April 6, 2023

To: aafc.sas-sad.aac@agr.gc.ca

Re: Comments on Developing a Sustainable Agriculture Strategy

We herein provide input for developing a sustainable agriculture strategy. The Discussion Document indicates that in general, the Sustainable Agriculture Strategy would aim to contribute to the goals and targets of the Federal Sustainable Development Strategy and the United Nations 2030 Sustainable Development Goals.

Our responses to the Discussion Questions require the below explanation to provide context and references supporting our comments. (This explanation includes sources that have references, but the references are not reproduced. They can be found in the source document).

## Introduction, and Meaning of "Sustainable"

The word "sustainable" is to be understood with reference to future generations. Sustainable development means “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations General Assembly, 1987, p. 43). Thus any strategy that decreases the ability of future generations to benefit from agriculture, whether in terms of livelihood (as is the case with farmers and others in the agriculture supply chain) or consumers who eat healthy food, is not sustainable, by definition.

To increase competitiveness, it is vital that any sustainable strategy recognize the constraints presented by natural resources. In the case of agriculture the natural resource is the soil. As climate change continues to affect the ability of the soil to generate and support crops, the constraints will become even more pronounced.

## The Soil

The May. 2019 Foresight Brief of the UN explains how soil works in a symbiotic relationship with plants (p.3). Plants interact with microbes, fungi and other microorganisms in the soil, which all support the plant's growth and health. The microorganism system, or "wood wide web" provides nutrients and water to the plant and also signals to the plant when defensive postures are needed. For its part, the plant provides through its roots its products from photosynthesis, mostly carbohydrates, such that there is a symbiotic relationship between the plant and the wood wide web.

A fertile, health soil contributes to the 2030 Sustainable development Goals, as indicated by the UN and stated by UNEP soil and landscape expert Abdelkader Bensada:

> "Healthy, fertile soils will help to achieve Sustainable Development Goal 1 (No Poverty) and Goal 2 (Zero Hunger), better soil management will help achieve Goal 13 (Climate Action) and Goal 15 (Life on Land), and eliminating dumping and minimizing the release of chemicals and hazardous

materials into the environment will help achieve Goal 6 (Clean Water and Sanitation) by contributing substantially to reducing soil pollution.

> "There is, therefore, a **clear link between soil health and most Sustainable Development Goals**, requiring governments, the private sector and civil society to join forces to prevent new pollution, minimize its negative effects, and remediate polluted sites and soils that pose a risk to human health and the environment," says Bensada. (emphasis added)

## Industrial Agriculture and Climate Change

Research indicates that warmer, drier conditions associated with climate change will reduce the rates at dead plant matter is broker down by soil fauna (such as earthworms, springtails and mites) and microbes (such as bacteria and fungi).

Agriculture contributes about 23 percent of human induced greenhouse gas emissions. The UN reports that although Industrial farming systems produced large amounts of food, they also "cause significant soil erosion, biodiversity (including pollinator) losses and pollution of freshwater bodies." Agricultural practices are causing the loss of soil, and its associated soil fertility. It reports in its May, 2019 Foresight Brief that twenty-four billion tonnes of fertile topsoil extending to 12 million hectares are lost every year, and that soil is being lost from agricultural areas 10 to 40 times faster than the rate of soil formation.

Pesticides, in particular, are problematic because they are designed to, and kill life, including the life in the soil that is needed to create healthy, fertile soils. This particular issue is discussed in a section below.

## Agricultural Practices as a Solution

The UN recommends increasing soil fertility by methods such as regenerative agriculture practices. It indicates that increasing carbon in the soil has many advantages, including improved yields of crops. The Foresight Brief indicates: "(1) it increases the available water capacity, (2) it improves the plants' nutrient supplies, (3) it restores soil structure, and (4) minimizes risks of soil erosion".

The Foresight Brief states:

> "Agricultural practices have the potential to store carbon in the soil and plants, and thus help mitigate climate change, while at the same time increasing soil fertility and water-holding capacity, improving yields and good nutrition, creating drought-tolerant soils, restoring degraded cropland and grasslands and nurturing biodiversity, with positive consequences on local economies. Together these represent an across-the-board winning set of solutions".

Recommended practices set out in the Foresight Brief are:

- reduced or no-till systems (without glyphosate);
- crop management practices such as the use of cover crops and crop rotations, crops with deep roots, mulching and retaining crop residue;
- intercropping;
- using "living mulch" crops to suppress weeds and furnish organic matter; and
- application of compost.

The Foresight Brief makes the point that industrial farming systems produces large volumes of food, but brings with it many negative consequences, including soil erosion and biodiversity losses. It also promotes a dependence on the agro-industry and its products, an enormous freshwater and nitrogen footprint, and it contributes to agricultures approximate 25% share of global greenhouse emissions (See the references cited). The dependence on the agro-industry and its products does not support a versatile and resilient farming sector because such dependency decreases agricultural tools and decreases competitiveness.

The Rodale Institute produced a white paper in 2014 which it showed that regenerative organic agriculture can sequester carbon from the atmosphere and reverse climate change. The *White Paper: Regenerative Organic Agriculture and Climate Change A Down-to-Earth Solution to Global Warming* makes the case that "[w]ith the use of cover crops, compost, crop rotation and reduced tillage, we can actually sequester more carbon than is currently emitted, tipping the needle past 100% to reverse climate change".

The White Paper also makes the case that actual yields with organic regenerative agriculture outcompete conventional, particularly in drought years:

> "Actual yields of organic systems, rather than agglomerated averages, have been shown to outcompete conventional yields for almost all food crops studied including corn, wheat, rice, soybean and sunflower.(15) Importantly, yields under organic systems are likely to be more resilient to the extreme weather accompanying climate change. As found in the long-running Rodale Institute Farming System Trial, in drought years, yields were consistently higher in the organic systems. For instance, organic corn yields were 28% to 34% higher than conventional.(16)"

The 2014 White Paper was updated in 2020 with the publication *Regenerative Organic Agriculture and the Soil Carbon Solution. (***2020 White Paper**) The conclusion of that paper, after further research, was that " white paper confidently declares that **global adoption of regenerative practices across both grasslands and arable acreage could sequester more than 100% of current anthropogenic emissions of CO2** and that stable soil carbon can be built quickly enough to result in a rapid drawdown of atmospheric carbon dioxide". The Institute provide descriptions of carbon farming practices on p. 10, and sets out this list of regenerative farming practices that support carbon sequestration: Diversifying crop rotations; Planting cover crops, green manures, and perennials; Retaining crop residues; Using natural sources of fertilizer, such as compost; Employing highly managed grazing and/or integrating crops and livestock; Reducing tillage frequency and depth; and Eliminating synthetic chemicals.

This paper spoke to the Rodale Institute's Farming Systems Trial (**FST**), which was established in 1981. The trial compares organic to conventional agricultural over various measurables, and the findings are (p. 16):

> "The FST has shown that, in comparison with conventional methods, organic systems:
> • PRODUCE competitive yields with a good management plan
> • YIELD up to 40% more in times of drought
> • EARN 3-6x greater profits for farmers
> • IMPROVE soil health and build soil organic matter over time
> • USE 45% less energy

- RELEASE 40% fewer carbon emissions
- LEACH no atrazine, a toxic chemical, into waterways."

## Productivity and Economic Advantages

The productivity and profitability benefits of organic and regenerative agriculture are clear: As indicated, the 2020 Rodale FST of the Rodale Institute shows organic systems ear 3 to 6 times greater profits for farmers and provide greater yields in times of drought.

It has been demonstrated that an agricultural systems that puts carbon back into the soil supplies more nutrients to the plant and increase plant productivity. Sanderman et al found that soil management systems can simultaneously mitigate climate change through carbon sequestration and provide the nutrition needed for increased crop production. Moreover, they found that with a higher carbon return system there were i**ncreased** carbon cycling rates, i.e. an increased benefit for mitigating climate change. It appears that the higher carbon input affected the plant and microbial systems, which increased the rate of cycling carbon from the atmosphere. [Sanderman, J., Creamer, C., Baisden, W. T., Farrell, M. & Fallon, S. Greater soil carbon stocks and faster turnover rates with increasing agricultural productivity. SOIL 3, 1–16 (2017)] . Thus there is a is a positive correlation between the productivity (and profits) associated with regenerative farming systems and the particulate organic matter of the soil.

## Problem of Pesticides, Glyphosate in Particular

As indicated, with respect to the pesticide glyphosate, the Foresight Brief on  indicates it negatively affects soil biota and may harm human health. The UN in October, 2018 published a second Foresight Brief, entitled "Alternatives for the Use of Glyphosate" (the **Glyphosate Brief**). The question asked by the brief is framed as follows, and aligns with Sustainable Development Goals:

> "While it seems that the central question for farmers, is on how to combat weeds, the real question to ask should be on how we can have an agricultural system whose weed control measures ensure not only food security, but also protects human and environmental health?"

The Glyphosate Brief's discussion of the environmental impacts of glyphosate include:

- Herbicide-resistant weeds present the greatest threat to sustained weed control in major agricultural crops (24). So far, (38) weed species distributed across 37 countries and in 34 different crop situations have developed resistance to glyphosate (Figure 3) and other herbicides as well (24).
- After the application of glyphosate, nitrate and phosphate available in the soil increase significantly due to the die-off of the plants, “pointing to potential risks for nutrient leaching into streams, lakes, or groundwater aquifers” (25).
- Glyphosate alters and disrupts the population of microbes in the soil (26,27). It decreases the population of beneficial fungi (28–30), which play a vital role in facilitating water and nutrient uptake from plant roots (31–33).
- Glyphosate is toxic to beneficial soil bacteria that have a key role in suppressing specific pathogenic fungi, as well as in making soil minerals available to plants (34,35).

- Glyphosate reduces the activity and reproduction rates of earthworms (25,36) and perturbs the gut microbiota of honey bees (37).
- Glyphosate has been reported to bind to the soil minerals such as manganese, iron, etc. and blocks their availability to plants, leading to weakening of plant defenses against pathogens (38).
- One consequence of the suppression of weeds by glyphosate use is that food for insects, in the form of nectar, pollen, leaves and seeds, are eliminated from fields. This results in a diminished number of insects (39–42) and, as a further consequence, a lack of food for birds which feed on insects and seeds, leading to a further decrease in biodiversity (23,43–54).
- Although glyphosate degrades rapidly, its main metabolite degrades more slowly, and has been frequently and widely found in U.S. and EU soils, surface water, groundwater and precipitation (55,56) . Studies have shown its toxic effects on algae, plants, fish, invertebrates and mammals (57–59, 57,60–63,64).

Or particular note for the current strategy document are the facts that: glyphosate decreases the population of beneficial fungi and thereby harms the uptake of water and nutrients by plants; it is toxic to beneficial soil bacteria which suppress pathogens; it reduces the activity and reproduction of earthworms; it binds to bind soil key minerals making them unavailable for nutrient uptake by plants. In other words, it interferes with the soil symbioses described above, which is essential for a healthy soil, the resource upon which sustainable agriculture depends. **Thus the use of glyphosate is a technique of unsustainable, not sustainable, development.**

The quantities of glyphosate being sprayed in the world are enormous. Mandating a reduction of these quantities would have a significant impact on the Sustainable Development Goals. The Pesticide Action Network North American release a report on January 17, 2023 which is the first scientific examination of how pesticide use fuels climate change, entitled "*Pesticides and Climate Change*" (the **PAN Report**). It cites a statistic that in the U.S., glyphosate use increased 300-fold between 1974 and 2014 to 250 million pounds (113,400 tonnes) accounting for about 19% of global sales (p.4).

The Glyphosate Brief recommends various measures for weed control as alternatives to glyphosate, which admittedly may not provide yields as much as glyphosate spraying in the initial years, but contribute to "the well-being of people, soil, plants, animals and future generations" and therefore align with the Sustainable Development goals more than the techniques of the conventional spraying of glyphosate.

These measures (**Weed Control Measures**) include:
- keeping weeds to a manageable level, which allows them to be of benefit to the soil and ecosystems;
- increasing the fungi to bacteria ratio, by applying compost or inoculated seeds, which can lead to fewer weeds;
- mechanical weed control (or shallow tilling);

- crop rotation, which regulates the presence of weeds and feeds the soil;
- the use of cover crops, which supresses weeds and improves soil fertility;
- the use of undersown crops which protect against weeds and add nutrients, and may add nitrogen if the undersown crop is a legume;
- intercropping of 2 or more crops which results in reduced weed growth;
- controlling the biological cycle of weeds;
- no-till agriculture without pesticides;
- integrating animals into the cropping system, which supress the cover crop without the use of glyphosate and improved the quality of the soil through animal actions;
- providing a false seedbed for weeds that are then eliminated;
- applying mulch to the soil to prevent weed germination; and
- the use of bioproducts on weeds.

The Glyphosate Brief makes the concluding point that the emergence of herbicide resistant weeds requires a fundamentally different model of agriculture. A solution of applying more and different or stacked pesticides **will not work**, because resistant weeds and pests will by nature emerge, and meanwhile the harms of pesticides to the soil will have been amplified. Increasing harm to the soil is not by definition sustainable in that it does not take future generations into account.

Pre-Harvest Use Problems. Glyphosate is also used prior to harvest, "pre-harvest", ostensibly for 2 purposes. One is the usual purpose of "weed control", and the other is for purposes of killing the crop, or "desiccating" it. This is done so that the crop dies all at the same time and can be gathered on a predictable schedule.. The pre-harvest use of glyphosate is used extensively in the prairies provinces, because of the scale of the large farms there and the monocropping agricultural systems in place there. However, killing the crop can be done by other means, such as swathing and dry-down.

The problem is glyphosate contributes significantly to environmental and pesticide drift problems. The chemical is toxic to aquatic life and land species In addition, glyphosate chemical translocates to the seed of crops and thus gets right into our food, causing high residues in food which causes health problems, and also causing trade problems for Canadian growers whose products are rejected because of high residues.

This pre-harvest use is also not precise – the labels are not effective in preventing high levels and exceedances of thresholds in certain crops, particularly indeterminate crops. The inability of labels to prevent high levels from occurring is evidenced by a recent Agricultural Canada study on barley.

A simple way to significantly reduce the use of pesticides in Canada and the harms to the soil and associated climate change, environmental and biodiversity harms, is to prohibit any pre-harvest use of glyphosate, whether for weed control or desiccation. By the time of pre-harvest, the killing of weeds has minimal impact on yields, plus there are other methods for controlling weeds, as discussed herein. Killing and gathering the crop for harvest can be achieved by

means other than killing the crop with glyphosate (such as swathing and dry-down). The harms of glyphosate are too high a price to pay for efficiency in harvest in one specific type of agricultural system.

The PAN Report speaks to pesticides in general, rather than just glyphosate. It cites research showing climate change affects different pests in different ways, which means that specific regional climate impacts will have an impact on which pests will become more prevalent. The point is made that diversifying agricultural systems increases ecosystem resilience and associated agricultural resilience to climate change and is preferrable to a homogeneous solution. It indicates that climate change will increase the volatization of pesticides, which means more pesticides will end up in the air rather than hitting their targets, and also means increasing pesticide drift. Also increased rain will be problematic to the environment, because: "An increase in severe rain events is expected to increase pesticide loss to our waterways, with one study showing concentrations of pesticides in waterways to be 84–2100% higher after 100-year storms as compared to two-year storms". Climate change will also lead to quicker pesticide degradation, meaning they will be less effective.

The PAN Report notes that 99% of synthetic pesticides are derived from fossil fuels, and several large industry players develop ingredients. (p. 8) Some pesticides are coated in plastic which ae derived from fossil fuels. As indicated in the Foresight Brief, pesticides cause a dependence on large agro-industry players. **This dependence on agro-industry players reduces the competitiveness, market adaptability and resilience of growers.**

In its discussion on genetically engineered crops, the PAN Report provide clear evidence and statistics showing that genetic engineering has led to a large increase, rather than a decrease, in pesticide use because the approach of applying one pesticide to one monoculture GE crop leads to the production of herbicide resistance weeds (p. 4):

> "While the use of genetically-engineered (GE) crops is often touted as a tool for pesticide reduction,(36) scientific research shows the opposite to be true.(37) GE crops. are often crops that have been genetically modified to be resistant to a specific pesticide, so that farmers may apply the pesticide and kill or control surrounding pests without damaging their crop. However, the widespread adoption of GE crops has led to the emergence of herbicide-resistant weeds, causing farmers to apply more herbicides.(37) For instance, in the United States, the introduction and widespread planting of herbicide-resistant crops led to an increase of 527 million pounds (239,000 tonnes) of herbicide use from 1996–2011, and caused an overall 7% increase of herbicides and insecticides.(37) The use of glyphosate (the active ingredient in Roundup often applied to genetically engineered Roundup-tolerant crops) in the U.S. increased 300-fold between 1974 and 2014 to 250 million pounds (113,400 tonnes) accounting for about 19% of global sales.(38) Despite decades-long use of GE cotton designed explicitly to reduce insecticide use, cotton is one of the world's most pesticide-intensive crops.(39) Cotton production occupies 2.4% of the world's agricultural land but uses

> 4.7% of the world's pesticides, and specifically 10% of the world's insecticides.(40) This increasingly high use of pesticides negatively impacts both the environment and human health."

The energy use associated with pesticide use is massive. The PAN Report indicates (p. 8):

> "The production of herbicides creates between 18.22 and 26.63 kilograms of CO2e per kilogram produced on average.(2) The production of insecticides creates between 14.79 and 18.91 kilograms CO2e per kilogram and the production of fungicides creates between 11.94 and 29.19 kilograms CO2e per kilogram on average.(2) The GHG emissions of glyphosate, the world's most popular herbicide, produces 31.29 kilograms of CO2e per kilogram while other pesticides produce greater than 40 kilograms CO2e per kilogram.2 To put this in perspective, the energy used to produce the amount of glyphosate used globally in 2014 equals the energy needed to fuel about 6.25 million cars for one year.(102)"

In addition, extremely high levels of greenhouse gases are emitted through a pesticides life cycle. Some pesticides are themselves greenhouse gases, and others interact with other substances to create greenhouse gases. "Since often less than 0.1% of applied pesticides reach their target, (106) with the rest ending up on plant leaves, in the soil, in water, or in the air,(107) the implications for GHG emissions of these pesticides' fate (their off-target movement) in the environment is significant."

The PAN Report also provides statistics to show how pesticide use disproportionately affects the health of people of colour, which is inconsistent with the sustainable development goals.

### Agricultural Practices Must be Adapted and Adaptable to Regional Conditions

Jeremy Rifkin, in the book *The Age of Resilience,* makes the argument that with climate change, members of society will come to adapt and focus politically on the ecoregions in which they dwell. He indicates the successful strategy will be one that allows for resilience, as first understood by the Canadian ecologist Crawford Stanley (p. 151). "Therefore, a major strategy selected is not one maximizing either efficiency or a particular reward, but one which allows persistence by maintaining flexibility above all else… ". The idea is that success will be measured by "adaptability", rather than efficiency. Similarly, a successful agricultural system is one that can persist and survive and adapt as the conditions in which it operates changes. It is resilient.

If follows that tools which allow for research into changing regional ecosystem conditions and how to meet them, and a system that promotes flexibility and adaptability so that the new conditions can be met, will be most useful for achieving sustainability and resilience.

### Summary

In summary, Sustainable Development in agriculture requires increasing the health of the soil and its symbiotic relationship with plants. Techniques and strategies that promote soil health are good policy goals, and those that do not may not be effective. Techniques that decrease

the health of the soil do not align with Sustainable Development in agriculture. These techniques and strategies should be working to further adaptivity and resilience, as regional ecosystems change.

## Discussion Questions and Responses

Please note that some of the response may be applicable to more than one discussion question, so we ask that the reviewer please review and consider all responses with a view that the response may apply to more than one discussion question.

**Issue 1:** What do we want to achieve through a Sustainable Agriculture Strategy?
Discussion Questions

- Which of the proposed goals for a Sustainable Agriculture Strategy do you agree with most? What would you add or change?

*Response:*
We agree with proposed goals 1, 2 and 3 and point out that improved soil health will achieve these goals, as discussed above.

With respect to goal 4: "A more comprehensive and integrated approach is taken in addressing agri-environmental issues in the agriculture sector, across policy, programming, and partners in the value chain", we agree that an integrated approach is needed, and all parties should align on common goals and targets for agri-environmental improvement.

Our concerns is that "comprehensive and integrated" among partners in the value chain could lead to reliance on the agro-industry for techniques and solutions, which is problematic as discussed above and runs counter to the Sustainable Development Goals.

In addition, the more players involved in an integrated approach, the more difficult it may be for the approach to be suitable for adaptation to the regional ecosystem level. The approach should build up from regional platforms and support these platforms, rather than be a top down approach.

We would add goals relating to achieving a reduction in the use of pesticides and achieving an increase in the build-up of soil particulate matter.

We would also add the goal of improving the development of crops without techniques that alter the gene or sequencing or number of genes, because (i) these techniques have not been and by their nature can never be adequately assessed for risks, (ii) genetically engineered crops are new to nature and so will not adapt as well to ecosystems and biodiversity as those that are already present in nature.

- What should a Sustainable Agriculture Strategy aim to achieve in the agriculture sector in terms of: Climate change mitigation; Adaptation; Biodiversity; Water; Soil health

*Response:*
The Sustainable Agriculture Study should aim to achieve significant improvements in all of these areas. As shown above, the key to this is focussing on improving soil health. Improved soil health with retain more water, and contribute to carbon sequestration and therefore help mitigate climate change. Better soil also supports more species, thereby increasing biodiversity and thereby increases resilience, or adaptability.

Improved soil health can be achieved by eliminating the use of pesticides and using the Weed Control Measures set out above. We also support the practices recommended in the Foresight Brief and the Best Management Practices put forward by the National Farmers Union.

For adaptation and biodiversity, it is key to understand that the sustainable agricultural strategy that will see the most success will be regional, meaning the techniques recommended should be developed and adapted to local/regional conditions. Climate change brings different changes to different areas, which cannot be predicted. For example, some areas will see more rain and sever flooding, some will see more drought. In such a situation, diversifying agricultural systems increases ecosystem resilience and associated agricultural resilience to climate change. Adaptivity should be an overriding principle.

- How can a Sustainable Agriculture Strategy support an environmentally, socially, and economically sustainable agriculture sector?

*Response:*
Provide tools, financial incentives and support, knowledge and inputs to improve soil health – this will support an environmentally and economically sustainable agriculture sector as discussed above.

Also put in place barriers to prevent growers, workers and others in the value chain from being dependent on any one technique or products and/or on the suppliers of same (which historically have been large agroindustry players, as discussed). This will increase competitiveness and reduce capture, thereby empowering growers to work within their own environments and conditions – those on the front lines of the value chain.

A socially sustainable strategy will be focussed on regional results, as society moves toward organizing around the regional ecosystem level.

**Issue 2: Approaches to overcome barriers and advance environmental outcomes in the sector**
Discussion Questions

- What success stories can you share about approaches to improve environment and climate outcomes in the sector? In what way have those approaches impacted yields or costs?

*Response:*

As referenced above, Sanderman et al found that soil management systems can simultaneously mitigate climate change through carbon sequestration and provide the nutrition needed for increased crop production. Moreover, they found that with a higher carbon return system there were increased carbon cycling rates, i.e. an increased benefit for mitigating climate change. It appears that the higher carbon input affected the plant and microbial systems, which increased the rate of cycling carbon from the atmosphere.
[Sanderman, J., Creamer, C., Baisden, W. T., Farrell, M. & Fallon, S. Greater soil carbon stocks and faster turnover rates with increasing agricultural productivity. SOIL 3, 1–16 (2017)] .

In addition, the Rodale Institute has shown, through the FST, that agricultural systems that improve the soil improve the environment, sequester carbon and mitigate climate change, while increasing yields (up to 40% in drought years, which will become more prevalent in many regions in the future), save on energy costs and increase profits by 3 to 6 times.

- What suggestions do you have for additional approaches that could be part of a Sustainable Agriculture Strategy to:
    - Support environment and climate outcomes in the agriculture sector in general?

      *Response:* Set up and fund regional cooperatives for growers, to share information, tools, and machinery specific to that region, to allow the growers to develop their own strategies for on the ground resilience.

      Eliminate the pre-harvest use of pesticides, whose harms outweigh the benefits.

    - Support the agriculture sector in reaching net-zero by 2050?

      *Response:* Incent build-up of soil organic matter and subsidize diversification of crops that initially may not be economic. Eliminate the use of pesticides and provide the resources to effect Weed Management Practices.

- Given the pace of change needed, in which areas could regulatory approaches or changes to existing ones be used to accelerate environment and climate action?

  *Response:* To be clear, new products and approaches are not needed, since the solution is regenerative organic agriculture, whose methods are old and known. So faster regulatory approvals are not needed. Any calls for such approvals likely come from the agro-industry or parties operating at a level above the regional level, signalling that the motivation is to profit from the financial opportunity presented by climate change by creating new products.

  What is needed is the creation of more organic soil matter for farms and the promotion of regenerative organic techniques. For example, techniques and methods that assist in producing organic compost and delivering and placing it on soil should be prioritized. Regulations aimed at this goal could be used.

A simple way to improve the environment, human health and the health of the soil is to eliminate the pre-harvest use of glyphosate, which is used for this purpose on a massive scale in Canada.

- What type of research should be prioritized to advance environment and climate outcomes in the sector?

  *Response:*
  As discussed, research at the regional level would best support an adaptive and resilient regional agriculture system. Research into the environmental conditions, the biodiversity picture, and synergistic, adaptive crops would improve outcomes and sustainability for these regional systems. Research into methods for implementing growing methods in changing conditions would help: for example, if drought conditions are increasing, what water retention and distribution methods can be developed; what diversion crops can be planted to distract unwanted pests, and the like.

**Issue 3: Targets and data on environmental performance**

Discussion Questions

- What kind of data are most important for measuring environmental and climate outcomes in the sector?
  *Response:*
  Date on increases in soil organic matter, and of carbon cycling ratees (as measure in the Sandestrom paper).
  Data on quantities and reductio in the use of inputs such as pesticides, fertilizers, water.

- What suggestions do you have for improving how environmental data is collected and shared in the sector?

  *Response:* A platform for inputting data could be developed for application to different regions. Instruments and funding for collecting data should be made available to those collecting the data. The decision on who should collect the data is important: funding can be provided to third party data collectors, growers themselves could collect it if they have the time and tools, or government agencies can collect the data. The key is transparency and ease of access to the data, so any party who likely will claim proprietary rights to the data should not be collecting it or owning it any way. The data should not be proprietary and measures should be taken if needed to make it anonymous.

- What qualitative or quantitative targets do you feel would be realistic, ambitious, and measurable to generate the most action in the following:
  - Reducing GHG emissions or storing carbon
    *Response:*

- Net-zero emission agriculture by 2050, with intermediate goals such as a 20% reduction in absolute emissions by 2030
- 50% absolute reduction in fertilizer-related emissions by 2050
- 100% reduction in emissions from new machinery sold in 2040
- 50% reduction in emissions from farm buildings by 2030 (driven by incentive and financing programs)
- 0% rate of wetlands rate loss by 2030
- 10% increase in treed area on marginal land every five years

- Making the sector more resilient
  - measure the soil organic matter and carbon cycling rate in every region and compare for differences
  - Soil organic matter in every province increasing by several percent per decade
  - cut or forgive farm debt cut by 50% within 5 years, to aid in transition and to aid financial resilience to climate impacts
  - improve financing from regionals, community local credit union type sources to growers by 30% by 2023, provided they provide beneficial terms. Government should provide funding or guarantees to backstop the community financing
  - similarly, prohibit extortionist or predatory terms in financing or supply of services or goods to growers from private parties – terms such as transfer of proprietary rights, confidentiality agreements, non-competes and the like
  - Measure the resulting financial margins in all agricultural sectors 50% larger by 2040 (via reduced dependence on purchased inputs, etc.)
  - analyze the value chain to see where bottlenecks or resistance to sustainable development occurs and why, and target these locations
  - 90% of farms complete (expanded and comprehensive) environmental farm plans (EFPs) by 2025 supported by provided platforms, these could include emission-reduction plans, pesticide reduction plans, transition to regenerative plans, and nutrient/fertilizer-management plans
  - prohibiting the financial ejection of growers, and providing redemption rights and funding to support their work.
  - setting up a fund to pay growers for the advice and services they provide on a time basis, or provide them with the opportunity to issue credit offsets for their work.
  - finance, organize and teach an organization of "next generation" farmers, who are willing but do not have the skill set to take over the work needed for farms. The model might see the organization owning the farm, or as an alternative working it and providing a royalty to the owners so the original farm owners can keep their farms.

- Supporting biodiversity
  - setting aside 10% of farmland or marginal land near farms every 5 years for "rewilding", which can significantly increase biodiversity quickly over a small space. Establish a baseline and then look for a biodiversity increase of 10% every

year. By 2040, 10% of Canadian agricultural land in set-aside programs that prioritize rewilding and biodiversity
- prohibiting pesticide spraying on forests or roadsides, other areas located in the regions of the farms. It is now known that pesticides volatize and travel, so regional spraying has a negative impact.
- 0% rate of wetlands loss by 2030

- Supporting water quality and availability
  - prohibit pre-harvest spraying of pesticides,
  - Wetlands loss falls to zero by 2030 and then area and number are increasing
  - Losses of nitrate to groundwater are cut by 50% by 2030
  - Pesticide and fertilizer contamination of surface waters is cut by 50% by 2030

- Improving soil health
  - a 10% increase in soil carbon sequestration tonnage every 5 years
  - Area planted to cover crops is doubled every 5 years
  - a 10% increase in the length/area of tree rows, hedgerows, and fence rows in every region every 5 years
  - an increase in the creation of soil organic matter every 5 years, based on established metrics.

Final Questions:

- Do you have any other ideas, comments, feedback or suggestions to share on a Sustainable Agriculture Strategy?

  A simple way to improve the environment, human health and the health of the soil is to eliminate the pre-harvest use of glyphosate, which is used for this purpose on a massive scale in Canada. This step would move Canada in the right direction for Sustainable Development and COP 15 goals.

Thank you for this opportunity.

President,
Safe Food Matters Inc.