced targets to reduce by 50% the use of chemical pesticides, among other proposed actions, by 2030, in conjunction with the EU Pollinators initiative.

- The G-20's Task Force on Climate-related Financial Disclosures (TCFD) is promoting better corporate climate risk disclosures as a means to inform credit, investment and insurance decisions.[19] The materiality of "nature-related risks" is also imbedded in investor-driven ESG assessments of companies (i.e., on environmental, social, governance risk). These efforts are "forcing up" supply chain-wide traceability and transparency on land-use conversion and ecosystem impacts globally.[20] For instance, nearly 60 institutional investors with assets totally some US$6.3 trillion expect soy trading companies to demonstrate progress on eliminating deforestation, including how they are engaging suppliers.[21]

- Within Canada, there are policies related to prohibiting the net loss of wetlands, such as in Manitoba.[22]

b) Industry requirements and initiatives

- Biodiversity loss is seen as a material issue for many responsible global food and agricultural supply chains.[23] There is increasing global attention to the externalities of food production[24] (e.g., deforestation) and scrutiny

13 https://www.cbd.int/doc/c/0b54/1750/607267ea9109b52b750314a0/cop-14-09-en.pdf
14 Under the current framework (ending 2020), there is a target 7 relates to agriculture: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.
15 *Changes in farming urgent to rescue biodiversity*, University of Göttingen, News Release, July 20, 2020.
16 Known as the "15th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP15)".
17 https://www.un.org/sustainabledevelopment/food-systems-summit-2021/
18 "EU Labels Biofuel From Palm Oil as Unsustainable, Bans Subsidies," *Forbes*, March 19, 2019: https://www.forbes.com/sites/davekeating/2019/03/14/eu-labels-biofuel-from-palm-oil-as-unsustainable-bans-subsidies/#7b7cc3639c9d
19 https://www.fsb-tcfd.org/wp-content/uploads/2020/03/TCFD_Booklet_FNL_Digital_March-2020.pdf
20 World Business Council on Sustainable Development: https://www.wbcsd.org/Overview/News-Insights/Member-spotlight/COFCO-and-World-Bank-s-IFC-partner-for-more-sustainable-soy-in-Brazil
21 *Nature Risk Rising*, World Economic Forum, Jan. 2020: http://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf
22 https://www.producer.com/2019/10/manitoba-wetlands-policy-upsets-producers/
23 AXA: https://www.axa-research.org/en/news/biodiversity-at-risk-preserving-the-natural-world-for-our-future
24 The State of Food Security and Nutrition in the World, FAO, 2020 (p. 94): http://www.fao.org/3/ca9692en/CA9692EN.pdf

of industrial agricultural practices, notably monoculture.[25] (Externalities also apply to social and health impacts.) With most agricultural land worldwide (77%) devoted to livestock production, animal protein is particularly criticized globally for contributing to biodiversity loss.[26] In response, many in the global agri-food sector are continuing to produce more food on less land so to mitigate negative impacts. Certain commodity sectors and food companies are certifying sustainable commodity production, labelling products as biodiversity-friendly and explicitly setting biodiversity improvement targets.[27]

- Business organizations are part of a global dialogue underway to account for natural capital in financial accounting.[28] In part, this is prompting interest in how countries' credit ratings and sovereign bond pricing might reflect environment management.[29] Insurance companies are also taking an interest in "decline in the natural world" and its implications for economic risk assessments.

- One Planet Business for Biodiversity (OP2B), a consortium of 21 global companies (including Loblaw and McCain Foods), intends to "shift land use and agricultural practices, and to have a positive impact on biodiversity and ecological services they depend on". In partnership with the World Business Council for Sustainable Development (WBCSD), in 2020 it will publish "ambitious, timebound science-based and measurable targets" and policy proposals relevant to the Convention on Biological Diversity. It aims to scale up regenerative agriculture practices (including reducing dependency on monocropping or mono-genetic sourcing), increase product portfolio diversification, eliminate deforestation/increase restoration and conserve high value ecosystems.

  - Regenerative agriculture is referred to by both conventional and organic sectors but, at its core, it is about embracing good agronomic and grazing practices that minimize inputs and sequester more carbon in order to improve soil biodiversity and revitalize natural systems.[30]

- Describing its work as urgent and transformative, the Consumer Goods Forum (representing some 400 retailers and manufacturers in 70 countries) has established KPIs on zero net deforestation for agricultural commodities (soy, palm oil, cattle) to address climate change and biodiversity loss.[31]

- Financial markets are starting to reward environmental actions. In late 2019, Maple Leaf Foods became the first Canadian company to receive "sustainability-linked" credit terms (reduced interest rate) because its key sustainability targets were met. Bunge secured favourable credit terms linked to sustainability targets tied to GHG reductions, increasing traceability for key agricultural commodities and enhancing sustainable practices in soybean and palm supply chains.[32]

- Commodity programs are increasingly considering biodiversity conservation. The Canadian Roundtable for Sustainable Beef includes a component on ecosystem management in their certification standard for producers.[33] The Canadian Roundtable for Sustainable Crops is developing a code of

25 *Nature Risk Rising*, World Economic Forum, Jan. 2020: http://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf
26 *The State of Food Security and Nutrition in the World*, FAO, 2020 (p. 105).
27 Examples of initiatives: The Canadian Roundtable on Sustainable Beef has a goal to enhance ecosystems and biodiversity on lands managed by beef producers. Syngenta has a goal to enhance biodiversity on farmland. General Mills pledges to protect priority watersheds. McDonald's promotes verified sustainable wild-caught fish.
28 Natural Capital Coalition: https://naturalcapitalcoalition.org/wp-content/uploads/2020/04/NatCap_VisFinAccount_final_20200428.pdf
29 Grantham Institute – Climate Change and the Environment: https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2020/02/The-sovereign-transition-to-sustainability_Understanding-the-dependence-of-sovereign-debt-on-nature.pdf
30 "Regenerative agriculture as a tool to help limit climate change," *Canadian Cattlemen*, Dec. 3, 2019, https://www.canadiancattlemen.ca/features/regenerative-agriculture-as-a-tool-to-help-limit-climate-change/; "What is regenerative agriculture?" *The Canadian Organic Grower*, Nov. 2018 http://magazine.cog.ca/article/what-is-regenerative-agriculture/
31 Consumer Goods Forum: https://www.theconsumergoodsforum.com/environmental-sustainability/forest-positive/
32 *Maple Leaf Foods Secures First Sustainability-Linked Credit Facility in Canada*, Press Release, Dec. 11, 2019; *Bunge Limited Closes its First Sustainability-Linked Revolving Credit Facility*, Press Release, Dec. 16, 2019.
33 https://www.crsbcertified.ca/producers/beef-production-standard/

practice for crop production which includes land use and biodiversity.[34]

c) Addressed in global indices

- Global indices send mixed messages. Canada's ecological footprint is far lower than most of its peer competitors when considered against its total biocapacity, according to the Global Footprint Network.[35] But a host of other indices present a more critical and mixed view based on a range of methodologies and factors to assess environmental performance, noted below.

- The EIU's Food Sustainability Index scores Canada 3rd overall but 16th in sustainable agriculture. This latter measure is made up of 21 indicators, 3 of which are related to environmental biodiversity.[36] Canada ranked 65 out of 67 on the deforestation indicator, which appears to be driving the biodiversity ranking, with an assumption that deforestation reflects agricultural land expansion. The indicator also considers percent of total land area in forest, without considering pasture and grassland areas, and without considering that northern areas cannot be forested.

- Yale's Environmental Performance Index ranks Canada 20th out of 180 countries. A closer look at the basket of factors that contribute to this ranking reveals the complexity of assessing such performance. Canada scored 90th on biodiversity overall while one sub-indicator reveals that Canada is 1st on a biodiversity habitat index but 101st on its species habitat index, 70th on grassland loss and 55th on wetland loss.[37]

- The Global Sustainability Competitiveness Index ranks Canada 20th – with most leading countries being European – and is calculated by including an assessment of how it manages natural capital, among other factors such as social stability and good governance factors.[38]

- While Canada ranks 17th out of 129 countries on the World Intellectual Property Organization's Global Innovation Index, it scores Canada's ecological sustainability as 79th. This is driven by a high GDP/unit of energy use score and a low adoption rate of ISO 14001 environmental certificates. Canada scored 24th on the environmental performance sub-indicator.[39]

- The CGIAR, a major global research partnership, assessed food system sustainability across 97 countries; Canada ranked 3rd overall and performed well on environmental indicators, including biodiversity.[40] Biodiversity is assessed by crops and wildlife diversity. Using crop diversity as a proxy for biodiversity deserves more understanding. Modern agricultural practices and reliance on high-performance crop species to increase agricultural productivity has led to a perceived reduction in the genetic diversity of crop species, however, this is a point of contention in the literature and varies based on what one consults.[41]

- CGIAR has also published its first Agrobiodiversity Index. In 2019 it assessed food system sustainability and resilience across an initial list of ten countries.[42] The U.S. scored "below average" because of its low agrobiodiversity. Canada was not included in the sample. The Index is being positioned as "an action-oriented tool that countries, companies and investors can use to assess their sustainable

34 http://sustainablecrops.ca

35 Canada's biocapacity (defined as the capacity of a country's ecosystems to be regenerated from the demands placed on it) exceeds its population's ecological footprint, known as having an ecological reserve; Global Footprint Network: http://data.footprintnetwork.org/?_ga=2.95542110.393783626.1598706915-67348583.1598706915#/

36 *Food Sustainability Index,* 2018, Economist Intelligence Unit: https://foodsustainability.eiu.com

37 *Environmental Performance Index*, 2020, Yale Center for Environmental Law and Policy, https://epi.yale.edu/epi-results/2020/country/can

38 *Global Sustainable Competitiveness Index*, 2019, Solability, http://solability.com/the-global-sustainable-competitiveness-index

39 *Global Innovation Index*, 2019, World Intellectual Property Organization, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019.pdf

40 International Centre for Tropical Agriculture, CGIAR: https://www.nature.com/articles/s41597-019-0301-5

41 Panel of eminent experts on ethics in food and agriculture. The Food and Agriculture Organization of the UN, http://www.fao.org/3/i2043e/i2043e02a.pdf

42 *Agrobiodiversity Index Report, Risk and Resilience*, 2019, CGIAR (Bioversity International is a CGIAR Research Centre): https://cgspace.cgiar.org/bitstream/handle/10568/100820/BookIndex_RiskResilience_01Ago_LOW.pdf?sequence=11&isAllowed=y

use of agrobiodiversity for improving food systems and identify areas where they can take action to make diets, markets and production systems healthier, more resilient and more sustainable". The Index will be expanded to include other countries (and later, companies).

CURRENT STATE OF METRICS COLLECTION

What is being done now in Canada?

Metrics baseline
A baseline understanding of current practices is required before justifying/developing new indicators.

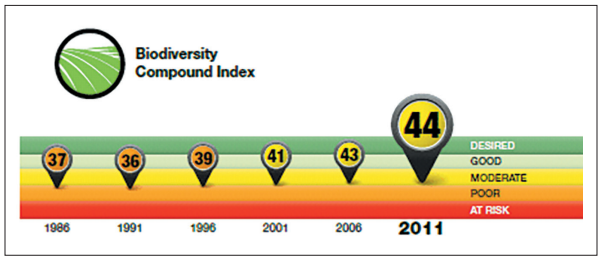
a) Are metrics/benchmarks now being published on this matter in Canada – and how is this being used?

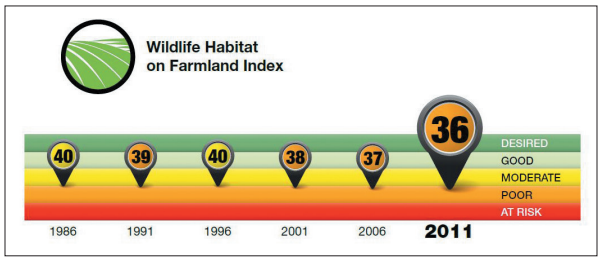
- Assessing nature-based risk is embedded within Canadian Sustainable Development Strategy. "By 2030, support improvement in the environmental performance of the agriculture sector by achieving a score of 71 or higher for the Index of Agri-Environmental Sustainability (reflecting the quality of water, soil, air and biodiversity)."[43]

- The Biodiversity Index component (see diagram) points to Canada's moderate ranking of 44% in 2011, an improvement over time since 1981.[44] "Moderate" indicates that there is room for improvement in the management of agricultural landscapes. This index is a weighted average of two indicators:

  - Soil Cover Days (SCD): This measures the number of days that the soil is covered in a year given current management practices. It is a proxy indicator for soil microbial health. The move to annual cropping with the requisite decline in perennial landcover and the reduced diversity in crop types with increasing acreages of canola, soy and corn tend to reduce habitat scores while the move to less tillage tends to increase habitat availability as well as increasing SCDs.

  - Wildlife Habitat Availability on Farmland (WHAF): The WHAF measures habitat availability for 579 species terrestrial vertebrates on agricultural lands with each crop and landcover type being assigned a habitat score per specie. This is the principle indicator used by Canada to measure agricultural impact on wildlife biodiversity under the Convention on Biological Diversity. (This matter is discussed further below.)





- Other measures of biodiversity have been tried in the past but have not been successfully implemented in Canada. Plans are in the works to revisit insect habitat availability and an improved soil microbiology indicator.

b) Supply chain scope of metric? (i.e., Is the data available at every stage in food production and supply?)

No, data is collected just to the farm gate which is understandable given the nature of farming/ranching.

[43] http://fsds-sfdd.ca/index.html#/en/detail/all/goal:G11
[44] Environmental Sustainability of Canadian Agriculture: Environmental Indicator Report Series, AAFC, Report #4.

c) What are type of data is being used and what are some data sources?

- The wildlife habitat indicator (WHAF) currently relies on AAFC's Ag Crop Inventory earth observation data. The 2011 model used census of agriculture data. The soil cover measure (SCD) uses primarily census of Canada data.

GAPS & ISSUES

What's missing or needs to be addressed to advance the index concept?

a) Data gaps

- High resolution earth observation products (classified satellite imagery) is available, expensive and faces some limitations. For instance, insect habitat can consist of very small landscape features, fence rows, shelterbelts, riparian vegetation, small wetlands, etc. The current imagery resolution is far too course to measure these features. As well, wildlife respond to scales generally larger than farm size, so aggregating data at a regional scale would be more practical and useful and would relieve concerns of privacy. Measures need to provide a fine enough resolution to be accurate and measure at scale to be meaningful to assess species.

- There is also a lack of data on the actual state of biodiversity. Efforts are required to assess the populations of insects, birds and other species, hence the reliance on proxies to assess biodiversity. Canada has good data on birds, fish, and game species and decent data on listed species, but very little long term data on insects beyond listed species and some specific regional projects.

- Biodiversity can be viewed from different perspectives. Measuring the diversity of crops being grown (an issue of interest particularly in Europe) could be potentially captured as a point of sale metric. This could be known as "below ground" biodiversity and could become an important indicator of soil health, a basis to assess carbon storage and microbial communities. Whereas "above ground" biodiversity is commonly now used to assess conservation biology measures of birds, insects, etc. (A third perspective, not considered within the scope of this paper but nevertheless important, would consider biodiversity in water systems – fresh water and oceans.)

- See the discussion on deforestation/grassland loss discussion, below.

b) Metrics issues (challenges/ opportunities)

- *GMOs*: CGIAR's Agrobiodiversity Index comments on the challenge of metrics selection and interpretation. On the one hand, it observed that the use of genetically modified glyphosate-resistant crop cultivars in the U.S. resulted in "a simplification of landscapes" due to less crop rotations. On the other, it stated that genetically modified crops in the U.S. has resulted in lower applications of insecticides and that herbicide-tolerant varieties has increased conservation agriculture practices.[45] GMO crops complimented by using no-till practices means far less carbon loss, a key outcome of conservation agriculture.

- *Species at risk*: Dialogues to protect biodiversity often focus on protecting species at risk. However, looking mainly to producers to bear the costs of recovering species at risk places producers in a difficult situation. While they can, indeed, play a proactive role to help protect such species, this index does not suggest using species at risk as an indicator in the proposed national index.

- *Metrics specificity vs. comparability* (the issue of deforestation): The intent of benchmarking is selecting metrics that are relevant to Canada's agricultural context while responding to global concerns and goals.

    - For instance, much attention is devoted globally to deforestation (notably tropical rainforest destruction).[46] For most, boreal forest deforestation may not be the material indicator of Canadian sustainable agriculture. Instead, how we manage native grasslands

[45] *Agrobiodiversity Index Report*, Risk and Resilience, CGIAR, 2019 (p. 93).
[46] Example: The EIU Food Sustainability Index's indicator 4.4 calculates environmental biodiversity by assessing deforestation and forest area.

could be. While there are challenges to measure this issue, such an indicator could be of increasing interest. (At least one global index measures "grassland loss". The Environmental Performance Index (published by Yale and Columbia universities) ranks Canada 70th on this score.[47] Overall, Canada ranks 110th in the Environmental Services category, which measures tree cover loss (allotted 90% weight), grassland loss (5%) and wetland loss (5%).) How Canada measures native grasslands may deserve future consideration as a possible metric.

- *Wildlife Habitat on Farmland*: This indicator is moving in the wrong direction (see chart, above).[48] However, diverting marginal land to conservation could enhance biodiversity and technology, science and analytics will help to make this possible. Advanced technologies-adoption, such as widespread adoption of precision agriculture, is boosting yields on highly productive land. Over time, this can relieve the need to farm marginal land. Such practices can also be encouraged with a variety of programs (such as ALUS, alternative land use practices). An index that tracks marginal land changes could become more important going forward. Developing a marginal land ratio as a subset of Canada's total ~95 million acres of productive land could become a useful indicator of agriculture's environmental footprint.

- *Correlating metrics*: Selecting metrics requires understanding the interaction between metrics within an overall basket of measures. Example:

  - Canada has been a leading adopter of no-till which enhances soil health, contributing to "below ground biodiversity" and reduces carbon loss via sequestration. However, no-till has been more limited in advancing "above ground biodiversity" (due to monoculture practices). Consequently, a reasonable holistic picture of impact and progress, above and below ground, is required. In other words, potentially selecting no-till adoption as the primary metric might warrant including another metric to provide a fuller view, including to reflect positive change/strengths and areas for improvement, such as on marginal land, noted above.

c) Key policy issues

Societal benefits vs. producers

A recurring issue is reconciling how to enhance biodiversity without disadvantaging producers. This is about avoiding unintended consequence of developing benchmarks. Looking to producers to assume full responsibility to improve eco-systems that also benefit society raises an important public policy issue. This matter prompts a discussion about compensating producers and enabling ecosystem improvements so the burden does not fall inappropriately on producers.

National development plans

Given biodiversity's close connection to many other issues, UN dialogues are emphasizing the importance of "mainstreaming biodiversity into national development plans" and better understanding how policies affect this, such as reducing harmful subsidies that undermine biodiversity.[49] Biodiversity links to Canada's commitments to global agreements and goals, such as the CBD, Paris Agreement and SDGs. Every province addresses biodiversity in their respective environmental farms plans and this tool could be a key enabler to deliver on biodiversity actions relative to these broader goals. Reducing food loss and waste, for instance, is a major issue that can alleviate pressure on productive systems to produce more food and its associated impacts.[50]

47 *Environmental Performance Index*, Yale Center for Environmental Law & Policy, 2020.
48 https://www.agr.gc.ca/eng/agriculture-and-the-environment/agricultural-practices/soil-and-land/wildlife-habitat-capacity-on-farmland-indicator/?id=1462916293297
49 https://www.unenvironment.org/news-and-stories/story/towards-vision-2050-biodiversity-living-harmony-nature
50 "Nature: Humanity at a Crossroads, UN Warns," UN Environment Programme Press Release, 15 Sept. 2020: https://www.cbd.int/doc/press/2020/pr-2020-09-15-gbo5-en.pdf

Research

Governments and research agencies could work jointly to identify the research and evidence required to better understand better agrobiodiversity practices.

Carbon credits

Measuring increases or reductions in soil carbon is influenced by both biodiversity and agronomic practices. Promoting genetic diversity within crops and introducing greater root biodiversity – key determinants of enhancing below ground diversity (agrobiodiversity) – could have a powerful impact by increasing carbon sequestration and nutrient use efficiency (reducing the volume of agricultural inputs). Doing so could promote a win-win situation for farmers and the environment. This could be incented by deploying carbon credits, although it is beyond the scope of this work to elaborate on this matter. Nevertheless, this could evolve to become a key indicator of sustainable agricultural practices. (For this item and the following, refer also to the case study on GHG emissions and sequestration.)

Enabling the Clean Fuel Standard

Incentivizing responsibly-produced feedstock to be used in biofuel refineries can help limit impact on wetlands, forests and riparian areas. Identifying criteria to satisfy this objective and collect the metrics to do so (as part of the pending Clean Fuel Standard) is an acknowledged administrative burden for government. However, emerging data platforms being set up to enable metrics collection among producers might help alleviate this task. By tracking environmental farm plans that meet or exceed the biodiversity criteria of the CFS might deliver on this program and help farmers benefit financially by participating in the CFS.

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