CAPI
THE CANADIAN AGRI-FOOD POLICY INSTITUTE

“Optimizing Land Use for Sustainable Growth” a CAPI Dialogue Guelph 2019

Dialogue Summary Report

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I. INTRODUCTION

In light of one the top global challenges of the 21st century, (i.e. producing enough affordable and accessible food to meet the demands of an increasing population while maintaining and improving natural capital (land, water, air, biodiversity)), *quality* growth will be needed to ensure that *any* growth in the sector will be sustainable.

In agricultural production, soil use and soil quality are connected to farmers' choices among competing enterprises, such as crops versus livestock. They are also linked to environmental outcomes such as biodiversity, air and water quality, carbon sequestration and climate change. Farmers allocate their land to optimize economic returns. However, optimizing land use with a view to maintain and improve its productive capacity over the long term requires more than just responding to market signals. The key question becomes: "how can land use be optimized to improve environmental outcomes, while ensuring long-term competitiveness and growth?"

To seek answers, CAPI and partners convened two dialogues: one on February 21-22, 2019 in Calgary, Alberta and another on April 24, 2019 in Guelph, Ontario.[1] The objective of these dialogues was to convene a transdisciplinary group of experts from industry, government, academia and others to start a conversation on "Optimizing Land Use for Sustainable Growth." The *Calgary Dialogue* focused on land use choices, agronomic practices, and policy instruments and their impacts on soil, air and biodiversity, while the *Guelph Dialogue* had a large focus on land use and water quality.[2]

With over 100 participants, the dialogues helped raise awareness about sustainable land use practices and their impacts on GHG emissions, air and water quality, biodiversity and sector profitability and competitiveness, as well as the options available to optimize land use for sustainable growth. A summary of the *Guelph Dialogue* is provided below.

II. WHAT WE HEARD

SESSION: AGRICULTURAL SYSTEMS, LAND USE PRACTICES AND WATER

Session I addressed land use practices and water quality.

The first speaker, **Dr. David Rudolph** of the University of Waterloo Water Institute, presented on "Managing Water Resources within the Agricultural Landscape: Challenges and Progress." Dr. Rudolph focused on the interaction between agriculture and water resources.[3] He argued that by 2050, when global food demand is projected to rise by 70%, global demand for water will increase by 50%. Also, with

[1] The Agenda for both dialogues and the papers and presentations are available here: https://capi-icpa.ca/events/capi-dialogues/

[2] A summary of the Calgary dialogue is available here: https://capi-icpa.ca/explore/resources/optimizing-land-use-for-sustainable-growth-a-summary-of-a-capi-dialogue-calgary-2019/

[3] Dr. Rudolph's presentation is available here: https://capi-icpa.ca/explore/resources/managing-water-resources-within-the-agricultural-landscape-challenges-and-progress/

Climate Change occurring, historical relationships and conditions are becoming less predictable, so more research is needed around agriculture-water linkages, and data/metrics that measure water use and availability should be updated.

Agriculture is considered one of the largest sources of water pollution globally, with water pollution from nitrogen, pesticides and pathogens posing increasing risks.[4] While progress has been made in reducing the impacts of agriculture on water quality since the 1970's, the past decade has seen some deterioration. Nitrates in groundwater are considered a hazard, as they threaten human health. Testing of drinking water wells in Southern Ontario found that 37% of wells contained one or more target contaminants at concentrations above provincial drinking water standards. Dr. Rudolph's research found that Best Management Practices (BMPs) can help mitigate the impacts of agricultural production on water quality. This includes regional nutrient management strategies, where appropriate types of nutrients are applied at optimal rates and at optimal times. Other BMPS include crop rotation, cover cropping for N fixation, and riparian zones and buffer areas around waterways. Maintaining wetlands on farmland for filtering and storing excess run-off are also beneficial. In a case study of polluted public drinking water wells around a small Southern Ontario town, water quality was found to improve after BMPs were used on adjacent farmland. He concluded that BMPs targeting nutrient reduction can significantly reduce long-term water quality impacts while maintaining yields.

Professor Bruno Larue of Laval University followed with a presentation on "Agricultural Systems, Land Use Practices and Water in Quebec".[5] He described how agricultural production can lead to both "good" and "bad" outputs. "Good" outputs are the commodities that are produced, while "bad" outputs are the *negative externalities* or environmental costs associated with agriculture, such as water pollution and N_20 emissions. "Bad" outputs are very highly localized, and depend on weather, soil type and geological characteristics of the region, in addition to how well agricultural resources are managed. *Externalities* do not factor into farmers' decision-making since they are not monetized through the markets, so government has a role to play in incenting farmers. To discourage "bad" outputs, policies that tax "polluters" or the "bad" inputs are one solution. Other measures, such as regulations or negative subsidies associated with eco-conditionality, may be more acceptable ways to discourage "bad" outputs. Quebec has made use of many of these measures.

Professor Larue described how agriculture in Quebec has evolved since the 1970's, influenced by government policies, strategies and incentives. Programs such as the revenue and crop insurance programs (i.e. ASRA) and subsidized credit and loan guarantees encouraged the production of hogs and major crops. Supply management restricted production of dairy, poultry and eggs, yet dairy production continues to be important in the province. Horticultural production also expanded substantially as a result of these programs/policies. The production of all of these commodities has an impact on water

[4] Canadian Council of Academies, "Water and Agriculture in Canada: Towards Sustainable Management of Water Resources" (2013).

[5] His presentation and paper are available at: https://capi-icpa.ca/explore/resources/agricultural-systems-land-use-practices-and-water-in-quebec/

quality, given the increase in manure, fertilizer and pesticide use. Increased pesticide use associated with Genetically Modified (GM) crop production, i.e. glyphosate, also added to pressure on water quality, as did antibiotic use in livestock production, although regulations around their use tend to be much stricter in Quebec than in other provinces.

Environmental regulations, *eco-conditionality* policies, *agri-environmental clubs* and programs were also used by the Quebec government to encourage the adoption of BMPs to address water quality concerns. Research by Professor Larue and colleagues found that non-farm rural residents were risk averse to paying for BMPS for this purpose, and prefer that farmers bear the burden of measures to improve water quality.[6] *Agri-environmental clubs* are helpful since they promote localized treatments with reduced dosage and spraying methods to minimize drift, with a positive impact on BMP adoption.[7] Regulations related to moratoria on hog farm expansion in 2002, and on cultivation in municipalities with damaged watersheds in 2004 have helped address water quality issues. *Eco-conditionality*, which ties government program payments to responsible environmental behaviour, was introduced in Quebec 2005 when ASRA payments became conditional on hog farms providing an agronomist-approved phosphorous report.

Discussant **Joann Whalen** from McGill University agreed that water is an important issue for agriculture. With climate change, there will be growing shortages and impacts, and with the rising use of fertilizers, pesticides, and antibiotics, there will be deteriorating water quality. She reiterated the importance of research and data benchmarks to improve our understanding of agriculture's impact, and to be able to respond with appropriate BMPs that are based on more recent data. The importance of wetlands should be reviewed, arguing that more areas around fields be kept as wetlands to help store and filter run-off, since they serve as water treatment plants. With fertilizer, it is important to understand where it is needed and where it is best to apply. Precision agriculture and programs such as the *4Rs Stewardship* program can help with this. Both Quebec and Ontario have done a good job introducing regulations and programs that address environmental issues in agriculture. Institutional support through cost-share programs that encourage BMPs, are important, due to the public good nature of environmental externalities.

A Participant Discussion then followed with comments from participants that included:

- Historical data needs to be updated;
- Big Data from precision agriculture should be used in decision-making models;
- There is a conflict between productivity growth and maintaining resource quality;
- Significant land use changes have taken place in Southern Ontario, such as apple orchards being converted to pastureland, wetlands to cultivated land and farmland to urban development; and

[6] Larue, B., G.E. West, A. Singbo, and L.D. Tamini, "Risk Aversion and Willingness to Pay for Water Quality: The Case of Non-farm Rural Residents," Journal of Environmental Management, 197 (2017), pp 296-304.
[7] Ghazalian, P.L., B. Larue, and G.E. West, "Best Management Practices to Enhance Water Quality: Who is Adopting Them?", Journal of Agricultural and Applied Economics, 41, 3 (December 2009), pp. 664-682.

- *Agricultural Extension* should be provided by governments to reduce the potential conflict of interest from input suppliers, who are increasingly providing it.

SESSION II – Animals and Soils: Industry Panel

Session II consisted of a panel of six experts from various industry sectors discussing how they are contributing to sustainable agriculture.

Keith Currie, President of the Ontario Federation of Agriculture (OFA) and a crop farmer, argued that farmers make their decisions based on market signals that come through prices and a need to be profitable. Opportunities arise from differentiating products with higher value characteristics and new technologies such as precision equipment and GPS are helping farmers save on costs. Farmers want to be able to leave what they have for their children, and they know soil health is key for ensuring this can be done. Farmers are willing to do their societal duty, but question whether they should be the ones to pay for what society wants. Consumers seem to be unaware of how much farmers are contributing to sustainability. Greater understanding is needed by consumers and better connection and communication between all players would help.

Professor Ralph Martin of the University of Guelph spoke on "Organic Agriculture: Impacts on GHG Emissions, Soil and Biodiversity". [8] He argued that organic agriculture plays an important role in reducing agriculture's environmental impact. Since the largest risks for the planet are from genetic biodiversity loss and excess phosphorous (P) and nitrogen (N) use, organic agriculture, which does not use synthetic N fertilizers, can help. However, the N that crops need will have to come from natural sources instead, such as crop residues and legumes in crop rotations. While the resulting crop yields are 20 to 25% less than conventional agriculture, there are environmental benefits, such as 56% less energy use per unit, 34 to 51% lower nutrient inputs (N, P and Potassium (K)) and biodiversity benefits; i.e. 40% more roots colonized by fungi and 3X more earthworms. GHG emissions are also lower. However, more land will be required to feed the growing population, unless less food is wasted and less meat is eaten, requiring less feed at the same time. Finally, organic agriculture can provide alternative options to mainstream agriculture which may help in certain circumstances, eg. when bulk commodity prices plummet, while also reducing the impact of agriculture on the environment.

Brian Gilroy, President of the Canadian Horticulture Council and an apple producer from Meaford, Ontario described how agricultural producers contribute to the Canadian economy and to Canadians' well-being. They produce over 100 crops, promote strong environmental stewardship and continue to evolve to produce for the changing demographic, (eg. bok choy is now the number one vegetable produced in Southern Ontario). In the case of apples, fruit and vegetable production makes use of pesticides and fumigants. Yet, producers are using a lot less than they used to and are making use of BMPs (eg. 3 to 4 year crop rotations for potatoes) to reduce disease and pest risk naturally. Integrated

[8] Prof. Martin's presentation is available here: https://capi-icpa.ca/explore/resources/organic-agriculture-impacts-on-ghg-emissions-soil-and-biodiversity/

Pest Management practices have been widely adopted as a BMP, resulting in a 50% reduction in pesticide use over the past 30 years. Apples are a good news story from an environmental point of view. Each acre in apple trees stores 20 tonnes of carbon dioxide, releases 15 tonnes of oxygen, and provides 12 BTU of cooling power. Producers have made significant productivity improvements over time: today we produce 1200 trees/acre compared to 300 trees/acre in 1994. However, fertilizer and pesticides used 30 years ago are still being used today, and soon many of these will no longer be available to producers. Agricultural extension services, which used to be provided by government and were tailored to local conditions, are now being provided by third party input suppliers, and are thus less location specific. On the buyer side of things, increasingly downstream players are making decisions that affect producers, eg. Walmart's sustainability guidelines. Mr. Gilroy argued that producers should become more proactive, or others will determine market specifications and some farmers may be driven out of business.

Professor Getu Hailu was the next panelist discussing the importance of reducing dairy production's environmental footprint, in light of the rising global demand for animal protein projected out to 2050.[9] Consumers are increasingly looking for environmentally-friendly products, such as "green" milk, which is being marketed in the EU. Fortunately, Canadian research on animal genetics and feed rations has contributed to greater feed efficiency and lower GHG emissions in dairy production. Professor Hailu found that farmers' attitudes towards climate change and environmental concerns were important for determining their willingness to adopt these new technologies. Specifically, when both technologies are considered together, farmers' willingness to adopt was greater, because of the lower costs of production associated with feed efficiency.

The next panelist, **Andrea de Groot,** Managing Director of the Ontario Pork Industry Council (OPIC) [10] explained how the pork industry is taking measures to produce top quality product for consumers while contributing to the environment, promoting stewardship of the land, water and the animals in their care. Areas of focus for producers include soil testing (80% of producers), water meter implications (over 50%), manure sample tests (over 50%), and pesticide management (over 80% using licensed professionals). In addition, over 80% of members have Environmental Farm Plans (EFPs), and over 50% make use of Nutrient Management Plans (NMPs) which include barns that comply with high environmental and safety standards. Several programs such as the Canadian Pork Excellence (CPE) program (formerly the Canadian Quality Assurance Program (CQA)) provide a national platform that allows registered pork producers to demonstrate compliance with food safety, animal care and traceability requirements. In 2018, OPIC developed its first Social Responsibility Report, a Life Cycle Assessment of the sector, measuring carbon and water footprints across the entire pork production chain, from feed production to processing and slaughtering. These benchmarks will be used to measure improvements over time for water and climate challenges, thereby helping hog producers take steps to improve their environmental footprint for a sustainable future.

[9] A CAPI commissioned paper by Prof. Hailu is available here: https://capi-icpa.ca/explore/resources/the-role-of-animal-genomics-in-reducing-greenhouse-gas-emissions/

[10] Available at: https://capi-icpa.ca/explore/resources/optimizing-land-use-in-animal-agriculture/

Lori Phillips, a soil scientist from Agriculture and Agri-food Canada spoke on the importance of the many organisms and biodiversity below the ground in agricultural soils that allow farmers to address both productivity and environmental issues.[11] Millions of organisms work together, from bacteria to fungae to worms that contribute to soil structure, carbon transformation, nutrient cycling and biocontrol. Biodiversity of the many microbes help provide sustainable production systems, regardless of whether the soil is wet or dry. Crop rotation affects these microbial habitats, as does tilling. Residue management and fertilizer inputs bias the microbial community in the soil. Farmers are the original ecologists looking after these systems and know how they can be altered and changed with fertilizer, soil amendments, drainage and crop cover and mix, leading to optimal sustainability and health outcomes. Research in this area has helped farmers improve their BMPs associated with soil quality improvements and environmental performance.

The **Participant Discussion** period included the following comments:

- There are many good things happening in farming today, between the new technologies and BMPs, that are leading to more sustainable production practices;
- Conventional and Organic agriculture have more in common than is often suggested;
- Yields are improving primarily due to the R&D being done in conventional agriculture;
- While there is great diversity in agriculture and differences in circumstances, resources and values between farmers, all can work together on sustainability initiatives;
- There are more young farmers entering the industry who are open and knowledgeable about the uses of technology and can help change the conversation;
- It is really important to get positive messages out to consumers about all the good things farmers are doing.

The **Industry Panel** was followed by luncheon speaker, **Greg Meredith,** Deputy Minister at the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). Greg Meredith argued that Canada has an excellent reputation in the international arena, after having demonstrated its leadership during past trade negotiations at the World Trade Organization, and we should leverage this leadership to influence global regulatory standards. He outlined 5 priority research and policy issues that are important for the sector and require further work. These include:

- Sustainable or "quality" growth;
- Farm level business risk management programs;
- Management of trade and global political risks to trade;
- Consumer preferences and managing market risks for novel products (i.e. GMOs, CRISPR products etc.); and
- Developing ways to influence global regulatory standards set by multilateral organizations.

He emphasized the importance of deliberate dialogue on these issues, with participation of industry, academia, NGOs and governments. Given the sensitivity of many of these issues, there is a role for a

[11] Available at: https://capi-icpa.ca/explore/resources/soil-biodiversity-and-sustainable-agricultural-systems/

neutral, unbiased thinktank such as CAPI, which can convene and lead dialogues with interested and informed stakeholders. Hence, it is critical to see that CAPI continues to be funded as a convenor of agri-food policy dialogue.

SESSION III: FACTORS AFFECTING LAND USE CHOICES AND AGRONOMIC PRACTICES

Session III focused on how farmers make decisions about sustainable land use practices.

The presentation by **Professor Brady Deaton** of the University of Guelph was entitled: "Do Farmers Treat Their Owned Land better than Rented Land?"[12] He made use of data from his annual Farm Rental Rates Survey to analyse conservation practices on owned versus rented land. Rented land area has been increasing over time: it reached 40% nationwide in 2011. Renting land from others provides flexibility, diversification, capacity, and transition for young farmers planning on entering farming. Most farmers rent from multiple landowners, with larger farms more likely to rent land from others than smaller farms. Farmers often rent on an informal basis, often without a contract, and usually on a cash basis. Professor Deaton studied the adoption of two conservation practices: conservation tillage and cover crops. Both depend on the type of land (i.e. whether it is flat or rolling), the type of soil (clay versus sandy), climate and region (i.e. conservation tillage is more prevalent on the Prairies while cover crops are used more extensively in the East). His sample covered a selection of farms in Manitoba and Southern Ontario that both rented and owned land. What varied was the length of the tenure (i.e. how long farmers expected to rent the land). He found that farmers are less likely to use cover crops on land they rent from others compared to land they own. Further, farmers in short-term rental relationships (i.e. 1 year) are less likely to use cover crops on their rented land compared to land they own. And farmers in long-term rental arrangements (i.e. 10 years) tend to treat rented land much the same as land they own. Therefore, he concluded that tenure status influences the adoption of site-specific conservation practices, such as cover crops. On the other hand, for practices such as conservation tillage, which can lead to lower costs of production almost immediately, there is no difference in adoption rates between renters and owners.

A **Participant Discussion** followed, where several issues were raised around rental rates, land values and BMPs. Specifically, there were comments made about:

- The competitive nature of bidding to rent farmland today, given the very high land values in most areas of Southern Ontario;
- There is hesitation on the part of landowners to share risk, so cash rent is more popular than sharecropping;

[12] See the paper by the same title prepared for presentation at the AAEA 2014 Annual Meeting in Minneapolis, MN by Nadella, K, B. Deaton, C. Lawley and A. Weersink. Available at: https://tind-customer-agecon.s3.amazonaws.com/a3aace72-90fb-43cd-b125-f119997e44ff?response-content-disposition=inline%3B%20filename%2A%3DUTF-8%27%27AAEA_submission.pdf&response-content-type=application%2Fpdf&AWSAccessKeyId=AKIAXL7W7Q3XHXDVDQYS&Expires=1559671224&Signature=s%2FfZUxPwg%2FhL6x%2FKUjROEkj7vD8%3D

- There was also general agreement that farmers renting land for short terms (i.e. 1 year) tend not to invest in cover crops as a conservation practice;
- Some argued that there has been an increasing number of formal contracts to rent farmland, with renegotiation after a few years;
- After renting for several years, there is an increase in trust between landowners and renters, and once there is more trust, there are more investments made by renters; and finally,
- Renting is often a way to preserve rural farmland for rural residents.

SESSION IV: EXTERNALITIES AND POLICY OPTIONS

Session IV focused on *externalities* and the policy instruments and initiatives that can address them.

Professor Alfons Weersink of the University of Guelph, spoke on "Externalities in the Sector, Where Are the Market Failures?"[13] His presentation was based on research that was commissioned by CAPI, to be published in fall 2019. Professor Weersink explained the concept of environmental "*externalities*" as "uncompensated environmental effects of production and consumption that affect consumer utility and enterprise costs outside the market mechanism." For *negative externalities* from agricultural production, such as water degradation and GHG emissions, private costs of production tend to be lower than their "social" costs. To internalize these *externalities*, the "polluter pay principle", which states that the source of the pollution pays for its abatement, is one way households and farm businesses might account for these costs in their plans and budgets.

Making use of existing research from both Canadian and international studies, Professor Weersink provided estimates of *negative externalities* in agriculture, such as GHG emissions, ammonia and particulate matter (PM) emissions, from agricultural production, and *positive externalities*, including erosion control, biodiversity and wildlife habitat and carbon sequestration. For example, estimates of GHG emissions from agriculture had declined by 10% over the 1981 to 2011 period, with Saskatchewan making the most improvement, Ontario some, Manitoba deteriorating, and Alberta and Quebec remaining stable. Estimates of the impact of N leaching into ground and surface water saw major increases, due to the growth in the use of N fertilizer on cropland and from manure. Quebec and Manitoba saw the largest increases, with estimates of *externalities* from N rising to $1 billion over the period 1981 to 2011. After accounting for all categories of *negative* and *positive externalities*, the net external benefits from agricultural production was valued at approximately $351 million in 2011: *negative externalities* were valued at $8.8 billion and *positive externalities* at $9.2 billion. He concluded that because efficient input use results in lower emissions, policies that enhance efficiency, both in crop and livestock production, will be crucial in reducing GHG emissions. Also, Professor Weersink argued these estimates can be used to identify policy priorities, in terms of which policies are more effective in mitigating the *negative externalities* and increasing *positive externalities*.

[13] Available at: https://capi-icpa.ca/explore/resources/estimates-of-negative-and-positive-externalities-from-agriculture/

The final presentation was by **Professor Glenn Fox** of the University of Guelph, who spoke on "The Role of "ation" in Policy Instruments for Addressing Environmental Externalities in Agriculture."[14] He described a taxonomy or "classification" for categorizing agricultural environmental problems and policy solutions as the following:

1) Excessive rate of time preference, such as related to soil fertility and land conversion, reflecting farmers' preferences and need for profitability in the short term;
2) *Externalities* or legalized nuisances, such as noise, odour, bacterial contamination of ground water, excess nutrients and dust;
3) *Public goods*, such as habitat loss and wetland drainage, that affect society as a whole; and
4) *Common pool*, such as groundwater depletion and surface water diversion for irrigation, where there are no property rights.

He then described the various policy options or remedies that address each category:

1) An excessive rate of time preference can be addressed by applying the social discount rate;
2) *Externalities* or legalized nuisances can be addressed through taxes, tradeable permits, regulations, legal reform or litigation;
3) *Public goods* issues can be addressed by financing out of general revenues with zero marginal cost to beneficiaries; and
4) *Common pool* issues can be addressed through fees, regulations, extraction permits (i.e. quotas), voluntary negotiation and clarification of property rights.

He clarified the difference between an *externality* or legalized nuisance and a *public good*, which require different remedies. He recommended eliminating legalized nuisances or reducing government subsidies to address *externalities*. To address *common pool* issues, he recommended clarifying ownership of water resources, using triage or targeting for prioritizing the most important environmental problems, and applying the full *public goods* model, such as *ALUS* for fairness.[15]

Kara Beckles, Director General at AAFC responded to the presenters by addressing policy responses to agri-environmental interaction in Canada. She commented that there is a wide range of policies to address agri-environmental issues, including standards, regulations, R&D assistance and subsidies. Unlike the case for most macroeconomic policy issues, agri-environmental issues are often not well defined, are heterogeneous and do not necessarily have clear objectives, so an ecosystem approach is needed. For many policies, impacts at the local level are not tailored to local issues and policy solutions are diverse and may require outreach and the right incentives for farmers, which depend on the desired environmental outcomes. Behavioural economics can provide some guidance for addressing these local level issues which become difficult to implement at the national level through the "*Living Labs*"

[14] Available at: https://capi-icpa.ca/explore/resources/the-role-of-ation-for-policy-instruments-in-adressing-environmental-externalities-in-agriculture/

[15] ALUS is a community based conservation program, funded by the Weston Foundation, described here: https://alus.ca/

approach, a new concept which attempts to address local issues[16]. New data sources, such as from remote sensing, mapping, weather and Geographical Information Systems (GIS) are providing the information required to better understand some of the local agri-environmental issues and providing the place-based evidence that governments need to develop good agri-environmental policy. Canada has also demonstrated an ability to punch above its weight in international fora for developing indicators (i.e. the OECD's Green Growth and Agri-environmental Indicators), in a fashion similar to its reputation in negotiating international trade agreements.

SESSION V: *NEXT GEN* PANEL: WHAT WE HEARD

Session V provided the *Next Generation* participants (i.e. those under 30 years of age) to provide their perspectives on the issues discussed and the potential solutions.

Some of the comments included:

- The need to clarify key concepts, such as *sustainability* so that there is a common understanding;
- Property rights are important when taking care of the environment and producing agricultural products;
- Achieving these targets while maintaining natural capital will be a challenge;
- Younger producers will probably be able to take a more proactive approach to responding to this challenge, given their openness to new ideas and technologies;
- The importance of understanding who are their buyers and where their markets are for their products, and the need to tailor communications and messaging to these markets and consumers for future success;
- Updating historical data and data sources, since historical data are less reliable for predicting the future than previously;
- The importance of re-evaluating farm practices given changing determinants, technologies and conditions (i.e. climate change); and
- The large impact of food waste on resources.

They concluded that the event gave them good insight into the issues around sustainable agriculture, identified key issues at the heart of sustainable growth, including accessing productive land, and stimulated discussion around key policy areas that will address optimizing land use for sustainable growth.

CAPI Board Chair John F. T Scott closed off the dialogue with a summary of the day, including what we learned, the issues we addressed and possible next steps in addressing sustainable growth in agriculture.

[16] AAFC program called Living Labs. Available here: http://www.agr.gc.ca/eng/programs-and-services/living-laboratories-initiative-collaborative-program/?id=1541182326184

CONCLUSION

The *Guelph Dialogue* generated interesting debate around optimizing land use and sustainable growth. It became clear that most feel the sector is making progress in improving its environmental performance for future sustainability, but there are still challenges that need to be addressed. New knowledge, better practices, data, metrics, innovation and new technologies will be key for helping address these challenges. The government has a role to play by investing in R&D, promoting agricultural extension and knowledge dissemination and providing incentives to farmers to adopt sustainable production practices, as well as influencing international standards and trade rules. This can be done through subsidies and more efficient regulations that allow market prices to signal market preferences. Industry too has a role to play, by innovating and responding to changing market demands for environmentally-responsible and sustainable products, by promoting BMPs, by developing transparent systems for verifying sustainable production practices and through collaboration across supply chains with partners. Community and voluntary initiatives that promote conservation, like *ALUS*, *Ducks Unlimited Canada* and *Living Labs*, will also be important, as well as future dialogues to inform options for future *quality* growth.