



Climate Resilient **FOOD** Systems

in the Greater Golden Horseshoe Region

2016
Ontario Climate
Symposium:
**Proceedings
Report**



ONTARIO CLIMATE CONSORTIUM

[www.climateconnections.ca/
symposium](http://www.climateconnections.ca/symposium)

On May 5th 2016, the [Ontario Climate Consortium \(OCC\)](#) hosted the annual Ontario Climate Symposium at the University of Guelph. The event brought together more than 200 stakeholders from across the Greater Golden Horseshoe region representing a diversity of sectors and disciplines to inform the development of strategies and policies to reduce greenhouse gas emissions from the regional food system, and support food security in the context of a changing climate. This document describes the proceedings of the day.

2016 Symposium Working Group

The 4th Annual Ontario Climate Symposium was a major undertaking and would not have been possible without the support of a number of individuals and organizations. We would like to thank the members of the Symposium Working Group for their invaluable input into the development of the event. Members of the Working Group included:

- Ben Bradshaw (University of Guelph)
- Kirby Calvert (University of Guelph)
- Sheri Harper (University of Guelph)
- Craig Johnson (University of Guelph)
- Dave Bray (Ontario Ministry of Agriculture, Food and Rural Affairs)
- Eric Meliton (Toronto and Region Conservation Authority)
- Mark Pajot (Region of Peel)
- John Smithers (University of Guelph)
- Joanne Rzadki (Conservation Ontario)
- Peter Love (York University)
- Christine Tu (Toronto and Region Conservation Authority)
- Ruth Waldick (Agriculture and Agri-Food Canada)

Sponsors

The OCC would also like to thank all our generous event sponsors! We would like recognize the [University of Guelph](#), [Toronto and Region Conservation Authority](#), [Enviro-Stewards](#), [Alternatives Journal](#), [Government of Ontario](#), and [Conservation Ontario](#) for their contributions to the event.

Volunteers

Our volunteers assisted with a number logistics on the day of the event and were integral to its success. We would like to recognize the following volunteers for their contributions:

- Austin Bender
- Alanna Bodo
- Alyssa Cerbu
- Marion Davies
- Jenessa Doherty
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- Nidhi Rawat
- Prasamsa Singh
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- Tiara Rycroft-Yon

About the Ontario Climate Consortium

The Ontario Climate Consortium (OCC) represents a network of research, policymaker and practitioner communities across Southern Ontario. The OCC Secretariat, which is hosted by the Toronto and Region Conservation Authority (TRCA), fosters interdisciplinary research partnerships between communities of research and practice that satisfy knowledge gaps or information needs to enable transformative climate action at the local and regional scale. Our network includes experts from York University, Toronto and Region Conservation Authority, Region of Peel, McMaster University, University of Guelph, and Western University.

OCC Members:



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Executive Summary

The 4th Annual Ontario Climate Symposium was held at the University of Guelph (UofG) on May 6th, 2016. Recognizing [UofG's research strength](#) in the areas of agri-food, environmental management and governance, as well as current provincial and municipal policy priorities relating to [regional land use planning](#) and [climate change](#), this year's Symposium focused on exploring the development of a climate resilient food system in the Greater Golden Horseshoe (GGH) Region.

The Symposium brought together more than 200 stakeholders from across the region representing a diversity of sectors and disciplines to inform the development of strategies and policies to reduce greenhouse gas emissions from the Regional food system, and support food security in the context of a changing climate. The goals of this event were to:

- Facilitate the production, adoption and application of climate research with respect to provincial policy and local governance as it relates to the GGH Region's agriculture and food sector;
- Provide an inclusive forum for sharing diverse perspectives on research and practical applications relevant to climate change impacts and vulnerability, and greenhouse gas emissions reductions;
- Foster the translation of regional climate change research into policy solutions; and,
- Facilitate collaboration across research fields and public policy silos.

The symposium, hosted at the University of Guelph, featured Dr. Evan Fraser as the morning keynote speaker. His keynote address was followed by a plenary panel on "The Role of the GGH Region Land-Use planning and Agriculture in the Ontario Climate Change Strategy and Action Plan" – it featured notable speakers like Wayne Caldwell (Dean, Ontario Agricultural College), Dianne Saxe (Environmental Commissioner of Ontario), Keith Currie (Vice President, Ontario Federation of Agriculture) and David McInnis (President and CEO, Canadian Agri-Food Policy Institute). After the plenary panel, Hank Venema (International Institute for Sustainable Development) gave a keynote address over lunch where he spoke about some of the work being done by the Prairie Climate Centre.

In the afternoon, attendees had the option to participate in one of three workstreams which started off with a series of presentations that set the context for the subsequent discussions that occurred in breakout groups. A brief description about each workstream is included below.

- **Workstream 1** focused on sustainable energy in the agri-food supply chain. More specifically, the purpose of this workstream was to identify economic, regulatory, and social barriers for the integration of sustainable energy technologies into land-use practices, business models and value chains of the GGH region's agri-food sector.
- **Workstream 2** explored pathways towards low carbon and climate resilient agriculture. This workstream highlighted cutting-edge research as well as innovative initiatives that mobilize a wide range of stakeholders in three key areas: (1) agricultural soils, (2) the livestock sector and (3) crop production methods.
- **Workstream 3** focused on planning for climate resilient and sustainable food supply chains in the GGH. It explored the value of short food supply chains in the GGH Region for supporting progress on interrelated climate change mitigation, adaptation, economic development and food security objectives.

Morning Keynote Presentation

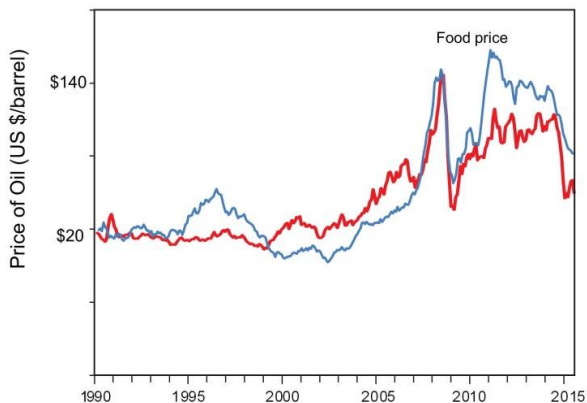
Author: Jenessa Doherty (York University)

Evan Fraser (Canada Research Chair in Global Food Security, University of Guelph)

“What will food systems look like in 2050?”

Dr. Fraser opened the symposium with the following thought-provoking question: “what will food systems look like in 2050?” In his keynote speech, Dr. Fraser identified three trends that he argued will shape the way we look at and deal with global food systems both now and in the future – population growth, climate change and policies that capture “negative externalities.”

As the world’s population continues to grow, stories of food poverty and barriers to access persist. However, according to Dr. Fraser, this is not because we are undergoing a food shortage. On the contrary, despite exponential rises in population over the past 25 years, production has historically always surpassed demand. The unfortunate truth is that one third of the world’s food does not find its way to the table. Dr. Fraser illustrates this reality with a powerful statistic: in the city of Vancouver alone, 80,000 potatoes, 30,000 eggs and 70,000 cups of milk are thrown away each day. It is this level of waste, he argues, along with the severe inequality that accompanies it, that creates an increased demand which threatens both local and global food security. To meet this demand, food is often produced in varieties and quantities that are vastly different than what the world’s population needs.



However, the leading cause of strain on the system is not population, asserted Dr. Fraser. Instead, he noted the startling reality that energy and oil prices are threatening food security. As climate change continues to alter existing landscapes, Dr. Fraser contends that mass migration will likely take place which will in turn raise energy and gas prices. However, this demand has little to do with supply; instead, he argues that the energy and oil sector determine the price and quantity of food.

With climate change influencing global temperatures and contributing to extreme weather events like severe drought and rainfall, Dr. Fraser argued that adapting to this second trend may be the difference between farmers coping or failing. In a model evaluating winter wheat in China, Fraser shows that 20-30% of crops fail without adequate adaptation. However, farmers can in fact successfully adapt to climate change threats to ensure food security. The downside he argues, is that farmers are not yet able to predict when adaptation measure may be required.

Although there is a need for adaptation measures, we also need to recognize the importance of mitigating the effects of climate change. Dr. Fraser recommended that this be done by creating and implementing policies that capture “negative externalities.” There have been several recommendations made by climate experts over the years on how to do this – from carbon taxes, to polluter-pays policies, to cap-and-trade systems. However, until the price of food properly internalizes the negative social and environmental externalities resulting from production, the global market will continue to make the same, limited, homogenized food

choices with the consequences of those choices (e.g. malnutrition, obesity, etc.) being carried on the backs of the tax-payers and the governments that support them. Once the marketplace begins to internalize the negative externalities, Dr. Fraser argued that individuals will change the way they make food choices.

Plenary Panel: The Role of GGH Region Land-Use Planning and Agriculture in the Ontario Climate Change and Action Plan

Author: Jenessa Doherty (York University)

Moderator: David McInnis (President and CEO, Canadian Agri-Food Policy Institute)

Dianne Saxe (Environmental Commissioner of Ontario)

“Paris, Climate and Soil Health”

During her presentation, Dianne Saxe stressed that all countries need to work together in order to adequately adapt to and mitigate the effects of climate change. She also highlighted the importance of COP 21 in Paris and called it a vital stepping-stone as it included 188 nations around the world and acted as a “launch pad” for numerous initiatives born from bold and aggressive financial commitments and agreements. Saxe also drew attention to the collaborative work that followed COP21 resulting in advances in energy, particularly solar, due in large part to the efforts of China.

Another of the important initiatives that Saxe introduced was a voluntary action plan developed by the Lima Paris Agenda for Action (LPAA), which purports that food security and combating climate change are directly correlated. A 4% annual increase in soil carbon via prevention of soil degradation, she argued, would provide a carbon sink that slows climate change whilst simultaneously improving soil fertility and agricultural production. Saxe emphasized the need to start thinking about soil carbon as a key climate mitigation opportunity, and emphasized the Environmental Commissioner of Ontario’s continued focus on exploring policy options to support soil carbon sequestration, and soil health more broadly, in Ontario. In this regard, Saxe referred to the [Soil Carbon Roundtable](#) hosted by the Office of the Environmental Commissioner in 2012.

Keith Currie (Vice-President, Ontario Federation of Agriculture)

“Land Use Planning and Agriculture in the Ontario Climate Change Strategy”

According to Keith Currie, farmer-feedback and consultation in terms of policy-making, planning and strategy is vital to land protection, watershed and forest preservation, fostering healthy communities and addressing climate change. Historically, farmers voices have been largely absent with regards to these salient issues. However, the Greenbelt Plan was introduced in the October of 2004 to protect farmland. The focus was to protect farmers and land through collaboration, integration and open communication, but Currie reckons that what we need now is matching legislation, regulation and policy. This will only come, he argues, through increased stakeholder engagement and identifying the needs of individual communities. As a representative for farmers across the GGH Region, Currie identified some of the key concerns to Ontario farmers, most notably consistency in policy and implementation across provinces, regular re-evaluation of existing strategies, the need to recognize the interconnectedness of other key systems such as transportation and infrastructure and lastly policies that reflect the unique challenges and opportunities of diverse communities. The main message heard loud and clear was that we need more collaboration – especially through comprehensive stakeholder engagement that adapts based on changing needs.

Wayne Caldwell (Dean of the Ontario Agricultural College, University of Guelph)

“Land Use Planning, Agriculture, and Climate Change”

Wayne Caldwell’s talk echoed key concepts addressed by both Dianne Saxe and Keith Currie: although countries across the world experience climate change in different ways, the one consistency lies in the reality that the global food supply is interconnected. This is particularly important, argues Caldwell, because Canada is continuing to lose farmland to settlement, expansion and development. The Niagara region alone has seen a 50% decrease in farmland since the 1980’s, a trend Caldwell argues has resulted in persistent challenges to food systems. There is now more agricultural uncertainty than ever before, he stresses, and this uncertainty continues to rise. This is supported by the fact that there has been a steady decline in Ontario’s farm population over the years, due in large part to the rising costs of land. Between 1973 and today the cost per farm acre has increased by nearly 2000% and Caldwell expresses concern over what this will mean for agriculture and food security should Ontario not enact bold measures to combat this trend.

Ultimately, land use planning is essential to preserve agriculture and to combat climate change. Caldwell calls for the building of more resilient systems as each is interconnected and struggle in one system creates a struggle in another. The province has generated several municipal plans, by-laws, policies and strategies to do this, but Caldwell recommends more aggressive intensification, transit plans, natural system protection, transportation planning and growth.

Future Directions

Key Research Priorities for Academics to Consider

Wayne Caldwell identified several evolving issues in the rural community context including poverty, infrastructure, and lack of public transit to name a few. He suggests that academics and industry experts invest time researching these issues, especially in the context of climate change since it has the ability to exacerbate issues we are already facing in rural Ontario. Caldwell argued that the province needs to focus its resources and research on creating more connected communities – we can start doing this by identifying suitable land use planning and transportation strategies to build stronger more resilient rural neighbourhoods.

Keith Currie also expressed a similar belief, identifying the creation of “complete communities” as the prescribed focus going forward. More specifically, Currie suggested intense research be dedicated to the impact of ecosystem services on agricultural land as well as climate mitigation and adaptation. Currie advocated that research which examines how to maintain and enhance agricultural systems would create more resilient farming methods.

Similarly, Dianne Saxe championed her office’s regular research and reports on soil health, which she argues is of paramount importance. Continued research into soil health and resiliency needs to be performed simply because our soil acts as a carbon sink. With the decline in Ontario’s soil health, research into this important topic will help create and maintain a healthy soil food web that will successfully sequester carbon, improve water quality and plant health, reduce flooding, and strengthen climate resilience.

Potential Policy Directions at the Local and/or Provincial Scale

Currently, the government controls policy in a top-down manner that applies a one-size-fits-all approach to Ontario’s diverse landscapes. Keith Currie argues that this approach creates inconsistency and confusion for

farmers and rural communities and recommends more collaboration and stakeholder engagement when designing and assessing legislation, regulation and policy. This starts with considering agricultural needs when making decisions associated with the land use planning and development, perhaps even instituting mandatory Agricultural Impact Assessments. Going forward, Currie suggested we treat policy and regulation as “living” documents with constant modification and adaptation that mold to changing landscapes. Before any of this can be done however, Currie argued that municipal, provincial and federal policy and initiatives need to turn their focus on public awareness and education.

Wayne Caldwell echoed these sentiments and identified some important provincial documents that are presently addressing the health, prosperity and growth of agricultural lands including the *Greenbelt Plan* and *Ontario’s Climate Change Strategy*. However, he questions how these documents integrate a land-use planning focus and recommends that current and future policy should take an anticipatory approach that recognizes the relationship with other policies to help create a more *resilient* system.

At the national level, Dianne Saxe highlighted the large financial pledges made not just by Canada, but by other countries at COP21 in Paris. This has led to hundreds of initiatives and aggressive targets and policies aimed at reducing global temperatures. As a province though, Saxe argued that Ontario needs to focus its policy on soil health and resiliency. Developing legislation that adequately tackles storms and droughts, emissions, pesticides, water and air quality will help strengthen agricultural land.

Lunch Keynote Presentation

Hank Venema (Director of Planning – Prairie Climate Centre, International Institute for Sustainable Development)

“Introduction to the Prairie Climate Centre”

Hank Venema provided an overview of the work that has been undertaken by the [Prairie Climate Centre](#). The Prairie Climate Centre has three strategic goals:

- **Climate Data and Research** – data and research that address critical knowledge gaps, facilitate adaptation planning, and generate solutions across the Prairie Provinces.
- **Communication and Outreach** – deploying video, mapping and other multi-media tools to mobilize knowledge tailored to the needs of different stakeholder groups.
- **Planning and Development** – Leading adaptation at local, regional and national scales, ensuring a new generation of leaders, and long-term vitality of the Prairie Climate Centre through strategic partnerships and constant innovation.

One of the initiatives that the Prairie Climate Centre has undertaken to support its mandate is the development of the Prairie Climate Atlas. This tool helps the Prairie Provinces to visualize climate change projections for their respective jurisdictions. Data from 12 downscaled global climate models was produced by the Pacific Climate Impacts Consortium (PCIC) in Victoria, BC and used to develop ensemble (average) projected conditions for the prairies. The centre can provide a detailed summary of the projected climate changes for any location/area in the Prairie Provinces (e.g., town, RM, crop district, etc.) by developing tailor-made reports.

The Prairie Climate Centre has also been developing a strategic plan. Staff undertook extensive consultations with government, NGO, and other relevant stakeholders; an external review of other climate centres (e.g. Pacific Institute for Climate Solutions, Potsdam Institute for Climate Impacts Research, Ouranos, etc.) and a SWOT analysis was also undertaken. In developing the strategic plan, it was determined that the niche of the Prairie Climate Centre is the way in which it creates synergies between mitigation and adaptation. In addition to this, a number of priority sectors were identified including: agriculture, water, health, emergency measures (risk assessment), and Aboriginal and northern affairs.

In addition to developing the Prairie Climate Atlas and a strategic plan for the organization, the Prairie Climate Centre has also undertaken initiatives related to adaptation policy and a number of their focus groups including agriculture and water. Ultimately, this work will help to advance the centre’s role in informing policy, developing solutions, and making climate change data more accessible.

Workstream 1: Sustainable Energy in the Agri-Food Supply Chain

Author: Rebecca Jahns (McMaster University)

Moderator: Kirby Calvert (University of Guelph)

Workstream Description

Renewable and sustainable energy options are becoming increasingly linked to the agri-food supply chain due to a widespread transition to a low-carbon society. The greenhouse gas emissions emitted by the agricultural sector in Ontario paired with its high potential for renewable energy integration make it the perfect sphere for developing lasting and meaningful systems that reduce emissions and combat climate change. Therefore, it is necessary to consider the integration of renewable energy resources such as agricultural biomass and on-farm wind and solar production into the energy mix in order for the GGH Region to be a leading contributor to meeting Ontario's climate change policy targets.

A shift towards renewable energy in the agricultural sector will also diversify the rural economy of the region and create more employment opportunities through development, ongoing maintenance, and eventual decommissioning. The food processing industry in this region can contribute to the low-carbon movement by integrating renewable energy, particularly bioenergy, into their production models. Along with these promising opportunities, challenges such as changing land use policy and opposition from stakeholders must be addressed.

The objective of this workstream was to showcase ideas from researchers, public policy makers, and industry professionals and use their expertise to recognize economic, policy, and social barriers to reaching the goal of renewable energy integration in the agri-food supply chain. A discussion following presentations was meant to discuss solutions to specific problems in the context of the overall goal to increase the presence of renewable energy in the agri-food system.

Summary of Presentations

Alfons Weersink – (Professor, University of Guelph)

“Energy Crop Potential under Alternative Scenarios”

Biomass, such as wood, some crops, and manure, can be used for the creation of biofuel or bioenergy in a renewable capacity. Dr. Weersink stressed the fact that energy crops have strong potential for feasible and sustainable expansion in Ontario, while also addressing the challenges associated with meeting this goal. A study that included test plots in Elora and Woodstock, Ontario, concluded that it would certainly be possible to grow enough switchgrass and miscanthus to meet all of Ontario's energy needs and even, for example, reopen the former Nanticoke coal-fired plant as a bioenergy plant instead. Findings such as this spurred a recent PhD dissertation which used GIS technology to map yields for switchgrass and miscanthus based on temperature and sunlight, and concluded that although miscanthus has higher overall yields, switchgrass has a higher break-even price point.

Successes in the field of bioenergy in Ontario, such as the ethanol plant in Aylmer which started as a farmer co-op and is now a prosperous biorefinery, have led other farmers to see potential for themselves in the future of the industry. Challenges the sector faces include the small market and the lack of a consistent supply chain, that there is competition with cheaper energy sources such as natural gas, the high land prices in the GGH Region, and serious questions about how best to use arable farmland (for food or fuel?). Overall, it is certainly possible for Ontario to invest in this resource, but adequate government and community support is key to its success.

Dimple Roy, (Director of Water, International Institute of Sustainable Development)

“A Watershed Bioeconomy Approach in Manitoba”

The International Institute for Sustainable Development (IISD) is a Canadian non-profit, non-governmental research organization based in Winnipeg, Manitoba. The organization recognized eutrophication in the Lake Winnipeg watershed due to increased flooding causing spikes in levels of nutrients like phosphorus and nitrogen. Their solution was to develop a logical system that was environmentally beneficial, economically sound, and advantageous for local communities. Instead of waiting for certain areas to flood every year and runoff into the larger lake network, they designed designated areas for the water to flow and prevent it from going too far downstream. They plant cattails in that water to remove unwanted nutrients, then teams remove the cattails from the water and use them as biomass products, such as pellets, that can be safely burned in lieu of coal to produce energy. There is research being done to see if phosphorus contained in the ash created by the burning pellets can be efficiently used as fertilizers. IISD is currently working on a decision-support-system tool called the Bioeconomy Atlas, which uses GIS technology to decide where biomass systems would be best set up in Manitoba. Since its original pilot projects in 2012, IISD has harvested 1200 tonnes of cattail biomass and removed 1.5 tonnes of phosphorus and 14.1 tonnes of nitrogen from the watershed. Overall, this system creates a biomass supply while capturing unwanted nutrients and offsets carbon emissions while sustainably managing surface water, biodiversity, and habitats. IISD attributes part of their success to the different policies that have been enacted in the province that favour ecosystem management and promote the use of renewable energy over non-renewables. More information about the IISD's approach to the bioeconomy is available [here](#).

Stephanie Thorson (Canadian Biogas Association)

“Closing the Loop: Climate Resilient Food Systems in the GGHR”

The Canadian Biogas Association promotes the development of biogas through its member-based organization which emphasizes education and advocacy for biogas. Biogas is created when anaerobic digesters take in organic waste such as manure or food waste, heat it to release methane gas, and then convert it to either electricity or Renewable Natural Gas (RNG), which can be injected directly into regular natural gas pipelines, or Compressed Natural Gas (CNG), which can be used to fuel suitable vehicles. Overall, their goal is to see biogas, RNG and CNG have an increased usage across Canada in order to significantly reduce GHG emissions. [“Closing the Loop”](#) is an initiative created by the association which aims to encourage municipalities' participation by including biogas in their energy and fuel mix. This strategy is being used partially because there is no current specific Feed in Tariff (FIT) program available for injecting biogas into the natural gas distribution network and any current participation is voluntary. The program has had some success thus far – for example, there is a wastewater treatment facility in Hamilton, Ontario that uses CNG to fuel the city's transit vehicles. The main challenge for biogas is that there is no pricing system

for RNG/CNG and it is not legal for local energy distributors (Enbridge, HydroOne etc.) to purchase RNG because it is more expensive than fossil fuels. The Canadian Biogas Association is advocating for policy changes like the allowance of RNG to be injected into natural gas pipelines, setting up proper pricing for the fuel, and banning organics in landfills completely so that they may be used for biogas production instead.

Tim Faveri (Director of Sustainability and Shared Value, Maple Leaf Foods)

“Maple Leaf Foods: From Farm to Plate”

Maple Leaf Foods is Canada’s leading consumer packaged meats company which incorporates a robust sustainability framework into its business model by establishing environmental company-wide goals, such as a 50% reduction in their eco-footprint (a measure of the human impact on Earth’s ecosystems) in 10 years. It is a vertically integrated food company, meaning that the company owns its supply chain as well. As a way to meeting their sustainability goals, the company installed a biogas recovery system in Brandon, Manitoba in 2001. The facility features an anaerobic wastewater treatment lagoon, wherein the wastewater flows into the basin, sits for two weeks, and then is sent back to the plant powerhouse where it is burned in a high pressure steam boiler to produce electricity. Some challenges regarding anaerobic digesters in Maple Leaf’s experience include the high start-up and maintenance costs, seasonality of their production cycle in terms of maintaining adequate amounts of feedstock, and the low winter temperatures in Manitoba causing issues with the processes within the plant. Moving forward, it is clear that new incentives from the government for biogas and other renewable solutions, in addition to upgraded technologies lowering the prices of these systems, would be very attractive for large companies and encourage them to continue investing in renewable energy systems.

Summary of Discussion Period

The purpose of the discussion period was to elicit conversation about the drivers, barriers, and potential solutions to advancing renewable energy in the agri-food sector. The presentations heard before the question period brought up many benefits to renewable energy in the food production system, particularly biomass, such as the fact that it is dispatchable and easier to make aesthetically pleasing to some than wind and solar. Co-generation plants are seen as the most effective way for biomass to enter the market – public-private partnerships, like the Maple Leaf example in Manitoba, could be excellent working relationships between industry and government.

The barriers to sustainable energy in the food sector are technical and policy-based; there are questions about the potential for odour from biomass plants and the fluctuating supply of feedstock for an anaerobic digester. There is also the issue of pricing because in the past (with solar in particular), a poorly informed government miscalculated the market value of energy and caused discrepancies with pricing.

The biggest issue seems to be the food versus fuel debate about whether to use viable land to grow food or energy crops. However, there are many solutions being brought forward for these issues; policies that protect the best farming land and force farmers to use marginal lands for energy crops would be helpful; the idea that policy-makers should not set the price for renewable energy, but instead set a mandate for production levels and let competition drive the price down; phasing out fossil-fuel subsidies would even the playing field and make renewable solutions more affordable for all; using GIS decision support systems to ensure plants are located optimally; and cost-sharing programs could solve the issue of high start-up costs that are less affordable to farmers. At the end of the day, the general consensus was that it is imperative for renewable energy systems to be integrated into the agri-food sector, but that in order to overcome the barriers to

reaching this goal, a combination of policy changes, technical advances, and smart planning solutions must be employed.

Future Directions

Key Research Priorities for Academics to Consider

There is a plethora of research opportunities in the scope of renewable energy development and sustainability that may be taken on by the academic community in contribution to renewable energy advancement in Ontario's agri-food sector. In terms of engineering, research could be directed toward improving efficiencies with any renewable technology (for example, addressing the problem of some anaerobic digesters malfunctioning in cold conditions, as mentioned by Mr. Faveri). Greater efficiencies for any renewable technology will also make that technology more attractive to stakeholders looking at integrating it into their agri-food systems because their energy generation and potential profits will increase. At a more general scale, qualitative studies dealing with stakeholders' perceptions of renewables could inform more specific decision-making research that involves GIS decision-support systems. In a geographical sense, GIS-based multi-criteria evaluations to find optimal locations for a given renewable could (and perhaps should) become the standard for decision-making in the renewable energy sector in order to include all contributing factors, from theoretical energy potential to the highest value sites. There is also a need for studies regarding new programs that could become 'two birds with one stone' type situations similar to the cattails' restoration-biomass success story told by Ms. Roy; for example, research into using invasive species as biomass fuel could be useful in the near future.

Potential Policy Directions at the Local and/or Provincial Scale

One of the policy proposals brought forward at the symposium was reducing subsidies and tax breaks on the fossil fuel industry and increasing incentive programs for renewable energy in order to even the economic playing field. Continued support and funding of academic studies related to renewables will support further steps to make renewable energy more accessible and affordable for businesses, farmers, and everyday people. The continuation of Feed-in-Tariff (FIT) programs in combination with mandates increasing the amount of renewable energy that should be added to the overall provincial energy mix would be other support systems for the renewable sector. Partnerships akin to the one between Maple Leaf and the City of Brandon, Manitoba with their anaerobic digester could be a good example for other municipalities to team up with local businesses large and small to integrate renewables into their business models. Finally, the cost of non-renewable energy sources (e.g. natural gas) should reflect the market price rather than an artificial cost that ignores externalities (e.g. damage to the surrounding environment); this will increase the transparency around the true cost of non-renewables and make renewable energy more financially attractive to consumers.

Workstream 2: Exploring Pathways towards Low Carbon and Climate Resilient Agriculture

Author: Marion Davies (University of Guelph)

Moderator: Ralph Martin (University of Guelph)

Workstream Description

This workstream examined the major sources of greenhouse gas emissions in Ontario's agricultural sector. A major theme that came forward was that reducing emissions in the agricultural sector requires a careful examination of full environmental and social systems beyond a farm to fork approach. In addition to acknowledging and measuring the environmental implications of agriculture in Ontario, these speakers emphasized the importance of reducing the industry's fossil fuel dependence. Given the realities associated with climate change and the associated uncertainty in agricultural productivity, the speakers argued that Ontario should rapidly transition towards climate-resilient agriculture. Although there is no 'cure-all' for socially and environmentally sustainable agriculture, the speakers suggested several approaches to improving sustainability and resilience.

Summary of Presentations

Claudia Wagner-Riddle (Professor, University of Guelph)

"Managing greenhouse gas emissions from agro-ecosystems in a changing climate"

Given the demand for agricultural products, there is increased pressure to evaluate the life-cycle sustainability of agro-ecosystems through scientific measurements. Claudia Wagner-Riddle spoke about how evaluating sustainability in this way requires the use of agro-efficiency metrics. For example, over recent years, grain production in Ontario has required decreased nitrogen inputs per unit of yield, which suggests that our systems are increasingly efficient.

In addition to this, Wagner-Riddle looked at how well-managed agricultural systems can act as both a source and a sink of atmospheric carbon given that certain land-use practices can lead to net-absorption of atmospheric carbon. Considering that carbon emissions and sinks in agricultural systems are varied and complex (occurring both on and off the farm), truly improving sustainability requires life cycle assessments to allow consideration of trade-offs and synergies between carbon uptake and emissions. Agricultural practices that are associated with high rates of greenhouse gas emissions and low rates of carbon storage include: degraded or marginal land, bare soil, low residue return, intensive tillage, drained wetlands, poor manure storage, and inefficient nitrogen use. Despite these sources of greenhouse gasses, agro-ecosystems with high capacity for carbon storage and low greenhouse gas emissions (and therefore the capacity to mitigate the effects of climate change) are: agro-ecosystems with reduced tillage, perennial crops, restored wetlands, cover crops, and biogas capture in manure storage.

Going forward, it is important to ask: how can we best manage the greenhouse gas emissions in the agricultural sector? First, it is important to identify if agricultural practices are sinks or sources of carbon, while also decreasing tillage, and increasing the use of cover crops. Further, we should aim to develop

perennial annual cropping systems that increase carbon storage while simultaneously decreasing greenhouse gas emissions.

Alan Freeden (Professor, Dalhousie University)

“Dairy System Resilience and Net-Zero Carbon Emissions: How are they Linked?”

In his presentation, Alan Freeden argued that resilience is a necessary cornerstone of global agriculture. A challenge related to increasing the resilience of our food system is the tendency to ignore its side effects: economic pressure tends to trump environmental concerns. For example, when calculating the environmental externalities of dairy production, it is common to focus on the farm-scale. However, we must also consider the inputs (e.g. feed) and outputs (e.g. potential soil degradation or degraded water quality) of these systems. This challenge is compounded by the fact that traditional metrics do not link economic profit and greenhouse gas emissions. Therefore, a change in metrics is required to effectively understand and reduce these emissions. For example, in addition to measuring the kilograms of milk produced per cow, we must also examine the kilograms of carbon dioxide produced per kilogram of milk and per hectare of agricultural land. This information will reflect net revenue in relation to the carbon emissions produced from these systems. Freeden refers to the redevelopment of metrics as “traditiovation” – an innovative re-development of traditional techniques to improve the resilience of food systems.

Freeden suggests that redeveloped, environmentally-focused metrics would improve our ability to make the most meaningful environmental changes within our food systems. For example, within dairy production systems, these metrics would make it evident that pasture-raised dairy cows produce less gas and that as individual cows become more productive, overall efficiency increases. Additional means of increasing the environmental sustainability of the dairy industry can include restoring biodiversity on farms by establishing diverse mixes of perennial forages and legumes.

Peter Tyedmers (Director of the School for Resource and Environmental Studies, Dalhousie University)

“Greenhouse Gas Emissions of Food Systems: Thinking about Mitigation Beyond the Farm”

Our entire food system – including agricultural production, processing, consumption, and waste disposal – accounts for 30% of Canadian greenhouse gas emissions. Therefore, our food system presents substantial opportunities for reducing total greenhouse gas emissions, particularly during primary production and consumption stages. In this way, life cycle assessments (LCAs) – a means of holistically examining the means of production and consumption of a product – are essential tools for understanding the broad resource and environmental implications of our food system, and allow insight into how to most effectively reduce the impact of a product. LCAs demonstrate that focusing efforts to reduce greenhouse gas emissions at the production stage is insufficient: rather, we must tackle emissions at every stage throughout the process. However, it is also critical to consider that while many opportunities for environmental change occur beyond the farm, these can often be affected by on-farm decisions. In a case study of dairy cows, feeds can be responsible for up to 50% of the greenhouse gasses of the dairy system – this reinforces the argument that making changes to upstream feeds, traditionally out of control of the farmer, may greatly reduce the emissions of the entire system. The conclusion of this presentation was that food systems present numerous opportunities for reducing greenhouse gas emissions, and it is essential to better understand these opportunities when seeking to create change within food systems.

Blake Vince (Director, Innovative Farmer's Association of Ontario)**“Conserving Farm Land with Cover Crops and the Importance of Biodiversity”**

Blake Vince has run a no-till farm since 1983, and prides himself on the very healthy, biologically-active, and productive soil that he has been able to maintain on his farm through careful management practices. In particular, the soil on his farm has been particularly well-managed through dedicated cover cropping and no-till agriculture.

No-till agriculture helps to increase the biological activity of soils and can improve the productivity of subsequent crops. A common practice in modern agriculture is to clean soils from crops or seeds following the growing season, and to leave soils without plants during the winter. However, cover cropping involves either planting an additional crop, or leaving discarded crop remnants on the soil following harvest. In this way, soils remain protected and nutrient generation occurs outside of the growing season; thus, cover crops reduce the need for nitrogen inputs and tillage, as well as decreasing erosion and increasing biological activity and future crop yields. However, it is very important to cover soils with locally-native crops; in other words, soils developed under locally-specific conditions, and will be best managed if covered in native vegetation. Cover crops are already being explored for their tremendous ability to improve soil health, but more investment is required before we will truly understand soil biology.

Moving towards a time of rapid environmental change, discussions of feeding future populations must increasingly prioritize water conservation and soil health as more yield does not necessarily ensure that farmers will achieve greater profits. Rather, sustainably managed agro-ecosystems will ensure that farms remain productive and profitable far into the future.

Summary of Discussion Period

There are a number of approaches that can be adopted to foster sustainable practices within the agricultural sector (e.g. pasture grazing, permaculture, and no-till). In addition to this, implementing more effective government programs such as carbon pricing, land stewardship, and better public policies for equitable access to healthy food can help to foster environmentally *and* socially sustainable food systems. To support the development of these programs, it is important to engage agricultural landowners with new data and holistic management approaches, while also improving relationships between consumers and farmers.

At the same time, there are a number of barriers which prevent the agricultural sector from adopting best practices that will help the broader system move towards a low-carbon economy. Prominent among these barriers are a lack of monetary incentives and infrastructure, as well as diverse perspectives that make it difficult to communicate between scientists, governments, and farming communities. Further, there is a tendency in governance to create uniform policies across diverse social contexts, which can hinder their relevance and efficacy. These barriers should push us towards solutions that include better transfer of knowledge and technology, as well as better analysis of the environmental impacts of food systems throughout entire value chains. Further, we must use relevant farmer-level data to customize resource-efficient and locally-applicable practices.

There are also major challenges to implementing more environmentally-sustainable practices in the agriculture sector, including the pressure to increase agricultural productivity and ability of wealthy individuals and corporations to influence policy decision. In this way, it has become very difficult to ensure equity within food systems, both for consumers and for producers. At the same time, the high capital investment and

financial risk involved in farming makes it increasingly difficult for new farmers to enter the business. In addition to this, the rural-urban divide highlights the need for better information so that farmers can better understand the environmental impacts of their practices.

Future Directions

Key Research Priorities for Academics to Consider

An important area for further research is developing effective and applicable tools for measuring the life-cycle impact of agricultural processes within complex systems. These tools will help to better answer the question: how can we most effectively manage and reduce the greenhouse gas emissions of agriculture? In order to do so effectively, we must first understand the opportunities for making change within food systems, and consider where there are currently gaps in our knowledge and consideration of the impact that agriculture has on our environment.

A component of this research that is often overlooked is the social context of rural communities. Therefore, research on the environmental impact of agriculture in Ontario must also focus on how information is transferred in rural communities, and how to make pro-environmental behaviour beneficial and attractive within tradition-rooted communities. In general, researchers must increasingly consider their area of focus within greater systems that include environment, economy, and society: understanding the interconnections within these spheres of influence will help to inform robust policies that foster meaningful improvement in the sustainability of agriculture.

Potential Policy Directions at the Local and/or Provincial Scale

A major outcome of this Workstream was the understanding that holistic management of entire food systems (rather than individual management of the components of agricultural production) is necessary to achieve net environmental benefit. A component of holistic management involves determining if agricultural practices create sinks or sources of carbon, as well as the relative *emission intensity* of individual products and practices. This information about the total environmental impact of a product – which can be collected through LCAs – may help policy-makers understand the most intense sources of emissions, and thereby the most important areas for change when seeking to mitigate the effects climate change. Therefore, emission intensity metrics (collected through LCAs or a similar tool) could be employed at both local and provincial policy scales to inform ‘climate-safe’ levels of production and consumption of individual products.

Workstream 3: Planning for Climate Resilient and Sustainable Local and Regional Food Supply Chains

Author: Brennan Vogel (Western University)

Moderator: Rod MacRae (York University)

Workstream Description

This workstream session explored cases, concepts and ideas for developing shorter food supply chains to support progress on a number of interrelated municipal and provincial policy-making issues in the GGH Region including: climate change mitigation and adaptation, economic development, and food security. Panelists introduced discussion topics and issues related to local and regional food production and processing capacity, food distribution and storage systems, institutional food procurement, and food access among the region's vulnerable populations. After the panelists' presentations, session participants were engaged in facilitated discussion groups, guided by six questions targeted at addressing the topics and issues raised during the presentations. The workshop purpose was to develop a policy agenda to support climate resilient and sustainable local and regional food supply chains.

Summary of Presentations

Moderator: Rod MacRae (Associate Professor, York University)

"Planning for Climate Resilient Local & Regional Food Supply Chains in the GGH Region"

Rod MacRae provided an overview of the panel and set the context for the workstream around the complexities of the food system and challenges related to climate change. MacRae observed that food systems are difficult to change, due to the global production scale of the food supply chain and complex socio-economic issues of food security (e.g. access, affordability) that extend beyond climate change issues at local and regional scales. MacRae discussed how greenhouse gas (GHG) point source attribution in food systems analysis ('food miles') is difficult to calculate given the multiple components of the food system. However analysis of the Canadian food system has indicated that there are opportunities for municipal policy-making to address GHG emissions related to food consumption waste, as well as the transport, processing, packaging and cooling of food in the GGH Region.

Barbara Emanuel (Manager of the Toronto Food Strategy, Toronto Public Health)

"Toronto Food Strategy"

Barbara Emanuel discussed how municipalities play a large role in promoting sustainable food systems by offering a presentation contextualizing the Toronto Food Strategy. Emanuel observed that globally, more than half of the world's population currently lives in urban areas and while there is enough food produced globally to feed everyone, distribution issues with the existing quantity of food results in a third of the global food supply being wasted. Emanuel also observed that while cities bear the significant costs of a

dysfunctional food system, they also have some limited policy power for impacting local food systems in diverse municipal sectors such as: socio-economic development and health promotion, land use planning / regulation and environmental protection. Emanuel then discussed the Toronto Food Strategy: a city-wide strategy to improve access to healthy food, enable food literacy and access, promote economic development, develop knowledge of food deserts in Toronto. Emanuel provided several examples of initiatives within the Strategy including Food Reach (a program that allows small agencies to purchase wholesale food) and Strategic branding, marketing and outreach initiatives (e.g. 'Grab Some Good' – a mobile food market in collaboration with Food Share to increase accessibility to healthy food in low-income neighbourhoods). Emanuel concluded by briefly discussing Grow TO, an urban agriculture strategy for promoting urban farming in Toronto, and highlighting the importance of making policy linkages between food systems and other municipal initiatives (e.g. transformTO - climate action strategy).

Sally Miller (Local Organic Food Co-op Network)

“Links, Lessons and Lives: The City Region Food System in the GGH”

Sally Miller began her presentation by describing the 'Links, Lessons and Lives: [City Region Food System Assessment Project](#).' The project includes seven global cities and is focused on exploring urban-rural linkages as well as developing indicators and measurements of food resiliency based on cases from around the world. The project focuses on the GGH Region which produces over 200 agricultural products and faces planning and policy challenges in maintaining a balance between ecological services provided by protected areas with urban population growth pressures, as it is anticipated there will be an additional 4 million more inhabitants living in the region by 2031. Miller provided an overview of the GGH regional food system's GHG contributions, in order to develop baselines for future monitoring, evaluation and resiliency indicators. Miller emphasized that energy use is greater in processing than in agriculture, also indicating that GHG reductions extend beyond reducing 'food miles' and that there are other sectors and areas for reducing emissions and advancing GHG mitigation and adaptation plans and policies in the regional food system. Miller then provided a series of food system case studies from the GGH region to highlight the various ways and means that the food system can innovatively help to reduce GHG emissions through changes to agricultural production methods (e.g. low-carbon fertilization; adaptive crop selection; reduced soil exposure; reduced energy intensity), food processing and storage innovations (e.g. energy efficiency) and sustainable retail and distribution practices (e.g. sustainable transportation).

Alison Blay-Palmer, Associate Professor (Wilfrid Laurier University)

“Sustainable City Food Systems”

Alison Blay-Palmer provided a presentation on the City Region Food System research project. The research was described as being grounded in communities of food practice (e.g. participatory, community-driven, through advisory committees, bottom up). She commented that there are multiple points of potential intervention to pursue co-benefits across multiple sectors of the regional food system while reducing GHGs and promoting adaptive capacities. However, Blay-Palmer made note of the need for more information provincially and generally regarding the concept and practice of 'food hubs' - defined as actual or virtual spaces through which local and or sustainable food is collected and distributed to processors, retailers, restaurants and other organizations. In the context of climate change and GHG mitigation, Blay-Palmer advocated that food hubs could create better linkages between producers and markets at the local scale by creating shorter supply chains while promoting education and awareness of the local food system. Blay-

Palmer then provided three case examples of food hubs in the GGH region: [Niagara Local Food Co-operative](#), [Open Food Network](#), and Plan B.

Franco Naccarato (Program Manager, Greenbelt Fund)

“Broader Public Sector Driving Change”

Franco Naccarato began by providing an overview of the goals of [Broader Public Sector \(BPS\) grant stream](#) targeted at increasing the local food procurement in Ontario’s public sector institutions (e.g. municipalities, colleges, universities, school boards, hospitals); and enhancing agri-food sector capacities (e.g. farms, processors, distributors) to access public sector consumers and increase the availability of Ontario food products in public sector institutions. The BPS has provided funding of \$8.6 million over 5 years for 111 projects including funding for farmers, processors, distributors, public sector institutions, NGOs and food service companies. Overall, the BPS has increased Ontario food sales by \$112 million, showing a return on investment of 13:1. Naccarato provided several examples of local food procurement in provincial institutions and municipal local food procurement. He suggested that the BPS has contributed to reversing the supply chain and improving market access by providing an intervention to increase demand for local food products through institutional buyers. The model contributes to advancing the traceability of local food in institutional procurement by providing more locally processed products in institutions through partnerships and collaborations. Naccarato also suggested that ‘rebuilding the middle’ (moving food from producers to consumers) necessitates innovations in food processing, aggregation and food hubs show potential. Next steps discussed included ‘rebuilding the middle’ through incubator, accelerator and co-packing financial support from the Green Belt Fund.

Summary of Discussion Period

The panel discussion raised several questions and issues for further consideration. The first issue that was raised related to equitable access to land and markets for small-scale agricultural producers in an economic landscape dominated by multi-national agri-food corporations, consequentially leading to diminishing opportunities and constraints for the entry of a new generation of farmers. Panelists provided several case illustrations of both opportunities to address equity issues (e.g. Funding/organizational assistance programs like the [Ontario Farmland Trust](#), [Farm Start](#), and [UK Land Share](#)). The second issue that was raised related to best practices for supporting new farmers with the burden of responsibility associated with producing food. At the macro-level, panelists suggested that innovation and support for agricultural development requires overcoming international trade agreements and the global legacy of economic and trade barriers that undermine domestic food sovereignty and the abilities of new producers to enter the market. The third issue discussed related to brownfield reclamation and restoration for urban agriculture; Emanuel commented that the Toronto Public Health Authority provides [soil assessment guidelines](#) to assess project feasibility. The final question related to good examples of food hubs: [Two Rivers](#) (Ottawa), [Wendy’s Mobile Market](#) (Kingston), [Food Share](#) (Toronto) and [100 KM Foods](#) (Toronto) were mentioned. The [LOFC project](#) on food hubs was also discussed as a capacitor for food hub development, stakeholder consultation and contextual advancement of food hub feasibility (e.g. [On The Move Organics](#), London). The importance of municipal support for access to land was also discussed as an important contribution to advancing the feasibility of food hubs.

Future Directions

Key Research Priorities for Academics to Consider

This workshop contributed to developing and advancing a research agenda for supporting climate resilient and sustainable local and regional food supply chains in Ontario. It appears that academia can contribute to advancing multiple objectives related to building resilience and adaptive capacity to climate change impacts and supply-chain disruption at the local scale, while also promoting healthy eating and sustainable local economic development. For example, MacRae observed that there is a 'medium' level of potential influence for municipal policy-making to address GHG emissions related to food consumption waste, as well as the transport, processing, packaging and cooling of food through policy interventions. Research priorities for academia to support progress in these sectors requires further articulating the conceptual underpinnings and measures of progress for a sustainable, resilient and adaptive regional food system capable of reducing GHG emissions, while co-beneficially advancing socio-economic and agricultural innovation and societal adaptive capacities to an uncertain climate. In addition to this, Emanuel noted Toronto based examples of municipal food and nutrition programs contributing to socio-economic development, health promotion and better land use planning, regulation and environmental protection. Further case based documentation and comparative analysis of municipal food and nutrition interventions could contribute to advancing grounded conceptual understandings of the nexus between regional food systems and climate action.

Potential Policy Directions at the Local and/or Provincial Scale

This session provided many examples of emerging best practices for supporting regional food systems with potential implications for the GGH region to sustain and further develop a resilient agricultural economy and food secure society in an uncertain climate. The workshop also provided a basis for advancing planning and policy recommendations for actors in the public sector (municipal, provincial, and institutional sectors) with the common goal of advancing long-term management strategies amongst existing agri-food business actors in the region, while also supporting climate-smart innovation in the regional food system of producing, transporting, distributing and supplying the growing population of South-western Ontario and the GGH Region with regionally produced healthy, sustainable food products contributive to sustainable economic development. Continued and expanded government support for advancing innovation in the regional system could include: 1. Strategic long term land use planning to preserve Ontario's agricultural land base; 2. Strategic policy reform and supportive funding and investment in innovation, to support the entry of new agricultural producers and the development of regional supply networks essential to 'rebuilding the middle' of the food system (in particular, fruits and vegetables); 3. Advancing food hubs through increased access to capital for investment, through provincial/municipal policy support.

APPENDICES

List of Participants

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