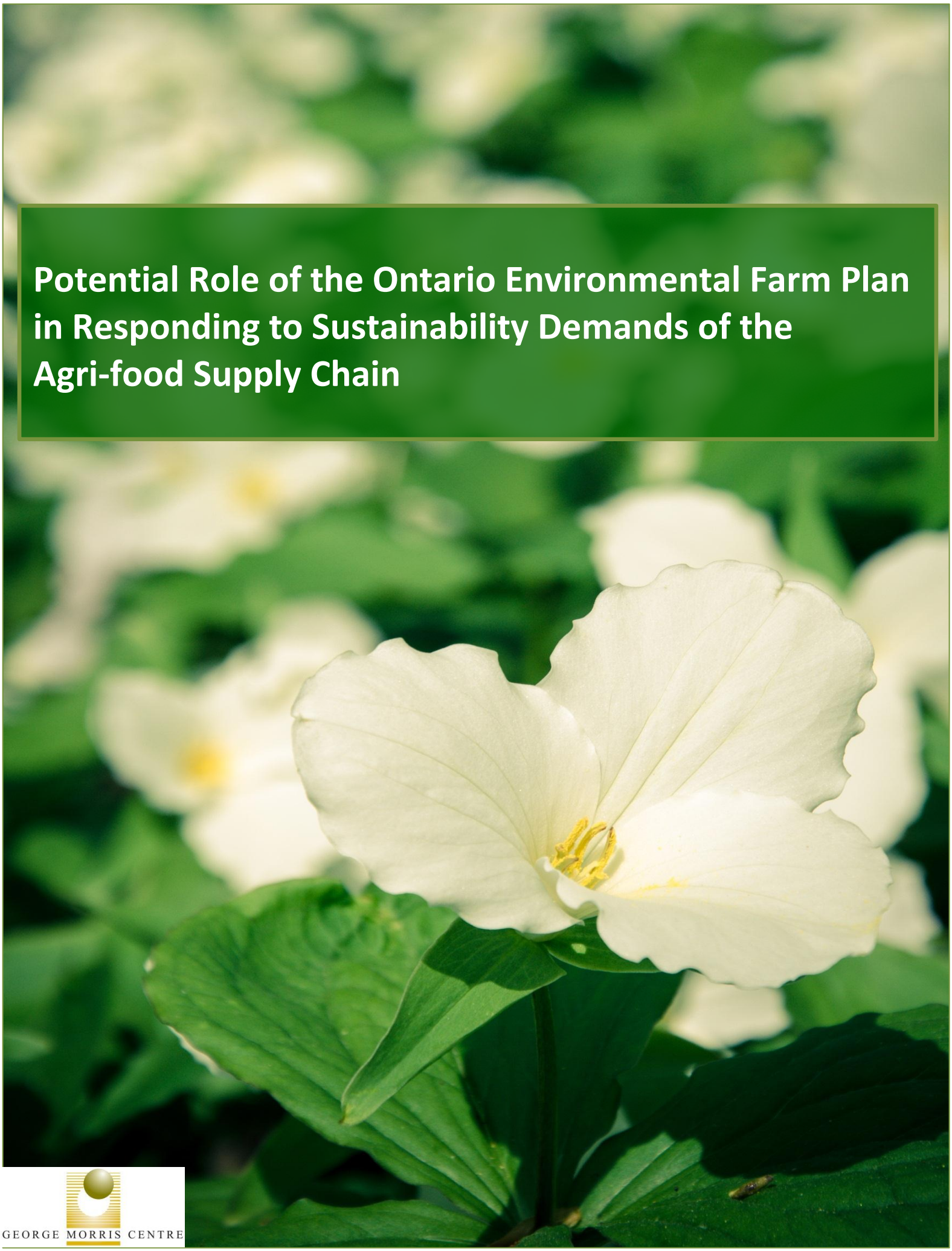
Potential Role of the Ontario Environmental Farm Plan in Responding to Sustainability Demands of the Agri-food Supply Chain



GEORGE MORRIS CENTRE

Authors

Claudia Schmidt, Janalee Sweetland and Al Mussell

Steering Committee

Harold Rudy (OSCIA)
Ralph C. Martin (University of Guelph)
Andrew Graham (OSCIA)
Cher Mereweather (Provision Coalition)
David Armitage (OFA)
Charles Lalonde (OFA)
Cindy Bradley MacMillan (OMAF)
Nigel Wood (OMAF)
John Cowan (GFO)
Eric Biddiscombe (Loblaws)

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EXECUTIVE SUMMARY

Sustainability is becoming a major consideration for the Canadian agri-food supply chain. In order to secure products and ingredients carrying sustainability attributes, processors and retailers will need to locate and work more intimately with the subset of producers willing to provide the desired sustainability characteristics. The purpose of this study was to explore how the Ontario Environmental Farm Plan (EFP) could be used to verify or validate sustainable farm practices to participants downstream in the Canadian agri-food supply chain.

To do so, a review of existing sustainability practices and protocols used by food retailers, food service providers, and food processors was conducted. The existing Ontario EFP was profiled, including the process employed and information assembled. Interviews were conducted with a range of downstream customers for Ontario farm products. Ontario producers familiar with the EFP were consulted regarding the use of the EFP to communicated sustainability attributes.

The results suggested the following.

- In addition to environmental sustainability, there is a growing trend towards social and economic sustainability measures requested by some downstream customers. Labour, animal welfare and food safety issues are perceived as becoming increasingly important for consumers.
- The ultimate strengths of the EFP were seen as its focus on environmental sustainability, voluntary participation, and confidential nature. There was a concern that the environmental focus would be compromised if the EFP was extended to social and economic sustainability. A willingness to share EFP information with customers was indicated, on a confidential basis, if this could assist farmers in marketing.
- The awareness of the EFP program in the downstream segments of the food supply chain needs to be developed. Most of the retail and food service firms contacted were either unaware of the EFP or had heard of it but were not familiar with it. There is a need for this to change if the EFP were to have an expanded role.
- An opportunity was identified through which the information collected in the EFP regarding environmental sustainability could be accessed in satisfying customer information requirements. A type of EFP "addendum" could be developed that was designed to map the information contained in EFP's into specific downstream customer sustainability requirements. This could benefit both farmers and their customers by making sustainability compliance less costly

- Under the condition of a name change and refocusing of objectives of the EFP, the inclusion of social and economic sustainability could be considered as a future development of the EFP.

    - There is also a need to better understand how the downstream segments would wish to use information accessed from the EFP. The prospects for uniformity across retail/food service firms in terms of the information sought from EFP's, and whether multiple firms could use common requirements and thus a single addendum for multiple downstream customers.
    - The relevant scale preferences of downstream segments must also be understood. This is critical in determining whether the EFP could be used based on the Ontario program and Ontario product volumes, or whether downstream purchasers would see Canadian volume as the threshold for participation, in which case there would be a motivation to more closely align provincial EFP programs for the purposes of designing sustainability addenda.
- Given that, for now, short supply chains are of more direct relevance to retailers, an opportunity was perceived for an exploration in the horticultural sector to develop a score card in "Environmental Sustainability".
    - EFP programs are in use across Canada, but the organization and authority for the EFP is provincial, so there can be differences between provinces in EFP programs. Depending on the success of the pilot project, it could be used as a template by other provinces or be available for standardization policies, according to the drivers for sustainability, along with decisions about metrics to meet the requirements of customers.

The following next steps were identified:

- Further dialogue with food and beverage manufacturers regarding the EFP and its potential uses in sustainability is required, as the awareness of the EFP program has to be increased and an improved understanding of how the information will be used by downstream purchasers is required.
- Pilot projects should be initiated with selected food manufacturers and/or retailers to determine how the EFP with an addendum could be used with sustainability metrics and to convey sustainability information.
- A forum should be organized to bring agricultural producers together to discuss key areas of sustainability, how these are addressed in the EFP across farm commodities, and what metrics could be used to demonstrate results to others.

Contents

2 Introduction

The concept of sustainability is becoming a major consideration for the Canadian agri-food supply chain. In addition to the focus on environmental sustainability, there is pressure to include social and economic sustainability attributes as well. Sustainability affects strategy, operations, workforce engagement and connection to consumers and communities (Retail Leaders Industry Association, 2012). Sustainability demands in the retail industry put pressure on suppliers to adopt sustainable practices. Just as retailers in general are looking at improving sustainability, food retailers are also turning their priorities towards sustainability, as evidenced by the increase in sustainably grown products available. Sustainability programs are also being viewed by retailers as a competitive advantage, improving business efficiencies as well as being a leading source of innovation (Siegel et al, 2012). As suppliers to food retail, farmers will need to turn their attention to on farm sustainability in order to maintain market position.

There are already a number of branded sustainability initiatives in the European Union, either led by or supported by the retailers themselves. There is additional collaboration of many leading food companies to design sustainability indicators to better communicate their performance to stakeholders, such as the SAI Platform. Manufacturers are responding to retailer requests. For example, Unilever intends to source 50 percent of its agricultural inputs sustainably by 2015 and 100 percent by 2020. Many other major food manufacturers are also making sustainability pledges to their customers.

In order to secure products and ingredients carrying sustainability attributes, processors and retailers will need to locate and work more intimately with the subset of producers willing to provide the desired sustainability characteristics. Accomplishing this goal effectively will demand much more from processors and retailers than their traditional procurement platforms have allowed. Thus far, relatively little attention has been paid to the economic incentives for farmers to implement sustainability initiatives.

The Environmental Farm Plan (EFP) is a voluntary program in Ontario that helps farmers to minimize potential risks to the environment that may be found on-farm through a confidential, voluntary process that educates and motivates farmers to target actions to priority areas. The EFP program has been accepted with its familiar platforms and adopted by the majority of Ontario farmers since 1993.

2.1 Project Goal and Objectives

The goal of this project is to explore how the Ontario Environmental Farm Plan (EFP), an existing and extensively used initiative can be used to verify or validate sustainable farm practices to participants downstream the Canadian agri-food supply chain.

The objectives of this project are:

- To review sustainability indicators that are currently used in conservation and sustainability programs by conducting an environmental scan of current programs and to survey current knowledge on the construction of sustainability indicators.
- To gauge the opinions and knowledge of Canadian based retailers, manufacturers and food service about the Environmental Farm Plan, by conducting interviews.
- To develop feasible options on how to adapt the EFP to satisfy retailer and manufacturer requirements, by conducting a focus group with producers.
- To make recommendations on next steps for the Environmental Farm Plan, by consulting sustainability experts.

The first part of this report draws on a number of sources to provide background on sustainability indicators; their importance to the food retail sector, the problems associated with developing indicators, and suggested guidelines for the development of these. Following, examples of sustainability indicators that are currently in use in North America, Australia, Europe and global initiatives are introduced. The second part evaluates the opportunities for the EFP and presents the results of interviews with retailers and a focus group with producers. The report concludes with recommendations from the project steering committee on how the EFP can be developed further to potentially satisfy retailer and manufacturer demands in the future.

3 Sustainability Indicators and Programs for Agriculture

In general, sustainability indicators are designed to objectively assess whether “things are getting better or worse” (Bell and Morse, 2008). Miller (2007), suggests that “a good indicator provides information valuable in the making of important decisions”, while describing the key feature of the human or environmental system.

Agriculture is an important topic in sustainability because it is one of the most land intensive industries and thus environmental effects from the industry are greater than from other industries, and some of the end products of agricultural production are food, feed, fibre and fuel for human consumption (Bell and Morse, 2008). Sustainability of agriculture can be influenced by both public and private decision making (Giovannucci and Potts, 2008). Government decisions and policy on environment, agriculture, trade, tax investment, energy and climate change influence sustainability (Giovannucci and Potts, 2008). At the same time, private decisions at the farm level regarding quality, food safety, global supply chains, procurement and differentiation also impact sustainability of agriculture (Giovannucci and Potts, 2008).

There is significant difference of opinion on the definition of sustainable agriculture. Bell and Morse (2008), have defined two general proponent groups of sustainability in agriculture:

1. Those who equate sustainability with “high-input, high output” conventional farming
2. Those who do not equate sustainability with conventional farming.

The World Commission on Environment and Development (Brundtland Commission) defines sustainable development as "development which meets the needs of current generations without compromising the ability of future generations to meet their own needs" in its report from 1987. This definition has shaped the international agenda on environmental, social and economic development (UNECE, 2012).

There is also the issue of “strong sustainability” and “weak sustainability”, which apply different approaches to the trade-off between sustainability and the economy (Bell and Morse, 2008). In strong sustainably no consideration is given to the costs, either real or opportunity, to attaining sustainability. Weak sustainability applies a value to environmental goods and services in order to assess what is to be gained or lost as a result of attaining sustainability. Weak sustainability is currently the dominant policy approach.

While this problem of defining sustainability is not unique to agriculture (Bell and Morse, 2008), identifying suitable indicators of sustainability will depend on the definition of sustainability that one chooses to employ. Thus, in examining sustainability indicators it is important to understand how the concept of sustainability is applied. Good indicators of sustainability may be disregarded if the indicators fail to align with the specific sustainability goals of the community (Miller, 2007).

Bell and Morse (2008) divide sustainability indicators into two groups. State sustainability indicators are measures of a specific variable, such as the physical or chemical properties of soil, or the concentration of a pollutant in water. Pressure Sustainability indicators measure the process that results in a change of state, for example the amount of pesticide that is used in an area.

Field to Market (2012) defines sustainable agriculture as, “meeting the needs of the present while improving the ability of future generations to meet their own needs by focusing on these specific critical outcomes:

- Increasing agricultural productivity to meet future nutritional needs
- Improving the environment, including water, soil and habitat.
- Improving human health through access to safe, nutritious food
- Improving the social and economic wellbeing of agricultural communities.

In general two approaches are taken using biological indicators as a measure of environmental health. The first is measuring a specific species which is sensitive to change in the environment. The second is to measure the biological diversity of a given geographic area. Sustainability however, is more complex and requires a number of indicators (Bell and Morse, 2008).

Using a number of indicators to determine sustainability adds an additional layer of complexity, for example if one indicator is within the prescribed limits, but another is not, is the system rated as sustainable or not (Bell and Morse, 2008)? When using a number of sustainability indicators to create an index or more complex system of sustainability assessment the weighting of individual indicators may be important. For example, determining whether an apple is more sustainable if it comes from a local farm in a water scarce growing area or if it travels from a distant water rich area depends on the weighting of transportation pollution and water depletion (Antsey, 2010). Many of the aggregated approaches (those that include more than one indicator) choose to avoid weighting indicators, instead choosing to weight all indicators equally.

Another important note is that sustainability indicators need not be quantifiable. Miller (2007), uses the example of BGH-free labels on milk as a non-numerical indicator which effectively communicates information needed for decision making. Many of the programs evaluated in subsequent sections used compliance rather than quantifiable sustainability measures.

Indicators can also be used at varying points of environmental change. Compliance indicators are used to show a change from conditions at a prior point in time, diagnostic indicators can identify the specific cause of a problem and early warning indicators can alert users to upcoming larger changes (Walker, 2002). Compliance indicators typically do not provide any information about the source of the change in environment (Bell and Morse, 2008).

Another concern with the use of sustainability indicators is that they are often created to use existing data that are readily available, because new data may be difficult to obtain or make sense of in a timely fashion (Miller, 2007). Using existing data also reduces the cost of introducing and using sustainability indicators, but leads to indicators that may not be as effective as creating indicators using new data. In terms of agricultural sustainability, measures need to be easy to collect and useful to farmers in allowing them to make decisions to change practices (Hayati et al, 2011).

Threshold indicators which set acceptable limits for resource conditions are popular; a common example would be emissions levels. However, the variability of values across geospatial areas must be considered when looking at environmental threshold indicators (Walker, 2002). An alternative to threshold measures would be relative measures, which compare different systems among themselves or with other selected reference systems (Hayati et al, 2011). Sustainability also has a dynamic nature; practices that contribute to sustainability now, are subject to shift as systems change (Hyati et al, 2011). Dumanski et al. (1998), suggest that given this dynamic nature, tracking changes in indicators over time is more useful than setting threshold limits as sustainability is likely never to be achieved, but rather is a concept towards which we should move.

According to Hayati et al (2011), indicators that are acceptable for measuring sustainability in aggregate are not appropriate for measuring sustainability at the farm level and conclude that “most agricultural scholars believe that measuring sustainability at the farm level is the most precise method”. At the same time, policies enacted at higher levels (ie: municipal, national)

impact farm level sustainability as well (Hayati et al, 2011). Bell and Morse (2008) point out that any indicator chosen is an over simplification of the real world. This inevitably leads to limitations for all indicators, but it should be recognized that these are indicators rather than true representations of the real world. “Indicators can be very useful… but they work best when dealing with limited, well-defined situations and when the methodology and interpretation can undergo rigorous testing” (Bell and Morse, 2008).

Agricultural sustainability can be thought of as comprised of three components: social, economic and ecological sustainability (Hayati et al, 2011). These three components take into account the multifunctional nature of agriculture. Many indicators fail to account for the interactions and interdependencies between the three components of sustainable agriculture (Hayati et al, 2011). Using a number of indicators, most of the major sustainability standards capture each of these goals, but they vary significantly with regards to weighting of these goals (Giovannucci and Potts, 2008).

Sustainable agriculture is frequently used to describe alternatives that are seen as being more beneficial to the environment than conventional farming methods (Bachev, 2005). This “approach” concept of sustainability may be useful but also has some downside. The application of certain practices or approaches may improve environmental outcomes in a specific geographic location, but may actually be more harmful to the environment in other regions. Additionally, the approach concept may reject approaches of conventional agriculture, which may enhance sustainability (Bachev, 2005).

The complexity of agricultural supply chains for many commodities, leads to miscommunication about what end-users value, as producers tend to rely on product specifications and price signals to determine value (Pulse Canada, 2011). Approaches to sustainability for large-scale annual cropping systems in developed countries are still in their infancy, and most of the research in this area is being done by private business (Pulse Canada, 2011). As a result, producers who may want to improve sustainability of their operations may lack knowledge and understanding of existing indictors and those in development and how they can be used to improve sustainability.

Life Cycle Assessment (LCA) is a common method used to examine environmental impact. “An LCA is an approach that assigns environmental and social impacts to a product by measuring the inputs and outputs that are associated with the entire supply chain of that product” (Anstey, 2010). LCA is an engineering model that has been adopted by the food industry and the results are not always “neat and straightforward (Anstey, 2010).” The use of life cycle assessment is complicated, complex and expensive.

Anstey (2010), identifies some of the issues with life-cycle analysis:

- Decisions made are critical to the results. Changing the decisions can drastically change results.
- Boundaries can be difficult to define and there is a lack of common methodology in defining them

- Challenges with gathering relevant data and appropriately allocating these to a particular product (for example how much of the costs should be allocated to the product vs the by-product).
- Difficult to assess impacts. In some cases, environmental scientists can't quantify the impacts.
- Tendency to over interpret results by confusing the model with reality.

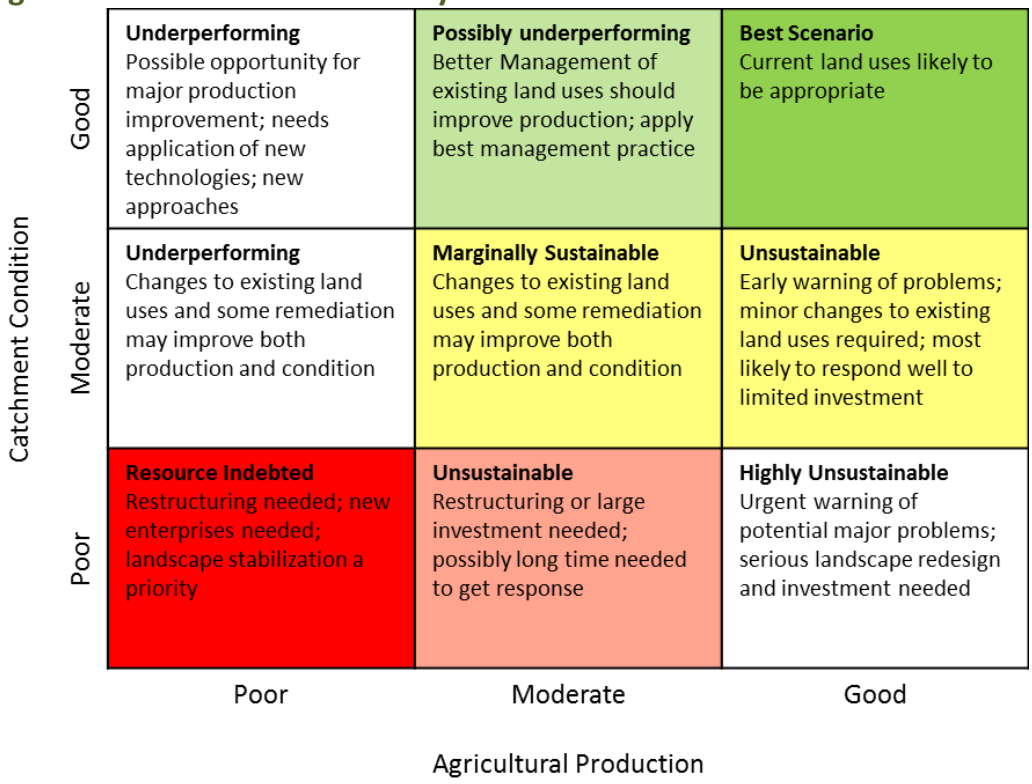
Carbon foot printing is a form of LCA that is used by some retailers in Europe (Anstey, 2010). Anstey (2010) notes that, decisions made based on life cycle analysis may actually have a negative impact on sustainability, if they are not interpreted correct. He cites the example of a Lincoln University study in New Zealand which found that 4 of the 5 commodities examined were more efficient environmentally if produced in New Zealand rather than Europe. However, the study only considered carbon dioxide. If the policy decisions had been made on the basis of these incomplete results, global sustainability may have declined.

Some measures of sustainability also require relatively long periods of time in order to truly assess the sustainability of agricultural practices. Hyati et al (2011) note, "some strategies relating to sustainable development require 5-10 years of implementation before they result in visible or measurable signs of payoff". It can take up to 30 years to develop rainfall trend data that is statistically valid (Dumanski et al, 1998).

Public involvement in the creation of sustainability indicators may have the effect of empowering consumers to set new priorities, realigning institutions and practices creating alternatives to current production and consumption patterns (Miller, 2007).

Walker (2002), presents a cross comparison matrix which uses the environmental condition of the surrounding area or the "catchment condition" and the agricultural production levels in the area to provide an indication of the overall sustainability of the agricultural system (Figure 1).

Figure 1: Matrix of Sustainability



Source: Walker, 2002

Total factor productivity (TFP) is a common measure of sustainability in agriculture. TFP is an index that measures changes in all outputs relative to changes in inputs (Dumanski et al, 1998), with a non-negative trend indicating sustainability. TFP is generally measured at an aggregate level and as such will not provide information on specific farming practices which are highly sustainable versus those that are not (Dumanski et al, 1998). The conventional measure of TFP used by economists often fails to include environmental externalities in calculation (Dumanski et al, 1998). These externalities may impact the sustainability of the system but are not captured in TFP. Total Social Factor Productivity (TSFP) was created to address the problem. Under TSFP non-market inputs and outputs are also included in the calculation. However, the inclusion of non-market factors leads to an issue of valuation (Dumanski et al, 1998); the value that one places on these factors can shift the TSFP measure significantly either towards or away from indicating sustainability. Nevertheless, attempts to determine values contribute to understanding of sustainability.

4 Guidelines for Developing Sustainability Indicators

Much of the literature on sustainability indicators provides guidelines for the development of such indicators. This section provides an overview of some of the suggested criteria for indicator selection. While this is not an exhaustive overview it is provided to show the

similarities and differences in approaches that researchers take to using indicators in assessing sustainability.

In general the examples below show that the availability and reliability of data are major factors to consider when developing sustainability indicators. The recommendations also favor trend analysis rather than specific quantification of results, suggesting that the goal is to sustain over time, or at least to be able to take corrective measures if sustainability declines.

The department of Agriculture, Fisheries and Forestry in Australia (Chesson, 2006) has outlined some of the issues that arise in developing effective sustainability indicators:

- People may be suspicious of the potential use of indicators.
- A specific indicator may not be appropriate in all circumstances.
- Considerable resources are needed to collect, collate and report on these indicators.
- Simple indicator sets have trouble encompassing all aspects of human aspirations, or adequately addressing complex concepts.

Recommendations for Selecting Indicators to measure agricultural sustainability (Hayati et al, 2011)

- Necessity to adoption of a systemic approach
- Establishment and gathering appropriate data base and other necessary information in shape of time series in developing countries
- More emphasis on determining of sustainability trend instead of precision determining amount of sustainability, especially with respect to lack of accessing such data in developing countries
- Launch of professional institutes to monitoring and measuring sustainability of agricultural and industrial systems
- Develop those indicators which are feasible to implementing, meanwhile responsive and sensitive toward any stresses and manipulation on system

Criteria for Development and Inclusion in Field to Market Indicators (Field to Market, 2012):

- National Scale
- Trends over time
- Science Based
- Outcomes-based
- Public Dataset availability
- On-Farm
- Grower Direct Control

Criteria for Indicator Selection (Walker, 2002)

- Reliability
- Interpretability
- Data Availability
- Established Threshold Values
- Known links to process

These factors should be considered in developing indicators to optimize uptake. In addition, “consumers and their ultimate engagement in the process is seen by many as critical to the long term progress of food sustainability initiatives (Pulse Canada, 2011).

Pulse Canada (2011) suggests that there are four elements of environmental sustainability which are becoming priorities for measurement by producers, processing chains and end users. These are:

- Greenhouse gas emissions
- Impacts on water
- Impacts of biodiversity
- Factors that are driving at the core issue of soil health.

In addition to these four elements social impacts are also a key consideration in measuring sustainability of agricultural systems as a whole (Pulse Canada, 2011).

Measuring sustainability performance and therefore establishing sustainability claims is a complex task. Certain consumers may want products that were produced in a sustainable way, but are skeptical of brand manufacturers' claims. To deal with this problem, many manufacturers look to voluntary certification schemes to provide third party confirmation of their claims (Anstey, 2010).

International Institute of Sustainable Development Criteria for Sustainability Indicators

•Policy relevance

Can the indicator be associated with one or several issues around which key policies are formulated? Sustainability indicators are intended for audiences to improve the outcome of decision-making on levels ranging from individuals to the entire biosphere. Unless the indicator can be linked by readers to critical decisions and policies, it is unlikely to motivate action.

• Simplicity

Can the information be presented in an easily understandable, appealing way to the target audience? Even complex issues and calculations should eventually yield clearly presentable information that the public understands.

• Validity

Is the indicator a true reflection of the facts? Was the data collected using scientifically defensible measurement techniques? Is the indicator verifiable and reproducible? Methodological rigor is needed to make the data credible for both experts and laypeople.

• Time-series data

Is time-series data available, reflecting the trend of the indicator over time? If based on only one or two data points, it is not possible to visualize the direction the community may be going in the near future.

• Availability of affordable data

Is good quality data available at a reasonable cost or is it feasible to initiate a monitoring process that will make it available in the future? Information tends to cost money, or at least time and effort from many volunteers.

• Ability to aggregate information

Is the indicator about a very narrow or broader sustainability issue? The list of potential sustainability indicators is endless. For practical reasons, indicators that aggregate information on broader issues should be preferred. For example, forest canopy temperature is a useful indicator of forest health and is preferable to measuring many other potential indicators to come to the same conclusion.

• Sensitivity

Can the indicator detect a small change in the system? We need to determine beforehand if small or large changes are relevant for monitoring.

• Reliability

Will you arrive at the same result if you make two or more measurements of the same indicator? Would two different researchers arrive at the same conclusions?"

Source: IISD 2000, in Miller 2007

Bélanger et al (2012), makes the case for collaborate development of indicators by engaging producers in the development and evaluation of indicators. The study consulted with producers to develop indicators for dairy farm sustainability in Quebec. The indicators were then tested on farm to determine "practicality" and "usefulness" of each indicator tested. Including producers in the development of indicators will likely improve participation in a voluntary standards program.

A more intimate understanding of the situation confronting producers, their incentives, motivations, risks, desired rewards, and intentions will be necessary to develop indicators that will be acceptable to producers. If relatively few producers are equipped to provide sustainability attributes, supplier relationships will need to be managed much more like strategic alliances than simple purchasing agreements. Unless farmers are engaged effectively, sustainability requirement initiatives could end up being a new market access barrier to farmers, which could create social liabilities for processors and retailers, and ultimately limit the availability of sustainably produced product.

5 Sustainability Indicators in Existing Programs

This section discusses indicators that are used in environmental and sustainability assessments and certifications in various geographical locations. Included in this section are both government and industry developed indicators. While not an exhaustive examination the descriptions provided will allow for comparison to current requirements of the Ontario EFP. The first section looks at current food industry initiatives on sustainability.

5.1 Food processing sustainability platforms

5.1.1 Global Reporting Initiative

The Global Reporting Initiative (GRI) is a non-profit organization that provides a global sustainability reporting framework, focusing on environmental, economic, social and governance performance. GRI also provides guidance for sustainability performance in the food processing sector. [1]

5.1.2 Canadian Agricultural Sustainability Dialogue

A number of food companies participated in the Canadian Agricultural Sustainability Dialogue. "The Dialogue" was a national multi-stakeholder initiative, that included retail and consumer products company interests, designed to develop a sustainability approach that builds on existing sustainability programs that provides benefits to key stakeholders along the crop supply chain in Canada. The EFP has been discussed in the Dialogue (Loose, 2013).

[1] https://www.globalreporting.org/

5.1.3 AIM-Progress

AIM-PROGRESS is a global initiative that establishes a forum of consumer goods manufacturers and suppliers to: “enable and promote responsible sourcing practices and sustainable production systems”. Members from the food sector, among others, include Kellogg’s, Kraft, McCain, MacDonald’s, Nestle, Pepsico, Coca Cola and Unilever. The objectives, as listed on the AIM-progress website are: to provide a forum for the exchange of ideas and learning; information sharing – such as SAI; and the promotion of common evaluation methods by encouraging suppliers to share their audit reports with many customers to avoid duplicate audits. "An audit for one is an audit for all".[2]

5.1.4 The Consumer Goods Forum

The Consumer Goods Forum (CGF) was created in 2009 and is a global member driven industry network. Members are CEOs and senior management of over 400 retailers, manufacturers and service providers across 70 countries. The aim of the CGF is to provide a platform for knowledge exchange and initiatives around the areas: emerging trends; sustainability; safety & health; operational excellence; and knowledge sharing & people development.[3] In March 2013, the CGF’s published an “Activation Toolkit for Sustainability”, looking at deforestation (including sourcing sustainable beef), refrigeration, measurement of GHG emission and packaging.

5.1.5 Sedex

Sedex is a company that offers an online database which allows members to store, share and report on information on four key areas: labour standards, health & safety, environment and business ethics. Suppliers can share their information on the database by conducting a self-assessment questionnaire and other documentation such as audit reports and certifications. This information can then be accessed by buyers, which enables them to keep track of their suppliers’ performance. The goal is to cut down on paperwork and save time and money.[4] Sedex operates globally and its members span over 150 countries and many industry sectors, including the food and agriculture industry.

5.1.6 American Meat Institute – Environmental MAPS

The American Meat Institute (AMI), America’s largest meat and poultry trade association, has developed a four tiered environmental management system program for its members. The program is tiered in recognition that business structures require different levels of environmental capabilities based on their business plans, needs and capabilities. [5]

As shown in Table 1, the requirements of each tier increase progressively with Tier I including full implementation of ISO 14001.

[2] http://www.aim-progress.com/index.php
[3] http://www.theconsumergoodsforum.com/about.aspx
[4] http://www.sedexglobal.com/about-sedex/what-we-do/
[5] http://www.meatami.com/ht/d/sp/i/11735/pid/11735

Table 1: Requirements for Tiers of the AMI Environmental MAPS Program

Tier	Requirements
Tier I: Environmental Master	• Commitment of upper management • Develop a core EMS team • Develop and adopt environmental policy • Develop business case • Adopt AMI model pollution prevention plan • Adopt AMI model emergency response plan • Adopt AMI model preventative maintenance plan • Adopt AMI model internal communication plan • Monitor and record water/utility use, wastewater discharge, air emissions and hazardous/solid waste generation rates
Tier II: Environmental Achiever	• Meet Tier 1 Criteria • Expand EMS team • Conduct gap analysis • Adopt 5-9 Environmental Practices • Identify and prioritize environmental aspects and impacts • Develop and implement external communication plan
Tier III: Environmental Pioneer	• Meet Tier 1 and 2 Criteria • Complete "Plan, Do, Check, Act" components • Establish Objectives and Targets • Educate at least one additional facility about EMS program and encourage participation
Tier IV: Environmental Star	• Complete Tier 1, 2 and 3 criteria • Complete Auditing Cycle and Certification checklist • ISO 14001 Certification

Source: AMI (2006).

While specific targets are chosen by the participant to meet their own individual needs, AMI has provided a number of sample environmental indicators which processors may choose and use in their environmental management plans. In developing environmental targets AMI suggests that indicators be: *simple and understandable, objective, measurable and relevant to what the organization is trying to achieve* (American Meat Institute, 2006).

They also provide some indicators for accessing the effectiveness of the management system, including (AMI, 2006):

- Percentage of objectives and targets met on time
- Number of closed corrective actions versus total number
- Number of employee's suggestions for improvement to environmental programs
- Training recipients assessments of training delivered
- Number of non-conformances to internal EMS assessments
- Average time for resolving corrective action

AMI also launched a specific sustainability initiative in 2009. They compiled data from participants to develop benchmarks based on industry averages for "water and energy use, recycling, worker safety statistics, food safety, animal welfare practices, and community outreach". [6] AMI has also produced a Sustainability Self Inventory which processors can use on an ongoing basis to assess where they stand on sustainability issues, determine potential actions, and benchmark themselves over time (American Meat Institute, 2009).

Table 2 Indicators Used in AMI Sustainability Self-Assessment

Category	Indicators
Water Use Practices	• Water reuse system in place to recycle water • Use of water conservation devices throughout the plant • Water conservation program and team in place • Water use metered to account for daily use • Daily report developed and distributed to detail water use trend data and convert water usage to an appropriate cost figure • Determining the needed water pressure and regulating pressure to the facility as a whole, as well as specific water intensive units. • Dry clean up emphasized where possible to minimize waste water • High pressure washdown pumps sized and maintained to deliver adequate but not excessive pressure. • Hose stations and nozzles maintained to provide adequate access and pressure for washdown areas • Nozzles from product cooling/spraying maintained and appropriate flow rate • Recycling of cooling water • Reuse of cooling water • Leak reporting and repair program
Plant and Transportation Energy Use	• Use renewable fuels for heating and cooling plant • Use energy-efficient light bulbs throughout plant • Use motion sensitive lights that turn off when no activity is detected • Use fuel-efficient or alternative fuel fleet vehicles • Use long-haul truck routing planning for efficiency • Use strategic consolidation program • Plan for efficient warehousing • Use bio-diesel and/or other alternative fuels • Have auxiliary power units on refrigerated units to avoid engine idling • Use efficient tires • Use diesel particulate filters • Improved aerodynamics • Have automatic tire inflation systems to maximize fuel efficiency • Have speed governors
Recycling and waste reduction	• Recycle paper, plastics, glass, metals • Recycle pallets • Recycle packing materials • Recycle tires, oil, florescent light bulbs, thermometers • Recycle tritium signs • Use an "environmentally preferred" procurement process
Caring for	• Participate in AMI Worker Safety Awards Program

[6] http://www.sustainablemeatindustry.org/

Employees	• Participate in OSHA's VVP Program • Follow AMI's "Voluntary Ergonomic Guidelines for Meat Packers". • Host worker safety training for all new employees • Provide on-site physical therapy • Provide adjustable work stations to ensure comfort and prevent injuries • Run in-house safety committee • Offer child care assistance • Offer health insurance • Offer ESL tutoring • Provide chaplain services • Provide citizenship assistance • Provide free or reduced meals to employees • Offer discount meat sales to employees • Provide performance awards • Offer profit-sharing program • Offer retirement benefits/pension/401k • Have on site fitness center or subsidize off-site fitness center • Offer work and home programs • Offer wellness programs and/or health risk appraisals • Offer smoking cessation programs
Caring for Animals	• Follow AMI's recommended Animal Handling Guidelines and Audit Guide • Use AMI's animal handling audit internally on a weekly basis • Conduct in-house training program for all new employees who work in live animal handling, stunning and sticking • Send employees to AMI Animal Care & Handling Conference annually • Run in-house animal welfare committee • Have third-party animal welfare audit at least annually. • Use cameras as part of animal welfare monitoring program • Have heat mitigation programs in place for livestock
Caring for Customers: Ensuring safe and nutritious foods	• Provide training in food safety good manufacturing practices • Provide HACCP training • Seek equipment designed according to AMI's Sanitary Equipment Design Principles • Run a toll-free number to respond to customer concerns • Have allergen control program in place • Complete SQF certification
Caring for the Community	• Donate surplus food to food banks • Tutor local children • Purchase FFA or 4-H livestock • Engage in community environmental clean-up projects • Sponsor sports teams • Work with Big Brothers/Big Sisters or similar organizations • Donate food for local events such as festivals, charity runs • Sponsor teams for charity runs/walks • Host Boy/Girl scouts to assist with merit badges

Source: AMI, 2009

5.2 ISO Certification

ISO 14000 series provides a set of internationally recognized standards for environmental management (Sparling et al, 2008). It forms the basis of many of the programs discussed within this study. ISO 14001 has particular emphasis on environmental management systems (Sparling et al, 2008). ISO certification is designed to be applicable to all industries (Sparling et al, 2008), and thus is in some cases of limited application to agriculture. Sparling et al (2008), note that time constraints associated with certification are an issue, however they go on to suggest that if farm groups rather than individual farms undertake certification, scale economies can be achieved which help to offset these costs, relative to potential benefits of certification.

ISO 14001 is based on a "plan-do-check-act" methodology. This is achieved by initial goal/objective and action planning, followed by implementing processes, monitoring, measuring and reporting results, and taking continuous action to improve performance (Sparling et al, 2008). In the planning stages producers are required to develop an environmental policy, which will shape their environmental management plan. They are also required to identify environmental impacts of their operations, over which they have some control, allowing them to form processes and action plans for their environmental management system.

Under ISO 14001 there are no specific environmental performance targets, as the focus is on meeting legal requirements, preventing pollution and continual improvement of performance (Sparling et al, 2008). It is recommended that targets be measurable where appropriate (Sparling et al, 2008), but again, no specific measures are suggested.

Table 3: Implementation and Operation Requirements for ISO 14001

Segment	Requirements
Resources, Roles, Responsibility, Authority	• Management must ensure that resources (human, infrastructure, technology, financial) are available for use within the environmental management system (EMS). • Roles, responsibilities and authorities must be defined, documented, and communicated • A specific representative should be appointed to ensure that the EMS functions in accordance to international standard and to ensure management understands the performance of EMS and potential areas for improvement.
Competence, training, awareness	• Any person performing tasks that may have significant environmental impacts must be deemed competent on the basis of education, training or experience. • Training needs should be identified and adequate training should be provided and records should be kept of training activities. • Procedures should be in place to inform employees of the importance of complying with the environmental policy, the requirements of the EMS, the potential environmental impacts of their work and the benefits of improved performance, their role and responsibility in conforming to the EMS and consequences of not following procedures.

Communication	• Procedures should be developed for internal and external communications. • External communication about environmental decisions can be communicated through management approved methods.

Documentation	• Required documentation includes:
	  ○ The environmental policy, objectives and targets.
	  ○ Description and scope of the EMS
	  ○ Description of the main elements of the EMS and the relationships between them
	  ○ Documents and records as required by the international standard
	  ○ Documents and records that the farm business feels is necessary to ensure proper planning, operation and control of processes that relate to its environmental aspects.

Control of documents	• Processes must be in place to approve, review and change documents to ensure they are updated and secure
Operation Control	• Identify and plan operations associated with significant environmental aspects to ensure they are carried out in the proper manner
Emergency Preparedness	• Establish procedures and responses for emergency situations and potential accidents that can impact the environment.

Source: Sparling et al, 2008

Farm managers are also responsible for monitoring and measuring elements of their environmental management system. Part of this includes internal auditing to review progress and plan for corrective action for non-compliant activities (Sparling et al, 2008). In Canada, the Standards Council of Canada approves accredited organizations to assess conformity of on farm EMS to ISO 14001 standards.

Sparling et al. (2008) conducted case studies to provide a more in-depth perspective on agricultural businesses and industries that have adopted ISO 14001 around the world. One of these case studies was the Norfolk Fruit Growers' Association (NFGA). The NFGA is located in Simcoe, Ontario, Canada and is a co-operative that provides packing, storing and marketing for its members. The NFGA obtained the ISO 14001 certification as part of a Canadian Federation of Agriculture (CFA) project. The goal of the CFA project was to assess possible gaps and upgrades needed to transform agricultural industries to meet ISO 14001 requirements based on Ontario Environmental Farm Plan prerequisites. The main incentive for the NFGA to obtain ISO 14001 certification arose from the pressure of UK importers that required an environmental management system (Yiridoe and Marett, 2004).

According to O'Neill (2008), the general manager of the NFGA, the ISO certification was initially advertised on letterheads and sales information. However, there was no observable positive impact on sales. At the beginning, many potential customers expressed interest in the ISO certification; however, that did not translate into a significant business impact. This evidence reinstates what other authors (Wall et al., 2001) have claimed regarding the fact that a firm must enhance customer awareness of the environmental impacts of ISO 14001 before it can reap any benefits from an ISO 14001 registration.

The association decided not to proceed with the official audit for cost reasons and the fact that the ISO 14001 certification did not result in business benefits. According to O'Neill (2008), the ISO implementation was very paper and record intensive and took a lot of staff time. Furthermore, the compliance audit and internal auditor training took more staff time and proved to be more costly than expected. The only advantage of the ISO 14001 implementation was that an in-depth look at the business was facilitated. It provided an excellent overview on how processes work. The general recommendation from O'Neill was that a company should only implement the ISO 14001 system if it is very sure to have and find more customers to buy their products.

Figure 2: Advantages and Disadvantages of ISO certification

Advantages

- Enhanced organization image (process branding) among external stakeholders and the general public
- Better systemization of the existing environmental activities
- Potential market advantage through premiums in the case of environmentally sensitive consumers
- Cost savings on account of internal waste reduction (of natural resources) and better avoidance of environmental risks and litigation
    - Cost reduction by decreasing initial input rates and reusing/recapturing excess wastes, and lower insurance costs due to certification.
- Provision of market signals through environmental labeling
- Good environmental practices within the supply chain
- Reduced liability risks
- Anticipating and reducing government regulation

Disadvantages

- Annual audit for farm businesses may be expensive
- Adoption is challenged at the farm level by the high costs involved in complying with these standards
- Continuous improvement entails additional investment over time
- Complexity of environmental issues adds to the time and cost incurred by the farmer.
- Time requirements
- Lack of expertise in developing environmental policy for farm
- Only farm level certification is available
- Difficult to show consumer value because it is process based

Source: Sparling et al, 2008

5.3 Canada

5.3.1 Agriculture and Agri-food Canada Agri-Environmental Indicators

Agriculture and Agri-food Canada (AAFC) uses the Agri-Environmental Indicators (AEIs) "to conduct comprehensive national assessments and report on the agri-environmental performance of primary agriculture and the food and beverage processing industry" (Eilers et al., 2010).

To develop these indicators AAFC developed a set of criteria in order to allow for consistent and credible analysis. These criteria state that indicators must be (Eilers et al (eds.), 2010):

- Policy relevant
    - Must examine issues that government and industry are seeking to address
- Scientifically sound
    - Relying on scientific methodologies that to get results that are reproducible, defensible and accepted. They may also be developed in stages as methods and knowledge improves.
- Understandable
    - The significance of an indicator must be understood by a non-scientific audience
- Capable of identifying geospatial and temporal change
    - Allow for identification of trends over time and space.
- Feasible
    - Indicators should make use of existing data as much as possible, or be economically efficient to develop.

AAFC uses risk indicators, state indicators and eco-efficiency indicators in their assessments. Census data and special data surveys, such as the Farm Environmental Management Survey, are used to evaluate the impacts of Canadian agriculture on the environment, using mathematical models and formulas (Eilers et al (eds.), 2010). The models are largely based on the work of the Soil Landscapes of Canada (SLC) working group. Spatial aspects of the indicators are developed using Soil Landscapes of Canada polygon areas, as well as watershed boundaries to allow for analysis of effects on soils and waterways.

The food and beverage indicators focus on the intensity of resource use and waste discharge in the course of production (Eilers, 2010). Indicators for the food and beverage industry are relatively new, preventing trend analysis at this time (Eilers et al (eds.), 2010). Over time the indicators developed by AAFC will allow analysis of environmental performance of food and beverage processors across Canada.

Indicators are standardized and presented in a 5 class rating system. This applies to all indicators and allows for generalized meaning to be interpreted from the results. The Agri-Environmental performance index allows for comparison of status and trends over time.

AAFC recognizes the complexity of assessing environmental performance and lists a number of limitations on the use of AEIs (Eilers, 2010):

- Knowledge gaps
  - Indicator development is limited based on current understanding of ecosystem processes
  - For some indicators quantification methods are less developed
  - Boundaries for classification under the 5 class system are not always based on science-based thresholds, but rather rely on expert opinion in some cases
- Scaling up
  - Models are developed and tested at the field level and may be less reliable when applied to larger aggregations
- Data Issues
  - All data carries uncertainty.
  - Some data may not be available for all areas or time periods
  - Indicators are often calculated over different spatial components than the data was collected. Census data is based on political boundaries while SLC polygons are based on biophysical boundaries.
- Reliability
  - There is little experimental data to calibrate or validate results to

Table 4 and 5 summarize the indicators used by AAFC in their analysis.

Table 4: Agri-enviromental indicators use by AAFC for primary agricultural production

Category	Indicator used	Description	Status
Farm Land Management	Soil Cover indicator	• Number of days agricultural soils are covered and protected from erosive forces • Canopy development and decline between planting and harvest • Decomposition of residue • Removal of straw through baling or burning • Multiple cuts and grazing on hay and pasture	Fully developed
	Wildlife Habitat Capacity on Farmland	Capacity of agricultural lands to provide suitable habitat for terrestrial vertebrates • Land cover types are values based on use and habitat capacity for 588 species of bird, mammals, reptiles and amphibians	Fully Developed
	Water Use Efficiency Indicators for Irrigation	Estimate physical and economic productivity of water use for irrigated cropping	Under Development
	Risk of Wildlife Damage	Identify areas of higher than average risk of damage by wildlife and how risk is changing over time	Under Development
	Risk from Invasive Alien Species	Assess trends in population distribution and in numbers of invasive alien species in agricultural habitats	Under Development

Category	Indicator used	Description	Status
Soil Health	Soil Erosion Risk Indicator	Combined Risk of water, wind, and tillage erosion based on climate, soil, topography and farming practices	Developed
	Soil Organic Carbon Change Indicator	Change in organic carbon levels over time in agricultural soils	Developed
	Risk of Soil Contamination by Trace elements Indicator	Assessment of 6 key trace element inputs from fertilizer, manure, municipal biosolids and atmosphere • Assesses concentration in agricultural soils over time	Developed
	Risk of Soil Salinization Indictor	Estimates risk of soil salinization due to changes in land use and management practices (Prairie provinces only)	Developed
	Risk of Desertification Indicator	Estimate of areas of the Prairies at high risk for desertification	Under Development
Water Quality	Residual Soil Nitrogen Indicator	Estimates efficiency of nitrogen management by estimating excess nitrogen remaining in soil after harvest	Developed
	Indicator of the Risk of Water Contamination by Nitrogen	Uses residual soil nitrogen indicator to assess risk of nitrogen leaching into groundwater	Developed
	Indicator of Risk of Water Contamination by Phosphorus	Estimates relative risk of agricultural Phosphorus reaching surface water in Canadian watersheds	Developed
	Indicator of the risk of Water Contamination by Coliforms	Assesses the relative risk of enteric microorganisms from agricultural sources contaminating surface water bodies using Coliforms as a market	Developed
	Indicator of the risk of Water Contamination by Pesticides	Estimates the relative risk of pesticides reaching surface and groundwater in agricultural areas in response to agricultural management practices and chemical properties of the pesticides	Developed
Air Quality and Greenhouse Gases	Agricultural Greenhouse Gas Budget Indicator	Estimate of net on-farm GHG emissions of nitrous oxide, methane and carbon dioxide	Developed
	Ammonia Emissions from Agriculture Indicator	Estimates agricultural ammonia emissions	Developed
	Agricultural Particulate Matter Indicator	Estimates the agricultural contribution to airborne primary particulate matter	Developed
	Agricultural Odour Emissions Indicator	Rate at which odour mitigation methods are adopted by Canadian Farms	Under Development

Source: Huffman and Eilers (2010), Huffman and Coote (2010), Javorek and Grant (2010).

Table 5: Environmental indicators used by AAFC for the food and beverage industry

Indicator	Description
Energy Consumption Intensity Indicator	Measures the amount of energy used per dollar of manufactured goods produced • (MJ/$)
Greenhouse Gas Emissions Intensity Indicator	Measures the amount of GHG emitted • Carbon dioxide equivalent per dollar of manufactured goods produced (Kg CO_2e/$)
Water Intake Intensity and Water Discharge Intensity Indicators	Measures the total water intake and waste water output of the plant • Liters per $ of product sold
Packaging Use Intensity Indicator	Measures the annual purchases of packaging material per dollar of production

Source: Summary, Food and Beverage industry, in: Eilers et al (eds.)(2010)

Figure 3: Advantages of Disadvantages of AAFC Agri-Environmental Indicators

Advantages

- Data Collected and analyzed by government experts
- National analysis can compare progress across regions
- Comprehensive set of environmental indicators

Disadvantages

- Funding of collection and analysis dependent on government policies and priorities
- Regional rather than farm level analysis, helps to indicate potential areas for action but does not measure changes as the result of specific changes in farm management strategy
- Indicators use different spatial measures (ie some farms may be in one region for some indicators and another for others)
- No indicators for social or economic sustainability

5.3.2 CAN/CSA Z771: Environmental Management Systems for Hog Operations

Introduced in 2004 and reaffirmed in 2009[7], the CAN/CSA Z771 standard provides third party certification for environmental management systems for hog producers. The standard was requested by the Canadian Pork Council in cooperation with Agriculture and Agri-food Canada to provide a voluntary national environmental standard for hog operations in Canada (Sparling et al, 2008).

The Z771 Technical Committee is comprised of stakeholders who are potentially affected by the standards, including producers, government agencies, industry representatives, environmental groups and consumer groups from across Canada (Canadian Standards Association, 2004).

[7] http://shop.csa.ca/en/canada/environmental-management-systems/cancsa-z771-04-r2009/invt/27020702004/

The standard includes both management system and environmental performance components (Sparling et al, 2008). The management component is designed to encourage environmental considerations into the daily operations of the hog operation and the performance standards set norms for performance of operations or its products/services (Sparling et al, 2008).

The CAN/CSA Z771 standards are based on the ISO 14001 standard but have been adapted specifically for hog operations in Canada (Sparling et al, 2008), this means that it is more directly applicable to farm operations and may result in greater uptake. Much of the ISO 14001 requirements, as described in section 4.2 apply to CAN/CSA Z771, additional requirements are described below.

Figure 4: Advantages and Disadvantages of CAN/CSA Z771

Advantages

- Improving overall environmental performance
- Demonstrating commitment to compliance with applicable laws and regulations
- Eliminating or minimizing environmental incidents
- Improving response to environmental incidents
- Improving efficiencies through reduced resource use and waste
- Maintaining or improving market access and competitiveness
- Improving relationships with neighbours, regulators, customers and others
- Reducing environmental risk
- Increased employee involvement, health and productivity
- Better access to international trade

Disadvantages

- Cost
- Producers don't understand potential benefits, so adoption is low

Source: Sparling et al, 2008

The minimum requirements for environmental objectives are as follows (Sparling et al, 2008):

- Ensure compliance with legal requirements
- Eliminate point source discharge of manure to surface and ground water
- Reduce runoff to surface and ground water from non-point sources
- Apply manure and nutrients in accordance to manure/nutrient land application plan
- Control odour and dust from the operation
- Control disease transmitting pests
- Ensure responsible management of mortalities

The standard requires that targets be set of zero legal violations and zero point source pollution of water sources (Sparling et al, 2008). The standard also suggests that producers make a yearly summary of their EMS practices, based on their most recent third party audit.

5.4 United States

5.4.1 USDA Environmental Benefits Index

The USDA uses the environmental benefits index to allow for evaluation of applications to the Conservation Reserve Program (CRP). Under CRP producers are compensated for taking land out of agricultural production for conservation. Producers submit bids to the program, based on practices that are being undertaken or will be undertaken under the program and the bids are evaluated using the environmental benefits index to determine which lots of land are accepted into the program (USDA-FSA, 2011).

The environmental benefits index scores are based on the expected environmental benefits to soil resources, water quality, wildlife habitat and other concerns which vary according to time of enrollment (Rudy, 2003). Table 6 shows the determination of points for ranking bids to the CRP program.

Table 6: Determination of Environmental Benefits Index score for Conservation Reserve Program

Factor	Points Awarded	Calculation of Factor	Description of how points are determined
N1 Wild life Factor Score	0-100	N1=N1a+N1b+N1c	N1a (0-50 points) Wildlife habitat cover benefits score • FSA assigns points for cover practice planting mixtures based on the potential value to wildlife within each state. N1b (0, 5 or 20 points) Wildlife Enhancement • Points are provided for actions producers take to enhance the wildlife benefits for the offered acreage. N1c (0 or 30 points) Wildlife priority zones • FSA consulted with farm, commodity, wildlife and environmental groups to develop high-priority wildlife areas that would benefit from being enrolled in CRP, 30 points are awarded if 51% of the offered acreage is in this zone.
N2 Water Quality Benefits from Reduced Erosion	0-100	N2 = N2a+N2b+N2c	N2a (0 or 30 points) Location • Evaluation of the benefits of improving ground or surface water quality impaired by crop production. • States have identified water quality zones for protection. At least 51 percent of the acreage offered must be within an approved water quality zone to receive 30 points. N2b (0 to 25 points) Groundwater Quality • Point scores are based on the weighted average leach index for soils offered for

			enrollment and the population that utilizes groundwater for drinking. N2c (0 to 45 Points) • This factor is determined by potential water erosion, distance to the water and the watershed in which the offer is located.
N3 Erosion Factor Point	0-100		• Factor N3 is an evaluation of the potential for the land to erode as the result of either wind or water erosion ○ FSA awards points for the weighted average of the higher value of wind or water erosion erodibility index
N4 Enduring Benefits Factor	0- 50		• Evaluation of the likelihood for certain practices to remain in place beyond the CRP contract period.
N5 Air Quality Benefits From Reduced Wind Erosion Point	0-45	N5 = N5a+N5b+N5c+N5d	N5a (0 to 25 points) Wind Erosion Impacts • FSA will award points based on potential wind erosion and the amount of population that may be impacted by the erosion. N5b (0 or 5 points) Wind Erosion Soils List • If at least 51 percent of the offered acres are comprised of soils which are susceptible to wind and negatively impact air quality standards. N5c (0 or 5 points) • FSA awards a maximum of five points if at least 51 percent of the acreage offered is located in an air quality zone that contributes to nonattainment of air quality standards and the calculated weighted wind EI is equal to or greater than three. N5d (3-10 points) • Evaluation of the benefits of sequestering greenhouse gases by practice over the expected life of the practice.
N6 Costs		N6=N6a+N6b	N6a (point value determined after end of sign up. • Offers with lower per acre rental rates may increase chances of being accepted N6b (0 to 25 points) • Points are awarded based on relationship to maximum payment rate.

Source: USDA-FSA (2011)

Figure 5: Advantages and Disadvantages of USDA Environmental Benefits Index

Advantages
• Producers receive income for taking/avoiding action to improve environmental quality • Bids accepted based on cost-benefit analysis, protecting most vulnerable land
Disadvantages
• Subjective points allocation (different agents may award different points for same land) • Maximum points in one category, may underestimate the need for environmental protection • Discourages more costly actions which could provide greater environmental benefits in order to keep bids low, improving chance of selection. • Limitations of acreage and funding mean that producers who may be interested in taking action for some compensation will be denied access to the program

5.4.2 Keystone Alliance for Sustainable Agriculture - Field to Market

Field to market, the Keystone Alliance for Sustainable Agriculture is a "collaborative stakeholder group of producers, agribusiness, food and retail companies, conservation and non-profit organizations, universities and agency partners that are working together to define, measure, and develop a supply-chain system for agricultural sustainability"(Field to Market, 2012).

Their 2012 report looked at environmental trends in the United States from 1980 to present for corn, cotton, potatoes, rice, soybeans, and wheat. The Keystone Alliance also looked at socio-economic indicators; these were done by farm type. The purpose of their report is to provide "broad-scale, commodity level progress relevant to key challenges and indicators for agricultural sustainability" (Field to Market, 2012).

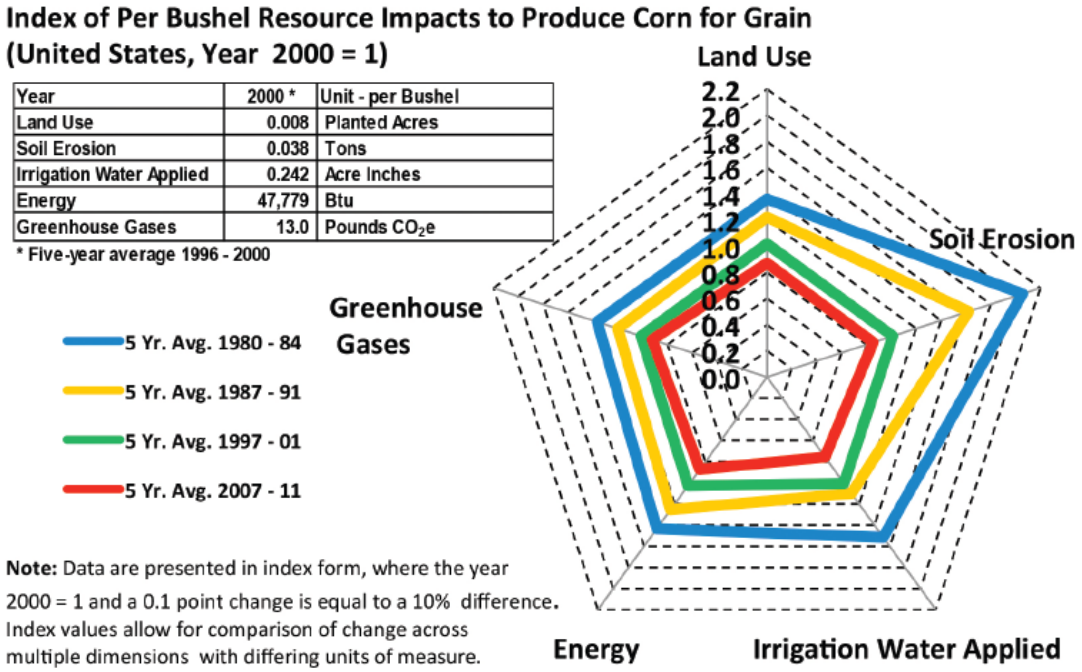
Table 7 summarizes the indicators used in their analysis. Farm type measurements for socio-economic indicators are in parenthesis. Field to Market uses spider charts to show progress or lack of progress for each commodity for land use, soil erosion, irrigation water, applied energy use and greenhouse gases. An example for US corn is shown in Figure 6.

Table 7: Field to Market Indicators

Environmental indicators	
Production and Yield	• Total Production • Yield per planted acre
Land Use	• Land use per unit of production • Total land use
Soil Erosion	• Soil erosion per unit of production • Per acre soil erosion • Total soil erosion
Irrigation Water Applied	• Irrigation water applied per unit of production • Per acre irrigation water applied • Total irrigation water applied
Energy use	• Energy use per unit of production • Per acre energy use • Total energy use
Greenhouse Gas Emissions	• Greenhouse gas emissions per unit of production • Per acre greenhouse gas emissions • Total Greenhouse gas emissions
Socio-Economic Indicators	
Debt to asset ratio	• Debt to asset ratio (Cash Grain Farms)
Contribution to National GDP – Crops and Livestock	• Billions of Dollars – Nominal (Total Crops and Livestock) • Share of total GDP (Total Crops and Livestock)
Non-fatal Injuries and fatalities	• Number of non-fatal injuries (U.S. crop farms, excluding Fruit, Vegetables and Horticulture Farming) • Workdays lost (U.S. crop farms, excluding Fruit, Vegetables and Horticulture Farming) • One or more days lost (U.S. crop farms, excluding Fruit, Vegetables and Horticulture Farming) • Number of fatalities (U.S. crop farms, excluding Fruit, Vegetables and Horticulture Farming) • Number of fatalities (U.S. crop farms, excluding Fruit, Vegetables and Horticulture Farming)
Labour Hours	• Hours/Planted Acre (Corn, Cotton, Rice, Soybeans, Wheat) • Hours/unit produced (Corn, Cotton, Rice, Soybeans, Wheat)
Net Returns Above Variable Costs (Real year 2000 dollars)	• $/Acre (Corn, Cotton, Rice, Soybeans, Wheat) • $/unit (Corn, Cotton, Rice, Soybeans, Wheat)

Source: Field to Market (2012)

Figure 6: Index of Per Bushel Resource Impacts to Produce Corn for Grain, United States, 1980-2011



Source: Field to Market (2012)

Figure 7: Advantages and Disadvantages of Field to Market

Advantages

- Compares sustainability across crops within a geographic region (U.S.)
- 5 year average smoothes out single year shocks in trend analysis
- Includes measures of environmental, economic and social sustainability
- Can be calculated with publically available data

Disadvantages

- National level analysis, does not provide any indication of farm level improvement over time
- Crop level analysis ignores whole farm sustainability (ie: overall farm practices may be more sustainable than indicators show)

5.4.3 Certified Environmental Management Systems for Agriculture

The Certified Environmental Management System for Agriculture (CEMSA) is an adaptation of ISO 14001 using the Natural Resource Conservation Service's nine step planning process[8]. The program is run by the Iowa Soybean Association and connects farmers with consultants who assist them in developing an environmental management framework.

Under CEMSA producers use the Agricultural Data Analysis and Planning Tool (ADAPT) to measure, monitor and validate processes. CEMSA also uses a tier system with the final tier involving 3rd party auditing and certification[9].

CEMSA uses a self-assessment tool to help producers target their environmental management plans to the concerns that are most appropriate for them and uses a scorecard to help in decision making. Figure 8 shows the risk scoring chart that producers use to determine which environmental issues are of most concern on their farm.

In some cases participation in CEMSA can be beneficial in receiving funding through USDA conservation programs (Sparling et al, 2008).

Figure 8: Risk Scoring Under CEMSA

Risk Assessment Scoring Matrix (likelihood x severity) = Risk Assessment Score

Likelihood (probability)		Severity (negative environmental result)	
Continuous (daily)	5	Breaks Law, Guideline or Rule	5
Very frequent (once a week)	4	Severe Impact	4
Frequent (2 or times per year)	3	Moderate Impact	3
Seldom (once a year)	2	Indirect Impact	2
Once in 2 years	1	Minor Indirect Impact	1
Never happened or heard of	0	Negligible	0

Public Concern Indicator Matrix	
High Level of Concern (Receive a complaint call, letter, personal visit, etc.)	3
Moderate Level of Concern (Occasional comments from the public)	1
Low Level of Concern (No comments, calls, visits or letters)	0

Source: Iowa Soybean Association (2010).

[8] http://www.iasoybeans.com/environment/programs-initiatives/cemsa-adapt
[9] http://www.iasoybeans.com/environment/programs-initiatives/cemsa-adapt/program-explanation

Figure 9: Decision Making Matrix for CEMSA

Table 2: CEMSA Decision and Development Tool for Sample Farms

ASPECT	IMPACT	RISK ASSESSMENT Likelihood x Severity + Public Concern Indicator = Total Score				SWAPA (y/n)	LEGAL (y/n)	CURRENT MGMT STATUS (y/n)	SIGNIFICANT IMPACT (y/n)
		Likeli-hood	Severity	Public Concern	Total Score				
Fall Tillage	Erosion	3	3	1	10	S1,S2,S9	Yes	Yes – cons plan	Yes (score)
	Water Quality	3	2	3	9	W6,W9	No		No
	Dust	2	1	1	3	A4	No		No
Herbicide Application	Compaction	2	1	0	2	S8	No	No	No
	Water Contamination	3	3	3	12	W8	No		Yes (score)
	Drift	3	2	3	9	A1	Yes		Yes (legal)
Cattle Trails	Erosion	4	2	0	8	S3	No	No	No
	Compaction	4	1	0	4	S8	No		No
	Sedimentation	3	2	1	7	W9	No		No
	Plant Health	5	1	0	5	P3	No		No
Rotational Grazing	Positive for water/plants						No		

Source: Iowa Soybean Association (2010).

Figure 10: Advantages and Disadvantages of CEMSA

Advantages

- Increased awareness of environmental and conservation issues
- Provides on-farm assessments that allow farmers to focus on priority issues
- Measures baseline data for those issues and helps to evaluate activities
- Prevents pollution
- Assists with government conservation programs
- Focused on the bottom line

Disadvantages

- Time requirements
- Environmental benefits may not be realized in the short term

Source: Sparling et al, 2008

5.5 Australia

5.5.1 Standing committee on Agriculture Resource Management (SCARM)

In the 1990s the Standing Committee on Agricultural Resource management developed an indicator framework for making sustainability assessments in the agriculture sector (Walker, 2002). Some of these indicators were later used in the National Land and Resources Audit (Walker, 2002). It was recognized that the original attributes measured did not allow for a full assessment of agricultural sustainability and an additional list of attributes that were not assessed by SCARM was developed (Walker, 2002).

Table 8: SCARM Indicators

SCARM Indicators	Attributes assessed by SCARM	Attributes not Assessed by SCARM
Long-term real net farm income	• Real net farm income • Total factor productivity • Farmer's terms of trade • Average real net farm income • Debt servicing ratio	• Costs of land degradation • Costs and benefits from remediating degraded resources • $ water use efficiency (for rainfed and irrigated farms)
Natural Resource Condition	Phosphate and potassium balance • Soil condition: acidity and sodicity • Rangeland condition and trend • Diversity of agricultural plant species • Water use by vegetation	• Nitrogen and sulfur balances • Extent of soil structural decline • Level of groundwater reserve exploitation • Extent of land salinization • Assessment of catchment condition
Offsite Environmental Impacts	• Chemical residues in products • Salinity in streams • Dust storm index • Impact of agriculture on native vegetation	• Impacts of soil erosion on river water quality • Extent of nonreserve native vegetation on Farms • soil carbon
Managerial skills	• Level of farmer education • Extent of participation in training and Landcare • Implementation of sustainable practices	• Adoption by industry of best management practices • Extent of farmer access to the internet
Socioeconomic impacts	• Age structure of the agricultural workforce • Access to key services	• Capacity of rural communities to change • Extent of diversification within rural regions • Extent to which current infrastructure, policies and laws support sustainable agriculture • succession planning • extent of owned land and rented land

Source: Walker, 2002

Figure 11 Advantages and Disadvantages of SCARM indicators

Advantages
• Measures environmental, social and economic sustainability • Includes measure of farm skills which would help in determining additional training needs for adoption of sustainable techniques
Disadvantages
• Original set of attributes is insufficient to assess agricultural sustainability • Only some measures have been applied in the National Land and Resources Audit; indicates that some may be difficult to measure (time/financial restraints)

5.6 Europe

5.6.1 SAI Platform

SAI platform is a global food industry initiative, with membership of over 40 leading food companies. The non-profit organization was developed: "to facilitate sharing, at precompetitive level, of knowledge and initiatives to support the development and implementation of sustainable agriculture practices involving the different stakeholders of the food chain."[10]

A Sustainability Performance Assessment was introduced in 2010. So far two phases have been completed, with a third phase introduced in 2011:

1. List and benchmark of existing indicators
2. List and benchmark of sustainability tools

Phase 3 is the development of fact sheets for the development of software to complement the Farm Management system, which will include calculation tools for the indicators included in the assessment. This phase resulted in version 1.0 of the SPA report in May 2012[11]. The guidelines will now undergo pilot testing in 2012-13 with version 2.0 of the report to be published in 2014. The SAI platform also has an arm operating in Australia since 2007.[12]

The working groups of the SAI platform develop principles and practices for the commodity groups for which they are responsible. The following table shows the principles for Arable and Vegetable crops.

[10] http://www.saiplatform.org/about-us/who-we-are-2
[11] http://www.saiplatform.org/uploads/Modules/Library/spa-onepager-may2012.pdf
[12] http://www.saiplatformaust.org/index.asp

Table 9: Sustainability Indicators for Arable and Vegetable Crops under SAI Platform

	Indicator	Principles
Sustainable Farming System	Site Selection and Management	When planning and managing the farm activities, be aware of the site history (previous land use).
		When planning and managing the farm activities, properly take into account the site specificities (such as topography, neighboring activities, ecological and social conditions).
	Sustainability management system	Maintain a functioning sustainability system on the farm, geared towards continuous improvement.
		Record reliable information on farm inputs and techniques used on the farm.
		Take the opportunity of accessing valuable information and support services to continuously improve the farm overall sustainability.
	Planting Material	Consider the farm's structure & local situation when choosing planting material.
	Integrated crop management	Use rotation practices for annual crops as an important tool of integrated crop management and as a diversified source of income for the farm.
		Use specific cultivation techniques to maintain or improve the physical and biological characteristics of the soil as well as to reduce mineralization and leaching of nutrients.
		Balance fertilization in order to provide the appropriate allowance of nutrients to the crops, taking into account release from other sources such as organic manures, soil organic matter etc.
		Avoid using sludge. If sludge is used though, manage it very carefully on the basis of proper risk assessment.
		Protect crops against pest, diseases and weeds with as little as possible reliance on pesticides. In particular, strive to use Integrated Pest Management (IPM) systems.
		Chose, handle and store agricultural inputs with great precaution as per label instructions.
Economic Sustainability	Safety, quality and transparency	Ensure the safety, quality and transparency of the products throughout the production methods and storage facilities.
	Financial Stability	Seek to achieve long-term stability of the farm income for proper investments and workforce payment
	Market	Seek to get organized and to select efficient trading channels in order to optimize benefits.
	Diversification	Seek to diversify the farm into other farming activities or/and possible non-farming activities if appropriate, in order to increase farm income and to reduce risk linked to market price fluctuations.

	Indicator	Principles
Social sustainability	Working conditions	Provide a cordial and pleasant working environment, free of any type of discrimination (as per ILO convention 111 and Convention 100) and free of disciplinary practices (as per universal declaration of human rights)
		Farm workers and their families (if applicable) have access to suitable sanitary, housing and transportation infrastructures and services.
		Provide recognized employment relationship to workers based on national law and practice.
		Ensure that workers' working hours comply with national and local laws. Overtime performed during peak season is acceptable but duly compensated.
		Ensure that wages and benefits received by workers comply as a minimum with local and national legislation.
		Ensure that working conditions comply with applicable laws as well as international Conventions and Recommendations related to occupational health and safety (as per ILO Encyclopedia on Health and Safety).
		Do not use any form of forced labour (as per ILO conventions 29 and 105).
		Allow workers to form and join unions of their choice and to bargain collectively (as per ILO conventions 87 and 98).
		Do not use child labour (as per ILO conventions 138 and 182 as well as recommendation 146 and Convention 190).
		Seek to assure children access to adequate education as well as to support the education of farm employees and workers.
	Training	Support the training of farm employees and workers on all aspects of sustainable agricultural practices.
	Local Economy	Contribute to provide economic benefits to local communities.
Environmental Sustainability	Soil	Maintain good soil fertility and prevent damage to the environment, soil erosion and pollution.
	Water	Properly manage and optimize water use.
		Properly manage the use of inputs and release of waste water in surrounding water sources.
	Biodiversity	Maintain or enhance biological diversity on the farm.
	Air	Preserve or improve the air quality.
	Climate Change	Minimize adverse impacts on the global environment and climate change.
	Energy	Properly choose and use energy resources.
	Waste	Use crop by-products as much as possible on the farm.
		Properly handle, and if possible recycle waste generated by the farm.

Source: SAI Platform Arable & Vegetable Crops Working Group (2009).

SAI also recently released a financial sustainability assessment tool for arable and vegetable crops. The macros based spreadsheet uses farmer inputted data to "help farmers learn the impact of crop rotation or the relation between cost of a crop and the revenue."

Table 10: Advantages and Disadvantages of SAI Platform

Advantages
• Compliance checklist approach is easy to administer; • Comprehensive indicators cover environmental, economic and social sustainability of production; • Buy-in from top food industry companies (retailers/processors) • Global participation improving marketability of products
Disadvantages
• Currently unproven (still in pilot stage); • No indication of improvement of sustainability over time for any specific indicator

5.6.2 Assured Food Standards

The Assured Food Standards (AFS) is a UK based, supply chain certification scheme, consisting of pre-farm (farm input), farm, post-farm certification. Participants are able to use the trademarked Red Tractor logo. The website offers retailers and distributors access to the database of participants for each commodity group[13]. The standards apply to food safety, animal welfare and environmental protection.

AFS has a number of certification schemes covering various commodities:

- RT Beef and Lamb Farm
- Pigs
- RT Poultry
- RT produce
- RT crops
- RT livestock transport
- RT Livestock markets and Collection Centres

AFS manages and approves third party evaluators to ensure that standards are being met (Intertek Sustainability Solutions, 2009). AFS will also rely on existing certification schemes in some sectors, for example feed suppliers are eligible to be part of AFS certification if they are part of one of 10 certification schemes for feed inputs[14]. Each sector has its own standards manual, but the standards were harmonized in 2010 to bring the core standards in line across the various sectors.[15]

[13] http://assurance.redtractor.org.uk/resources/000/576/837/Industry_Checkers_user_guide.pdf
[14] http://assurance.redtractor.org.uk/rtassurance/prefarm/livestock/feed/schemes.eb
[15] http://assurance.redtractor.org.uk/resources/000/577/129/RT_Website_Harmonisation_FAQ.pdf

Advantages
• Logo for products helps to differentiate product • Provides base standards, but allows for different standards for various production • Incorporates existing standards where available • Includes sustainability of input suppliers • 3rd party evaluation • Checklist approach is easy to administer
Disadvantages
• No measures for economic sustainability • 3rd party evaluation increases cost

5.6.3 Linking Environment and Farming (LEAF)

Based in the UK, LEAF was organized in the 1990s to help farmers improve environmental and business performance (Sparling, 2008). LEAF provides LEAF Marque certification for producers who adopt integrated farm management. Leaf Marque is complimentary to other farm assurance schemes[16]. Farms must be certified for GLOBALGAP Option 2 prior to LEAF Marque inspection (International Trade Centre).

The technical committee for LEAF Marque consists of members of the following organizations[17]:

- The Royal Society for the Protection of Birds
- Department of environment, farming and rural affairs (Defra)
- Natural England (NE)
- Environment Agency
- WWF
- Farming Wildlife Advisory Group (FWAG)
- NSF - CMi Certification Ltd
- Barfoots of Botley Ltd – Growers and importers
- United Kingdom Accreditation Service(UKAS)
- Leading animal welfare charity RSPCA Freedom Food
- Waitrose – UK retailer
- Crop Protection Association
- SAI Global Assurance Services Ltd
- University of Hertfordshire
- SFQC Ltd

[16] http://www.leafuk.org/resources/000/678/140/LEAF_Marque_Global_Standard_ver_10.pdf
[17] http://www.leafuk.org/resources/000/678/140/LEAF_Marque_Global_Standard_ver_10.pdf

The LEAF Marque system uses a series of Critical Failure Points within a checklist of questions to ensure that producers are meeting the standards. The full checklist can be found at: http://www.leafuk.org/resources/000/678/140/LEAF_Marque_Global_Standard_ver_10.pdf

Once registered for LEAF Marque producers are then inspected and certified. Certification under the LEAF Marque program allows producers to use the LEAF Marque logo on their products (Sparling et al, 2008). Participation under this program also requires that invoices and dispatch notices be labelled with the producer's LEAF Marque certificate number, allowing for traceability. The LEAF Tracks system allows consumers to trace product back to the farm through the certificate number.

The cost of membership is based on farm size and ranges from £72 to £288 per year (about $110 to $450 CDN).[18] This is in addition to the fees for other certification schemes required for Leaf Marque certification.

Figure 12: Advantages of LEAF

Advantages
• Compliance with environmental legislation • Potential access to new economic instruments • Improved public image • Informing customers and meeting their needs • Inexpensive means of certification • Marketing product based on LEAF logo • Potential to link to other types of environmental assessments
Disadvantages
• Membership can be costly for large farms • Must be certified in GLOBALGAP Option 2 prior to inspection for LEAF

Source: Sparling et al, 2008

5.6.4 Eco-management and Audit Scheme (EMAS)

Now in its third version the EU Eco-Management and Audit Scheme is "a management tool for companies and other organizations to evaluate report and improve their environmental performance."[19] EMAS is part of Regulation No 1221/2009 of the European Parliament and Council. EMAS is based on the ISO 14001 but includes additional requirements. Producers who are registered under EMAS are also certified under ISO 14001. Table 11 shows the main features of EMAS and ISO 14001 and where they differ.

[18] http://www.leafuk.org/leaf/global/join/farmmember.eb
[19] http://ec.europa.eu/environment/emas/index_en.htm

Table 11: Main Similarities and Differences for EMAS and ISO 14001

	EMAS	ISO 14001
General		
Legal status	• European Regulation (EC) No 1221/2009	• International, commercial standard under private law
Participation	•Voluntary	•Voluntary
Geographical Outreach	• Globally Applicable	• Globally Applicable
Focus and Objective	• Continuous improvement of environmental performance of the organization	• Continuous improvement of the Environmental Management System
Planning		
Environmental Aspects	• Comprehensive initial environmental review of the current status of activities, products and services	• Requires a procedure to identify environmental aspects • Initial review recommended, not required
Legal Compliance	• Proof of full legal compliance is required	• Only commitment to comply with applicable legal requirements • No compliance audit
Employees Involvement	• Active involvement of employees and their representatives	• Not required (ISO 14001 and EMAS both foresee training for employees)
Suppliers and Contractors	• Influence over suppliers and contractors is required	• Relevant procedures are communicated to suppliers and contractors
External Communication	• Open dialogue with external stakeholders is required • External reporting is required on the basis of a regularly published environmental statement	• Dialogue with external stakeholders not required • External reporting is not required
Checking		
Internal Environmental Auditing	• Environmental Management System audit • Performance audit to evaluate environmental performance • Environmental compliance audit	• Includes only the Environmental Management system audit of the requirements of the standard
Verifier/Auditor	• Environmental verifiers are accredited/licensed and supervised by governmental bodies • Independence of the environmental verifier is required	• Certification bodies are accredited through a national accreditation body • Independence of the auditor is recommended
Audits	• Inspection of documents and site visits to be carried out according to the regulation • Check for improvement of environmental performance • Data from environmental statement needs to be validated	• No certification rules in standard (other standards for auditing and certification) • Check of Environmental Management System performance, but no frequency specified or required

	EMAS	ISO 14001
Checking (continued)		
Derogations for SMEs	• Extension of verification intervals from three to four years • Updated environmental statement needs to be validated only every two years (instead of every year) • Environmental verifier takes into account special characteristics of SMEs	• No derogations foreseen
Official registration by authorities	• Publicly accessible register records each organization • Each registered organization receives a registration number	• No official register
Logo	• Yes	• No

Source: European Commission, 2011

As noted, an independent auditor/verifier performs an assessment. This assessment ensures that the environmental policy, management system and audit procedures meet the legal requirements of the regulation, as well as ensuring that the operation's environmental statement is reliable, credible and accurate (Sparling, 2008).

Figure 13: Advantages and Disadvantages of EMAS

Advantages

- allows organizations to:
  - Market their system and information based on environmental improvements
  - Respond to pressures for verified environmental reporting
  - Enhance their use of ISO 14001
  - Demonstrate concern for business and environmental performance
  - Manage environmental risks
  - Enhance business and market opportunities (without the use of the logo specifically on products)

Disadvantages

- Requires ISO certification
- High cost of audit process
- Scheme uses highly technical language
- Logos can only be used for operations not product

Source: Sparling et al, 2008

5.7 Other

5.7.1 Environmental Performance of Agriculture in OECD Countries

The Organization for Economic Co-operation and Development (OECD) collects statistics from member nations on various economic activities. Within their Agriculture data set, the OECD has Indicators of Environmental Performance. The data available does not itself indicate sustainability, but rather the database provides a quick reference for users to find data that they can use to evaluate sustainability of agriculture within their own parameters. The OECD itself provides analysis and context of the indicators (OECD, 2008).

The indicators are national in scope, providing a time series for each indictor across the entire country. The indicators allow users to compare trends across OECD countries, though the absolute values of the indicators vary based on total agricultural production in a given country.

Table 11 provides an overview of indicators that are included in the OECD environmental performance measurements. The OECD develops coefficients to convert raw data on nutrient sources into total nitrogen content derived from these sources. For example, the coefficient is used to convert the number of head of livestock into the nitrogen content of manure output by these animals.

The OECD notes in their analysis of these indicators (OECD, 2008):

"Data availability, quality and comparability are as far as possible complete, consistent and harmonised across the various indicators and countries. But deficiencies remain such as the absence of data series (e.g. biodiversity), variability in coverage (e.g. pesticide use), and differences related to data collection methods (e.g. the use of surveys, census and models)."

Table 11: Environmental performance indicators used by OECD

Category	Subcategory	Indicators
Agricultural Production and Land	Total National Land	• Total land area

	Agricultural Land	• Total agricultural land
		  ○ Arable Crop Land
		  ○ Arable and permanent crop area
		  ○ Pasture Area
		  ○ Other Agricultural land area
		• Other categories of agricultural land
		  ○ Fallow land
		  ○ Woodland area

Nutrients	Gross Nitrogen Balance	• Primary data
		  ○ Nitrogen fertilizer, inorganic and organic products (Tonnes)
		  ○ Livestock numbers (Head)
		  ○ Livestock Manure: withdrawls, changes in stocks and imports (Tonnes)
		  ○ Quantities of seeds and planting materials (Tonnes)
		  ○ Area of Legume crops (Hectares)
		  ○ Agricultural land use (Hectares)

		• Nitrogen content of crops and livestock (calculated by using coefficents)
		  ○ Nitrogen content of inorganic and organic fertiliser products (Tonnes)
		  ○ Nitrogen content of livestock manure production (Tonnes),
		  ○ Nitrogen content of livestock manure: withdrawals,changes in stocks and imports (Tonnes)
		  ○ Nitrogen uptake by crops and forage (Tonnes)
		  ○ Nitrogen content of seeds and planting materials (Tonnes)
		  ○ Nitrogen input from biological nitrogen fixation (Tonnes)
		  ○ Nitrogen atmospheric deposition on agricultural land (Tonnes)

	Gross Phosphorus Balance	• Primary data
		  ○ Phosphorus fertiliser: inorganic and organic products (Tonnes)
		  ○ Livestock numbers (Head)
		  ○ Livestock manure: withdrawals, changes in stocks and imports (Tonnes)
		  ○ Harvested crops and forage (Tonnes)
		  ○ Quantities of seeds and planting materials (Tonnes)
		  ○ Agricultural land use area (Hectares)
		• Phosphorus content of crops and livestock (calculated by using coefficents)
		  ○ Phosphorus content of inorganic and organic fertiliser products (Tonnes)
		  ○ Phosphorus content of livestock manure production (Tonnes)
		  ○ Phosphorus content of livestock manure: withdrawals, changes in stocks and imports (Tonnes)
		  ○ Phosphorus uptake by crops and forage (Tonnes)
		  ○ Phosphorus content of seeds and planting materials (Tonnes)
		  ○ Phosphorus atmospheric deposition on agricultural land (Tonnes)

Pesticides	Pesticide use	• Total Pesticide Use (Tonnes of active ingredients)
	National Pesticide Risk Indicators	Indicators specific to pesticide use in certain countries • Belgium: Risk for aquatic species • Denmark: The annual trend in frequency of pesticide application • Germany: Pesticide risk indices (1987 = 100) • Netherlands: Potential chronic toxic effects for aquatic,terrestrial organisms and leaching into groundwater • Norway: Trends of health risk, environmental risk and sales of pesticides (Average 1996-97 = 100) • Sweden: National level pesticide risk indicators and the number of hectare doses (Index 1988=100) • United Kingom (England and Wales): Total area of pesticide applications (Millions of hectares)
Energy	Energy Consumption	• Total economy wide final energy consumption (Tonnes oil equivalent) • Direct on-farm energy consumption (Tonnes of oil equivalent)

Soil	Water Erosion	• Area of agricultural land affected by water erosion in terms of different classes of erosion (Ha)
		  ○ Total agricultural land area affected by water erosion
		  ○ Tolerable water erosion (<6.0 t/ha/y)
		  ○ Low water erosion (6.0-10.9 t/ha/y)

		○ Moderate water erosion (11.0-21.9 t/ha/y) ○ High water erosion (22.0-32.9 t/ha/y) ○ Severe water erosion (>33.0 t/ha/y)
	Wind Erosion	• Area of agricultural land affected by wind erosion in terms of different classes of erosion (ha) ○ Total agricultural land area affected by water erosion ○ Tolerable wind erosion (<6.0 t/ha/y) ○ Low wind erosion (6.0-10.9 t/ha/y) ○ Moderate wind erosion (11.0-21.9 t/ha/y) ○ High wind erosion (22.0-32.9 t/ha/y) ○ Severe wind erosion (>33.0 t/ha/y)
Water	Nitrates - Measure of water quality	• Surface water ○ Monitoring sites in agricultural areas that exceed recommended drinking water limits (%) ○ Share of agriculture in total emissions of nitrogen (%) • Groundwater ○ Monitoring sites in agricultural areas that exceed recommended drinking water limits (%) ○ Share of agriculture in total emissions of nitrogen (%) • Coastal water ○ Share of agriculture in total emissions of nitrogen (%)
	Phosphorus-Measure of water quality	• Surface water ○ Monitoring sites in agricultural areas that exceed recommended drinking water limits (%) ○ Share of agriculture in total emissions of phosphorus (%) • Coastal water ○ Share of agriculture in total emissions of phosphorus (%)
	Pesticides - Measure of water quality	• Surface water ○ Monitoring sites in agricultural areas that exceed recommended drinking water limits (%) ○ Monitoring sites in agricultural areas where one or more pesticides are present in surface water (%) • Groundwater ○ Monitoring sites in agricultural areas that exceed recommended drinking water limits (%) ○ Monitoring sites in agricultural areas where one or more pesticides are present in groundwater (%)
	Water Use	• Total national water resources ○ National freshwater resources (million m3) • Water withdrawls ○ National water withdrawals (million m3) ○ National surface water withdrawals (million m3) ○ National Groundwater withdrawals (million m3) • Agricultural water resources ○ Total agricultural water withdrawals (million m3) ○ Agricultural surface water withdrawals (million m3) ○ Agricultural groundwater withdrawals (million m3) • Irrigation ○ Irrigation water withdrawals (million m3) ○ Irrigation groundwater withdrawals (million m3) ○ Irrigation area (hectares)

		○ Irrigation water application rates (Megaliters per hectare of irrigated land)
Air	Ammonia	• Ammonia emissions ○ Total ammonia emissions (NH3) (Tonnes) ○ Agricultural Ammonia emissions (NH3) (Tonnes) • Total acidifying gases ○ Ammonia (NH3) (Tonnes acid equivalents) ○ Nitrogen oxide (Tonnes acid equivalents) ○ Sulphur oxide (Tonnes acid equivalent)
	Methyl Bromide	• Agriculture methyl bromide (Tonnes of ozone depletion potential
	Greenhouse Gases (GHG)	• Total GHG emissions ○ National total GHGs (Tonnes CO2 equivalent) ○ Agricultural total GHGs (Tonnes CO2 equivalent) ▪ GHGs emissions from crop production ▪ GHGs emissions from livestock farming • Methane (CH4) ○ National total CH4 (Tonnes) ○ Agricultural total CH4 (Tonnes) ○ CH4 emissions from agriculture soil (Tonnes) ○ CH4 emissions from grassland (Tonnes) ○ CH4 emissions from rice cultivation (Tonnes) ○ CH4 emissions from field burning of agricultural residues (Tonnes) ○ CH4 emissions from livestock enteric fermentation (Tonnes) ○ CH4 emissions from livestock waste (Tonnes) ○ National total CH4 (Tonnes CO2 equivalent) ○ Agricultural total CH4 (Tonnes CO2 equivalent) ○ CH4 emissions from crop production (Tonnes CO2 equivalent) ○ CH4 emissions from livestock farming (Tonnes CO2 equivalent) • Nitrous Oxide ○ National total NO2 (Tonnes) ○ Agricultural total NO2 (Tonne ○ NO2 emissions from agriculture soil (Tonnes) ○ NO2 emissions from grassland (Tonnes) ○ NO2 emissions from livestock waste (Tonnes) ○ NO2 emissions from field burning of agriculutural residues (Tonnes) ○ National total NO2 (Tonnes CO2 equivalent) ○ Agricultural total NO2 (Tonnes CO2 equivalent) ○ NO2 emissions from crop production (Tonnes CO2 equivalent) ○ NO2 emissions from livestock farming (Tonnes CO2 equivalent) • Carbon Dioxide (CO2) ○ National total (Tonnes) ○ Agricultural total CO2 (Tonnes)

Biodiversity	Crops – genetic diversity	• Plant varieties registered and certified for marketing for the main crop categories (Number)
		  ○ Cereals
		  ○ Oil crops
		  ○ Dried pulses/beans
		  ○ Root crops
		  ○ Fruit
		  ○ Vegetables
		  ○ Industrial crops
		  ○ Forage
		• Five dominant varieties in total marketed production for selected crops:
		  ○ Wheat (% share)
		  ○ Barley (% share)
		  ○ Maize (% share)
		  ○ Oats (% share)
		  ○ Rapeseed (% share)
		  ○ Field peas (% share)
		  ○ Soybeans (% share)

	Transgenic Crops – genetic diversity	• Total hectares of transgenic crops

	Livestock – genetic diversity	• Livestock breeds registered and certified for marketing for the main livestock categories:
		  ○ Cattle (Number)
		  ○ Pigs (Number)
		  ○ Poultry (Number)
		  ○ Sheep (Number)
		  ○ Goats (Number)
		• Three dominant livestock breeds in total livestock numbers for the main livestock categories:
		  ○ Cattle (% share)
		  ○ Pigs (% share)
		  ○ Poultry (% share)
		  ○ Sheep (% share)
		  ○ Goats (% share)
		• Risk and conservation status of livestock
		  ○ Total (Number)
		  ○ Cattle (Number)
		  ○ Pigs (Number)
		  ○ Poultry (Number)
		  ○ Sheep (Number)
		• Endangered and critical maintained (under conservation programmes)
		  ○ Total (Number)
		  ○ Cattle (Number)
		  ○ Pigs (Number)
		  ○ Poultry (Number)
		  ○ Sheep (Number)

	Biodiversity	• Agricultural land area under biodiversity management plans (Hectares)
	Organic	• Agricultural land area under certified organic farm management (Hectares)

Farm Management	Nutrients	• Agricultural land area under nutrient management plans (Hectares) • Farms under nutrient management plans (Number) • Farms using soil nutrient testing (Number)
	Pesticide	• Agricultural land area under non-chemical pest control management practices (Hectares) • Arable and permanent crop area under integrated pest management (Hectares)
	Soil	• Agricultural land area under vegetative cover all year (Hectares) • Arable land area under soil conservation management practices (Hectares)

	Water	• Irrigated land area using different irrigation technology systems
		  ○ Flooding (Hectares)
		  ○ High pressure rainguns (Hectares)
		  ○ Low-pressure-sprinklers (Hectares)
		  ○ Drip-emitters (Hectares)

Socio-Economic	Production	• Index of total agricultural production (Base 100 = 1999-2001) • Index of crop production (Base 100 = 1999-2001) • Index of livestock production (Base 100 = 1999-2001)
	Structure	• Share of agriculture in Gross Domestic Product • Total number of farms • Machinery use (Harvesters-Threshers + Tractors) (number)
	Employment	• Primary agriculture employment (Number employed) • Total civilian employment (Number employed)
	Support	• Total Support Estimate (US $) • Producer Support Estimate total (US $) • Producer Support Estimate as a share of farm receipts • Share of output/input support in the total PSE

Source: OECD, Environmental Performance of Agriculture in OECD countries since 1990.

Figure 14 Advantages and Disadvantages of OECD Environmental Performance Indicators

Advantages

- Indicators for environmental, social, economic sustainability
- Data collected from national government statistics agencies, potentially higher accuracy
- Comprehensive list of indicators, many indicators for each category
- Provides data for country total for some indicators allowing calculation of agriculture contribution to national total for indicator

Disadvantages

- National scope, no way to measure farm level improvement
- Data not available for all indicators
- Need to have an understanding of indicators mean (ie: are drip emitters more or less sustainable than low-pressure sprinklers) in order to determine sustainability.

5.7.2 COSA Pilot of Sustainability in Coffee

As reported in Giovannucci and Potts (2008), the Committee on Sustainability Assessment (COSA) examined sustainability outcomes for coffee farms which were certified or registered with sustainability programs to compare the results of various indicators on these farms to those of conventional farms in Nicaragua, Peru, Kenya, Costa Rica and Honduras. They specifically looked at producers involved in the following initiatives:

- Fair Trade
- Organic
- Rainforest Alliance
- UTZ Certified
- 4C
- C.A.F.E.

The results were compiled through a number of producer surveys. The survey was completed with 51 coffee producers as a pilot for examining sustainability on farms. While some of the data are objective, others rely on more subjective measures. For example, access to market information was accessed by asking certified producers if access to information had improved as a result of certification.

Table 12 lists indicators that were examined as part of the assessment. Specific attributes are listed where available. These indicators were developed by COSA and are not necessarily part of the certification schemes in which farms participated.

Table 12: Indicators used by COSA for examination of Coffee Standards

Indicators Assessed	Examples Attributes Accessed
Income	• Average Gross Revenue • Average Cost of Production • Average Net Income of Coffee Farms
Production, Processing and Marketing Costs	
Access to credit	
Farm Management	
Quality Levels	
Market Access	• Change in the amount and quality of available market information due to certification.
Profitability	
Exposure to Risk	
Energy Management	• Amount of energy used • Kinds of energy used
Water Management	• Evidence of water conservation practices
Soil Resource Management	• Erosion and coverage or prevention
Biodiversity and resource management	• Percentage • Quality • Diversity ○ Tree diversity

Pollution reduction	• Record keeping • Products and chemicals applied • Use of Integrated Pest Management • Solid waste pollution • Water contamination • Fertilizer contamination • Agrochemical contamination
Recycling and re-using	• Systems in place
Carbon sequestration	• Vegetation density and quality
Health and Safety	• Existence and application of a health and safety plan • Access to medical services and first aid • Secure handling of agrochemicals • Access to potable water • Living conditions for workers
Labour Rights	• Freedom of association • Child labour • Discrimination • Existence of employment contracts
Supply chain organizational indicators reflecting effect on the community	• Transparent and democratic processes • Market information and extension services • Emergency response plans • Commercial, health, educational and social activities • Crop or price risk management
Working hours and wages	• Compliance with local minimum wage law

Source: Giovannucci and Potts (2008)

Figure 15: Advantages and Disadvantages of COSA indicators

Advantages

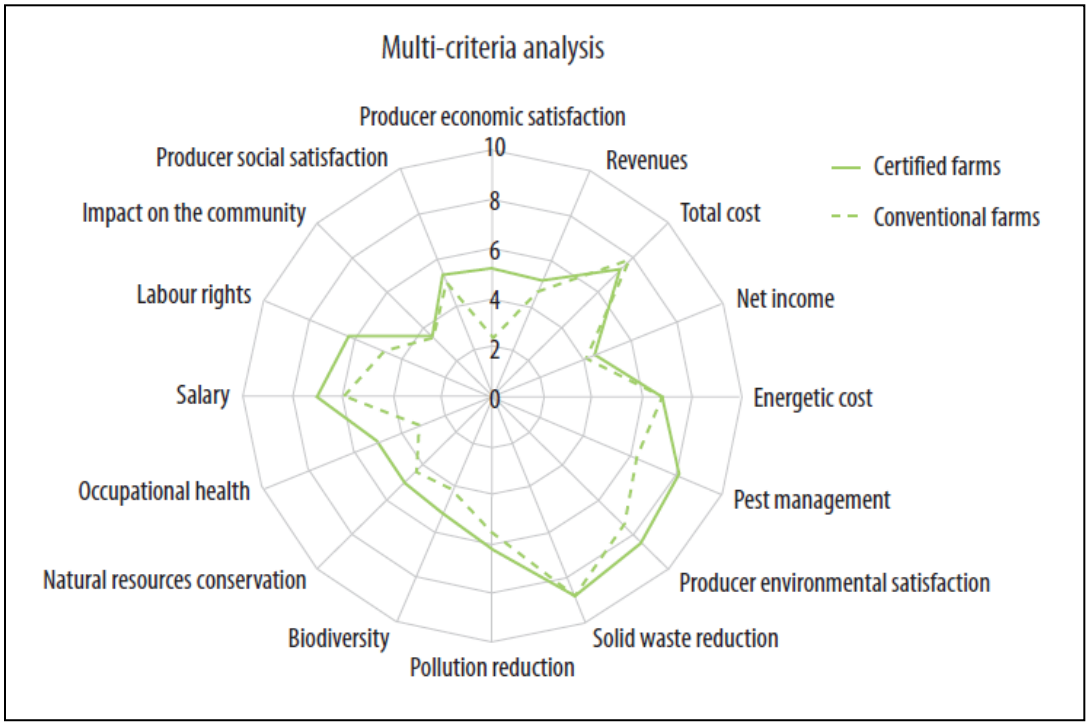
- Farm tested indicators
- Compares indicator levels on certified farms vs non-certified
- Avoids issues of weighting sustainability indictors
- Combines compliance with specific measures
- Measures environmental, economic and social impacts
- Ensures compliance with local food regulation

Disadvantages

- Used self-assessment (surveys) to some collect data
- Time consuming and potentially expensive to administer

To avoid issues with weighting of sustainability indicators COSA uses spider graphs to show sustainability performance. Figure 16 is the graph showing the overall results of the COSA analysis.

Figure 16: Spider Graph Showing Results of COSA Sustainability Analysis



Source: Giovannucci and Potts (2008)

5.7.3 Agricultura Certificada

The Argentine No Till Farmers Association (Aapresid) provides certification for producers based on a combination of good agricultural practices (GAPs) and soil quality indicators. Both physical and chemical indicators of soil health are used as indicators. Third parties are responsible for accessing that requirements for certification are met. The Agricultura Certificada relies heavily on record keeping, proving that certain activities are undertaken, rather than specific indicators of sustainability.

Table 13: Indicators and Attributes for Certification under Agricultura Certificada

Indicator	Criteria	Attribute
Legal Obligations	• All local, national and international legislations in effect are known and applicable to the activity • Land use is properly documented, and occurs only on owned landed or other land under contract	• Farmer demonstrates knowledge of laws that affect his activity • The farmer registers his farm or any rented land for participation in Certified Agriculture. Must provide legal documentation for the land • Any leased land must be contracted for at least 3 years
Work Obligations	• International Labour Organization Standards are adhered to (ILO OSH 2001), any third parties hired must also adhere to these requirements	• Visual and documented evidence that ILO OSH 2001 is being followed • Visual and documented proof to

	• Child, forced or slave labour and any kind of harassment is not allowed or supported • All employees are properly informed and trained about the tasks they carried out as well as their implications. They are also made aware of the quality management system adopted on the farm	ascertain that no children or slaves are working on the farm and that harassment is not supported • The farmer records training courses or lessons that he or managers give employees
Social Obligations	• Agricultural production does not affect traditional communities • Land is not misappropriated or used without the consent of the traditional community • There is a procedure to deal with claims and complaints	• There is documental substantiation to verify that traditional communities are not being affected • In areas or regions with traditional communities, the property document includes a clause to show that it is being used with the consent of the traditional community • The farmer is obliged to uphold testimony of the claims and complaints that the society pose in regard to his activity
Environmental obligations	• All available decisions are taken to minimize water, air and soil contamination, toxic residue production, greenhouse gas emissions, and any other action that may have negative effects on the environment and or society • High conservation value areas and habitats of native species and those that are endemic, unusual, endangered or in danger of extinction are protected • The expansion of agriculture into new areas in not permitted unless it is legally allowed. Clearing of prohibited area to increase productive area is not allowed	• The farmer preserves proof of all activities and documents all necessary information that states he is not producing negative impact on the environment or society Farmer provides analysis and potential solutions to environmental risks associated with his activities prior to certification • Farmers recognize high value conservation areas • The technical record states the last deforestation of his farm, proving that the expansion was legally permitted
Good Agricultural Practices	• Soil is not tilled and all necessary actions are carried out to achieve and maintain proper soil surface residue cover for the production system • Damaging and beneficial species are monitored • Approved phyto-sanitary products are used and selective active principles with minimum impact on environment and human health are prioritized • Efficient and responsible Phyto-Sanitary products use. Considering conditions of application, storage, transportation and residue disposal. Personnel must be properly trained and have all necessary	• A crop/field record and a crop rotation sequence is maintained • There is evidence of a crop rotation sequence and it is maintained and agronomically justified • The farmer completes a pest monitoring record and agrochemical application • Record use of phyto-sanitary treatments and container disposal Treatments must be justified through the pest monitoring record • Farmer must record employee

	safety equipment • Soil nutrient replacement based on soil testing and plant analysis. Nutrient cycling should be incorporated as system allows. • Livestock production complies with traceability and sanitation regulations as set out by the National Service of Animal Sanity of Argentina (SENSA)	training for this activity • Farmer must provide fertilizer application records and maintain crop/field lists. Nutrient balances are to be calculated based on associated records • Cattle management and sanitation records must be kept. All crops used for feedstock are subject to the same record keeping practices as noted above

Source: Aapresid, 2009.

Figure 17: Advantages and Disadvantages of Agricultura Certificada

Advantages

- Ensures compliance with local regulation
- Ensures compliance with good agricultural practices
- Indicators for environmental and social sustainability
- 3rd party certification
- Compliance approach easy to administer

Disadvantages

- Used self-assessment (surveys) to some collect data
- Time consuming and potentially expensive to administer
- Does not include measures for economic sustainability
- Relies on record keeping increasing administration costs to producer

5.8 Summary

Many of the programs examined use ISO 14001 as a base. They either have more lenient standards to encourage participation or more rigorous standards to provide further direction and improvement. Programs that have specific standards often take a compliance approach by providing producers with a checklist of procedures that must be followed. This approach then provides indication of directional change, under the assumption that if the guidelines are followed sustainability will improve. Very few of the certifications and standards offer specific measurements to indicate that quantity of change that occurs.

Some of the standards examined looked purely at environmental measures to improve sustainability, while other took a more triple bottom line approach, considering environmental, economic and social factors.

It was demonstrated that sustainability and environmental certification systems can be and are used as marketing tools. This is evidenced by the use of logos in programs like Assured Food Standards, LEAF Marque, EMAS and C.A.F.E.. Producers who undergo certification do so with the expectation that by having the logo on their products will increase revenues.

There is a significant push by the food industry for harmonization of measurement systems. This stems from the desire to avoid duplication, unnecessary cost, and consumer confusion about sustainability (Pulse Canada, 2012). There are already a number of branded sustainability initiatives in the EU which retailers are supporting. There is additional collaboration of many leading companies to design sustainability indicators, for example the SAI Platform. Others like EMAS, recognize the work of others but include their own additional requirements for recognition of sustainability. “A credible consensus could improve the efficiency of multiple overlapping approaches, each with its own communication and assurance structures” (Pulse Canada, 2012).

The following section will introduce the Environmental Farm Plan.

6 Opportunities for the Environmental Farm Plan

6.1 Ontario Environmental Farm Plan

Initial policies for the Ontario Environmental Farm Plan (EFP) program were developed in 1992 by the Ontario Farm Environmental Coalition, which consisted of four lead agencies: the Ontario Federation of Agriculture, Christian Farmers Federation of Ontario, Ontario Farm Animal Council and Agricultural Groups Concerned About Resources and the Environment (AGCare). Recently, funding for the EFP program has been provided through federal-provincial funding agreements including the Agricultural Policy Framework (2005-2009), Growing Forward (2009-2013) and now through Growing Forward 2 (2013-2018). EFP has been delivered locally by the Ontario Soil and Crop Improvement Association (OSCIA) in partnership with the Ontario Ministry of Agriculture Food (OMAF).

Every Canadian province has an EFP program in place.

The introduction of the EFP in Ontario has led to the adoption of EFP programs in other provinces as well. MacKay and Hewitt (2010), note that "the Environmental Farm Planning process has become a key source of information and education for producers in Canada." The following table shows the situation of EFP development across Canada. The majority of producers in Ontario that have an EFP have updated it less than 3 years ago. According to MacKay and Hewitt (2010), the participation rate for livestock farms in Ontario and Quebec is much higher than for other parts of Canada. Over 70 percent of all farmers in Ontario have some version of the EFP in place (Rudy, 2013).

Table 14 Development of environmental farm plans on Canadian farms, 2011 - Province or region

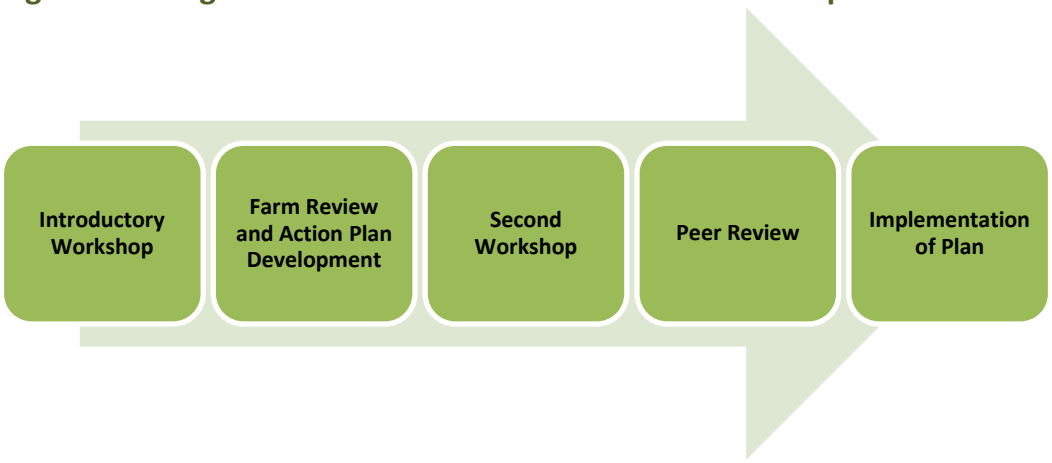
	EFP developed or last updated - <= 3 years ago	EFP developed or last updated - 4 to 5 years ago	EFP developed or last updated- More than 5 years ago
	percent		
Canada	59.2	23.7	16.5
Atlantic region	62.9	21.7	14.8
Quebec	88.8	2.1	8.6
Ontario	41.7	27.1	30.1
Manitoba	49.4	33.6	16.2
Saskatchewan	50.8	35.8	13.2
Alberta	45.9	40.7	12.8
British Columbia	62.5	24.0	12.3

Source: Statistics Canada, Environment Accounts and Statistics Division, Farm Environmental Management Survey,

EFP Process

EFP consists of a number of steps that participants undertake (Figure 12). For example, producers attend an introductory workshop, where farmers are encouraged to identify environmental strengths and potential areas of concern and develop an action plan for dealing with potential risks (OSCIA, 2012).

Figure 18: Progression of Environmental Farm Plan Participation



Source: Adapted from Rudy, 2003.

The EFP is a whole-farm platform.

Rather than being commodity-specific, the EFP considers all different types of commodities and covers the whole farm. The Ontario environmental farm plan worksheets focus on 23 topics listed in the table below.

Table 15: Ontario Environmental Farm Plan Worksheet Topics

• Soil and Site Evaluation	• Silage Storage
• Water Wells	• Milking Centre Wash water
• Pesticide storage and handling	• Nuisances under the *Farm and Food Production Protection Act, 1998*
• Fertilizer storage and handling	• Water Efficiency
• Storage of Petroleum Products	• Energy Efficiency
• Disposal of Farm Wastes	• Soil Management
• Treatment of household water	• Nutrient Management in Growing Crops
• On-Farm Storage of Livestock Manure and other Prescribed Materials	• Stream, Ditch and Floodplain Management
• Livestock Yards and Outdoor Confinement Areas	• Wetlands and Wildlife Ponds
• Use and Management of Manure and Other Organic Materials	• Pest Management
• Horticultural Production	• Woodlands and Wildlife
• Field Crop Management	

Source: Canada-Ontario Environmental Farm Plan Program, Third Edition Workbook, 2004

To complete an EFP, producers attend a two-day EFP educational workshop. The EFP workbook is used as a tool for producers to complete a self-assessment of their farm activities in three general areas: the farmstead, farming practices and natural areas. Producers complete the appropriate 23 risk assessment modules or worksheets for their farm operation and develop an individualized plan of action (the Action Plan) to address potential concerns identified through the EFP process. Producers may choose to have their Action Plan peer-reviewed, by the local Peer Review Committee, and once a producer's EFP action plan has been reviewed by the Peer Review Committee the producer is eligible to apply for cost-share funding to help implement actions identified in the plan.

First-time participants in the EFP program are strongly recommended to attend an EFP educational workshop. OMAF staff leads the development of the EFP workbook, coordinating input from technical experts from government, farm organizations, and other conservation organizations with expertise in the 23 topic areas covered by the workbook.

The EFP places a high value on awareness and education of stewardship practices (Rudy, 2003), as physical indicators are often difficult to obtain due to resource constraints. Under the EFP, producers conduct their own assessments of risk and are also responsible for managing those risks (Rudy, 2003). This is different than many other schemes which have extension personnel or third parties conduct the assessments.

Uptake of EFP and Implementation of Action Plans

Producer motivation for attending the workshops is influenced to a significant degree by the requirement to have a peer-reviewed EFP Action Plan completed to be eligible to apply for cost-share funding and the education provided within the workshops (Prairie Research Associates, 2011). However, this does not explain EFP participation; voluntary interest in environmental improvement is an important motivator. A recent survey of EFP participants found that farms invested on average $53,900 of their own funds and received $15,600 in cost-share funding per farm in the implementation of improvement activities identified in the environmental farm plans (PRA, 2011). At the same time, 42% of the activities completed by participants in the Prairie Research Associates survey had no implementation costs (Prairie Research Associates, 2011). 95% of participants surveyed noted that participation in the program has impacted their operations (PRA, 2011).

The following table lists the main reasons for not implementing beneficial management practices across Canada. Clearly, economic pressure outweighs all other reasons.

Table 16 Main reasons for not implementing beneficial management practices on Canadian farms, 2011 - Province or region

	Economic pressures	Lack of information or don't accept recommendations	Lack of time	Other
	Percent			
Canada	55.5	5.9	23.3	14.8
Atlantic region	58.4	4.6	22.5	13.6
Quebec	33.8	12.5	29.2	24.5
Ontario	54.1	9.3	20.1	15.4
Manitoba	63.3	F	21.6	12.3
Saskatchewan	62.6	1.6	24.2	11.6
Alberta	56.6	4.4	24.2	13.9
British Columbia	59.7	F	22.9	10.7

F - Unreliable to be published; Source: Statistics Canada, Environment Accounts and Statistics Division, Farm Environmental Management Survey

Performance measurement

Measurements of the EFP program focus on adoption and implementation of intermediate outcomes and outputs of the program (Prairie Research Associates, 2011). Currently, the environmental impacts of EFP are assessed by farmer self-evaluation, rather than specific metrics of environmental performance (Prairie Research Associates, 2011). The current self-assessments are not certified by an independent third party.

According to Prairie Research Associates, (2011), the education provided in the workshops is effective in changing producer's thoughts about environmental practices, with almost half of the survey respondents noting that their priorities for environmental improvement changed after attending the workshop. Producers who attend the workshop are also likely to complete the EFP program (Prairie Research Associates). The confidential nature of the EFP is very important to producers. In fact, in a survey conducted by Prairie Research Associates (2011), 80 percent of the surveyed producers responded that the confidentiality of the workbook and action plan is important and very important.

6.2 Retailers' Perceptions

The Canadian grocery industry is dominated by large chains.

Retailers have the closest contact to consumers and are therefore influenced by their demands for sustainability. Large grocers are also wholesalers.

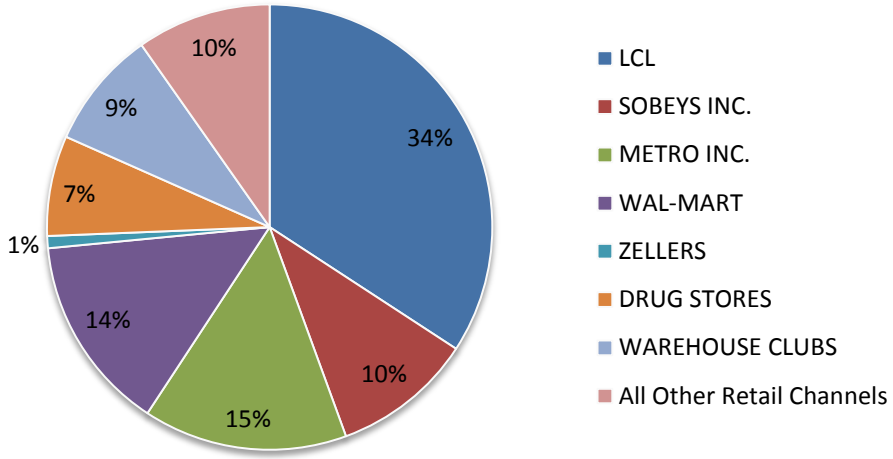
Grocery products flow through various channels in Canada. Supermarkets move the bulk of grocery products. The biggest supermarket chains, which are national in scope are the Loblaw Companies (LCL) and Sobeys. Metro is the third largest

retail grocery chain and operate only in Quebec and Ontario. This is followed by Safeway (Alberta) and Overwaitea (British Columbia).

Mass merchandisers are gaining in importance in the Canadian grocery market.

The market share of supermarkets is declining in grocery foods as other channels and retail formats are becoming increasingly important. The next largest channels are mass merchandisers, such as Walmart, Target and warehouse or clubhouses (such as Costco). Traditional supermarkets are losing their share mainly to mass merchandisers like Walmart and Costco. Walmart has become an important player in the Canadian grocery market, as it added the highest amount of grocery footage in the recent past and will probably do so in the near future. Drugstore retailers have also experienced aggressive growth in food retailing.

Figure 19 Grocery Sector Shares in Ontario



Source: Nielsen HomeScan

Grocery retailers differentiate themselves with different banners (for example, discount stores, such as Loblaw's No Frills or Sobeys' FreshCo) to appeal to price sensitive customers. In fact, Canada is a leader in differentiated banners and private label. Discount stores generate almost 50 % of all grocery sales in Ontario (Grier, 2013). Price is a major driver in this segment.

Knowledge of Primary Agriculture

Low level of awareness of EFP among retailers

A number of in-depth interviews were held with sustainability managers of companies in Canadian grocery retail and food service segments (nine in total). Managers were asked about the goal of their sustainability agenda and the role farmers play in it and their knowledge of the environmental farm plan.

Sustainability managers at the retail level in Canada are to a great extent not aware of the EFP. However, interest was expressed in learning more about it.

Environmental regulations in Canada are perceived as being strong and producers are expected to follow these. A number of sustainability experts responded that the farmer drives the sustainability agenda at the farm level and farmers know best how to produce food in a sustainable way.

While a number of companies actively involve producer associations in their sustainability dialogue, some felt that they do not engage farmers and producer groups enough. In general, reaching out to farmers and producer associations is a fairly new undertaking. There is a 'natural gap' between farmers and retailers, especially when it comes to intermediate products such as grains in very long and complex supply chains. Manufacturers are expected to close this gap.

Retailers and food service providers source their products and ingredients from around the world. Going forward, if sustainability indicators or metrics should be incorporated into the EFP, these would need to be accepted at a global scale.

> ***"Metrics need to be implemented that are globally accepted, but locally relevant."***
>
> Jeffrey Fitzpatrick-Stilwell, Manager Sustainability McDonald's Canada

The fulfillment of food safety requirements were seen at this point as more important than environmental requirements. In addition to environmental sustainability, social and economic sustainability are becoming increasingly important.

The confidential and voluntary nature was generally seen as an issue in moving the EFP forward. Metrics are seen as necessary; however, these would need to be acceptable at a global level. The quantification of metrics is important because it allows the measurement of progress. In addition, some form of audit procedures would need to be implemented, to provide some type of certification.

6.3 The Manufacturers' position

The food and beverage manufacturing sector sells products to retailers. A very large amount of Canadian food products are supplied by manufacturers that work at a global scale such as Unilever, Nestle, McCain and others. A number of these companies are involved with the SAI platform and follow SAI Principles and Practices. Manufacturers and processors work actively with producers on

production issues and increasingly on sustainability issues. McCain is the only manufacturer that has made the EFP a requirement for its suppliers.

Unilever

Unilever intends to source 100 % of its agricultural inputs sustainably by 2020.

Unilever has developed its own Sustainable Agricultural Code. According to Unilever "By 2020 we will source 100% of our agricultural raw materials sustainably" (Unilever, 2013). The code is targeted at suppliers and farmers. The code is a detailed self-assessment questionnaire with mandatory and voluntary requirements. The progress is tracked with a specifically developed software system called Quickfire. For crops, indicators covered include agrochemicals and fuels, nutrient and pest management, soil management, water usage, biodiversity, animal welfare, social and human capital and others (Unilever, 2010). [20]

McCain

McCain uses the EFP as part of their Good Agricultural Practices (GAP) program in Canada.

McCain is a Canadian company and the world's largest producer of frozen potato products. The main driver for McCain's sustainability agenda is to procure potatoes with the minimum environmental impact. Given its product focus, McCain is seeking solutions to reduce water input, carbon footprint, and the amount of pesticide used on the crop. McCain's contracted potatoes are grown following SAI Principles and Practices. McCain focusses on extension and research and staff is actively working with growers to promote and help them implement best management practices on their farms. McCain is using the EFP in addition to an addendum that addresses integrated pest management (IPM).

"The EFP is a flexible tool that allows farmers to respond to market demands. The EFP programs in Alberta and Manitoba have already been expanded to cover topics such as IPM (Integrated Pest Management) to serve the needs of the potato industry."

Yves Leclerc, Director of Agronomy, McCain Foods

Role of the EFP

Retailers and manufacturers operate in a global environment and products and ingredients are sourced from around the world. Going forward, if sustainability indicators or metrics were incorporated into the EFP, these would need to be accepted at a global level. Clearly, there are a number of sustainability dialogues

[20] http://www.unilever.com/images/sd_Unilever_Sustainable_Agriculture_Code_2010_tcm13-216557.pdf

underway. Producers have to get involved now and show their own leadership, or this will be done for them.

6.4 The Producer's View

A focus group was conducted to gauge the opinion of producers about potential changes to the EFP that could address sustainability verification to downstream customers. The participants included a cross section of producers from the grain and oilseeds, grape, greenhouse floriculture and horticulture sectors. Additional telephone interviews were held with livestock producers. All of the producers that participated had a peer-reviewed EFP Action Plan. Producers were asked about their experience with the current EFP process and the potential of an extension to the EFP was discussed.

Producers were aware of the increasing demand to prove sustainable farming practices. In some cases producers are asked by customers to prove sustainable practices. In the case of crop producers, usage information for water (including recycling of water), nutrient and pesticide is requested by some processors and retailers. In addition, government agencies, such as Environment Canada, intend to address pollution problems with the enforcement of regulations.

Current EFP

Voluntary programs are better received by producers than mandatory ones.

Two of the biggest advantages of the current EFP are the confidential and the voluntary nature of the program. The EFP was set up as a self-evaluation and it allows producers to identify areas of higher risk both in terms of the farm's natural resources and the management of the farm that many producers might not otherwise be willing to share. In addition, the EFP appears to have accomplished a lot in terms of both education and environmental improvement/remediation in the past without any verification in place.

Current confidential set-up of the EFP program is seen as an advantage

Some challenges were noted with the current cost-share funding programs associated with the EFP. Many of the current cost-share funding programs work on a first come, first served model. This approach to distribution of funding is seen as an issue because this funding is seen as an important incentive to implement the EFP. Therefore, some environmental improvements identified in a producer's EFP action plan sometimes might not be undertaken because of financial constraints.

EFP Options

The idea of building on the EFP to allow for sustainability indicators to be shared with downstream costumers, share some parts (of an adapted) workbook, or

some form of third party certification that would verify the implementation of the EFP action plan, was introduced and tested with producers.

There were risks perceived in sharing information in the EFP with downstream customers, notably that disclosure would result in an escalation in the future demand for BMP's, which in turn could create a demand to have higher levels of liability insurance, and make it more difficult for producers to access financing.

However, a key opportunity was identified in using the EFP to bundle some of the sustainability standards for a number of different downstream customers and thereby reduce the producer compliance burden. Essentially, the EFP would be viewed as a database, with a customer-specific or standard-specific "addendum" developed to extract information from the EFP that would inform sustainability measures. Many of the environmental sustainability measures identified by downstream customers are already contained within the EFP; the benefit would lie in creating addenda that access these, in the desired format, at reduced effort/cost to the producer.

A related idea was discussed that individual EFP's could be shared among a benchmarking group, with the possibility that the benchmark group as a whole could share information with downstream customers. There was also a thought that leveraging the EFP sustainability discussions with downstream customers might change the objectives of the program. This could be addressed with a two tiered program, by keeping the original voluntary and confidential set up of the program, but allow for a second tier, where farmers would agree to have their information used.

Going Forward

Producers indicated a willingness to share parts of the EFP that would be relevant to their downstream customers. Manufacturers and retailers could request specific information from producers and this information could be extracted from their existing EFP and provided to customers in their desired format through an addendum.

One of the biggest issues producers have, in order to satisfy different customers, is the time required to report on and comply with alternative sustainability protocols. There is the potential for OSCIA and its partners to develop an "addendum" to the EFP that fits with specific customer needs and results in the extraction of relevant information collected in the producer's EFP.

In the future, if producers completed their EFP in an electronic format, it would be possible to develop a system that would pull the relevant information out of the electronic EFP workbook, and report only these relevant areas of information

with the producers' consent to satisfy the sustainability goals of the manufacturer, retailer and others. The EFP- addendum concept could have the effect of standardizing company protocols through the areas of focus covered in the EFP workbook, which could be an advantage to Ontario farmers. There is some experience with this in terms of past work to develop an EFP addendum to support Ontario Power Generation's goals for sustainable biomass fuels to replace coal-fired generation plants, although this EFP addendum has yet to be implemented.

7 Recommendations and Further Research

The following recommendations follow from the above, in consultation with the research steering committee.

1. The EFP in its current format should continue to focus on environmental sustainability

- The ultimate strength of the EFP was seen as its focus on environmental sustainability. There was a view that this focus would be compromised if the EFP was extended to social and economic sustainability. Growing your Farm Profits, a companion program delivered by OSCIA and modeled after EFP, but very focused on the broader scope of Business Management for Farm Businesses, could also address the economic and social aspects required.

2. Consider expansion of the EFP to include social and economic sustainability indicators

- The trend towards social and economic sustainability measures requested by some downstream customers has been noted. Labour, animal welfare and food safety issues are perceived as becoming increasingly important for consumers.
- Under the condition of a name change, and refocusing of objectives of the EFP, the inclusion of social and economic sustainability could be considered as a future development of the EFP.

3. Create a dialogue with food and beverage manufacturers and grocery retailers in Canada.

- The awareness of the EFP program in the downstream segments of the food supply chain needs to be increased. Most of the retail and food service firms contacted were either unaware of the EFP or had

heard of it but were not familiar with it. There is a need for this to change if the EFP is to be successful in an expanded role.

- There is also a need to better understand how the downstream segments would wish to use information developed from the EFP. This should extend to the prospects for uniformity across retail/food service firms in terms of the information sought from EFP's, and whether multiple firms might settle on common requirements and thus a single addendum for multiple downstream customers.
- The relevant scale preferences of downstream segments must also be understood. This is critical in determining whether the EFP could be used based on the Ontario program and Ontario product volumes, or whether downstream purchasers would see Canadian volume as the threshold for participation, in which case there would be a motivation to more closely align provincial EFP programs for the purposes of designing sustainability addenda.

4. Create a dialogue between producers of different commodities

- Organize a forum to bring agricultural producers together to discuss key areas of sustainability, how these are addressed in the EFP and what metrics could be used to demonstrate results to others.

5. Develop a pilot project to determine the key areas of sustainability, how these are addressed in the EFP and what metrics could be used to demonstrate results to manufacturers and retailers

- In this pilot project, a group of selected manufacturers and/or retailers would be engaged to determine how the EFP with an addendum could be used in engaging sustainability metrics.
- Given that, for now, short supply chains are of more direct relevance to retailers, an opportunity was perceived for an exploration in the horticultural sector to develop a score card in "Environmental Sustainability".

6. Ensure that key points/metrics of sustainability can be addressed, included in the EFP's of all provinces, or look at the prospects for closer alignment in provincial EFP's.

- EFP programs are in use across Canada, but the organization and authority for the EFP is provincial, so there can be differences between provinces in EFP programs. Depending on the success of the

pilot project, it could be used as a template by other provinces or be available for standardization policies, according to the drivers for sustainability, along with decisions about metrics to meet the requirements of customers.

- There is still likely to be room for provincial flexibility as to what satisfies each province's "standard", but provinces could discuss the need for sustainability metrics and the potential to use their province's EFP as a base.

8 Summary and Conclusion

The purpose of this project was to explore how the Ontario Environmental Farm Plan (EFP) can be used to verify or validate sustainable farm practices to participants downstream on the Canadian agri-food supply chain. The EFP is a voluntary program in Ontario that helps farmers minimize potential risks to the environment that may be found on-farm through a confidential, voluntary process that educates and motivates farmers to target actions to priority areas.

The concept of sustainability is becoming a major consideration for the Canadian agri-food supply chain. Food manufacturers, retailers, and food service segments are engaging in a number of sustainability dialogues and platforms and the identification, measurement and practical application of agri-food sustainability within the Canadian marketplace continue to evolve.

The literature review drew upon a number of sources to provide background on sustainability indicators; their importance to the food retail sector, the problems associated with developing indicators, and introduced a number of sustainability indicators currently in use, or under development, worldwide. Programs that have specific standards often take a compliance-approach by providing producers with a checklist of procedures that must be followed. This approach then provides indication of directional change, under the assumption that if the guidelines are followed, sustainability will improve. A number of sustainability and environmental certification systems can be and are used as marketing tools.

Two of the biggest advantages of the current EFP for producers, the confidential and the voluntary nature of the program, are probably the biggest issues for manufacturers and retailers in accepting the program. Verifiable metrics are seen as necessary by the retail industry. The quantification of metrics is important because it allows for the measurement of progress. In addition, some form of audit procedures would be required to provide for certification of standards.

Producers indicated a willingness to share parts of the EFP that would be relevant to their downstream customers. Manufacturers and retailers could then request specific information from producers and this information could be extracted from their existing EFP and provided to customers in their desired format through an addendum.

As a next step, a dialogue with food and beverage manufacturers is required, as the awareness of the EFP program has to be increased. Pilot projects can explore what prospects exist for the EFP with manufacturers and retailers. In this pilot project, a group of selected manufacturers and/or retailers would identify the types of standards and information they require from producers and this information could be extracted from the existing EFP's and provided to customers in their desired format through a tailored addendum. Given that short supply chains

are of more direct relevance to retailers, the best opportunity for an exploration of this concept is with the horticultural sector; this could be leveraged in developing a score card in “Environmental Sustainability". Subject to their needs for scale, specific measures, and verification/certification, this could represent a new use for the EFP, and a competitive advantage for the producers who use it.

The EFP has achieved significant success in creating education and awareness of agricultural environmental issues, and material success in on-farm environmental improvements and remediation. At the same time, producers are facing pressure to demonstrate the sustainability of their on-farm practices. With a well-established EFP and extensive participation, Ontario should be well positioned to address these demands. The results of this study suggest a potential starting point to meet demands by using EFP’s that are already in place; most jurisdictions outside of Canada lack a similar platform. There is an important opportunity for further work to leverage this and assess the feasibility for the EFP as an important sustainability tool that can improve Ontario’s and Canada’s positioning as a key supplier of food that meets increasing sustainability expectations.

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