

**GOVERNMENT RESPONSE TO THE REPORT OF THE STANDING COMMITTEE
ON AGRICULTURE AND AGRI-FOOD ENTITLED: *TOWARD A RESILIENT
CANADIAN AGRICULTURE AND AGRI-FOOD SYSTEM: ADAPTING TO CLIMATE
CHANGE***

The Government of Canada (the Government) is pleased to respond to the Report of the Standing Committee on Agriculture and Agri-Food (the Committee) entitled: *Toward a Resilient Canadian Agriculture and Agri-Food System: Adapting to Climate Change* (the Report).

The Government commends the members of the Committee, and the witnesses who appeared before it, for their insight and commitment to improve understanding the challenges and opportunities faced by the agriculture sector, with respect to climate change, soil and water conservation, and approaches to address these issues.

The Government recognizes the vital importance of a resilient agriculture and agri-food sector that is able to adapt to climate change, and continue to grow sustainably. That is why the health of the environment, including climate change mitigation and adaptation, is a priority for Government of Canada policy and programming.

In Canada, agriculture is an area of shared jurisdiction between the federal and provincial/territorial governments, with the provinces and territories having primary jurisdiction over land and natural resource ownership and use. The Government has a role in supporting the provinces, territories, and agriculture sector stakeholders in the responsible stewardship of Canada's agricultural lands and environment. As noted in the Report, Canada has a long history of working with the provinces and territories to help producers and processors continuously improve the sustainability of their operations. Significant progress towards enhancing the sustainability and resilience of the agriculture sector has been achieved through three successive five-year federal-provincial/territorial agricultural policy frameworks. For example, total agricultural emissions (i.e., from livestock, crops and on-farm fuel use) have been relatively stable since the mid-1990s despite significant growth in production over the same period, indicating decoupling between emissions and production. This is in part due to the extensive adoption by producers of no-till or conservation tillage practices, combined with a major reduction in summer fallow and sound crop rotations.

Under the current \$3 billion framework, the Canadian Agricultural Partnership (the Partnership), covering the period 2018-2023, Agriculture and Agri-Food Canada (AAFC) and the provinces and territories will build on this progress by supporting various initiatives. Federal programs and activities under the Partnership will help the sector to grow trade and expand markets, advance science and innovation with an emphasis on sustainable growth, and enhance collaboration and support public trust. The Partnership also gives producers access to a suite of Business Risk Management programs, averaging over \$1.5 billion annually, to help producers remain viable under difficult conditions including those brought about by severe weather events. Through the Partnership, provinces and territories design and manage delivery of cost-shared environment programs, including, stewardship programs that increase farmers' awareness and management of on-farm environmental risks and adoption of practices and technologies that reduce these risks.

Together, these programs will contribute towards enhancing the long-term environmental sustainability and resilience of the sector.

Environment and climate change programming under the Partnership will also be the vehicle for the agriculture and agri-food sector's contributions to achieving greenhouse gas reduction and climate adaptation commitments of the Pan-Canadian Framework on Clean Growth and Climate Change (PCF).

As suggested in the Report, the Government also delivers climate change mitigation and adaptation programming outside of the Partnership. Initiatives delivered by Environment and Climate Change Canada (ECCC), such as the Species at Risk Partnership on Agricultural Lands, Habitat Stewardship Program, Lake Winnipeg Basin Stewardship Fund, and Great Lakes Protection Initiative, also support mitigation planning and adoption of sustainable agricultural practices targeted to particular issues and geographies. These efforts will directly contribute to a more climate-resilient and sustainable agriculture sector through the protection of wildlife habitat and water quality.

The Government appreciates the comprehensive recommendations developed by the Committee, and is working collaboratively with federal, provincial, and industry experts to adequately address several of the challenges highlighted throughout the Report. Details are provided below regarding the Government's response to the specific recommendations of the Committee in this regard.

The Response is the product of a collaborative effort among the following implicated federal departments and agencies: AAFC; the Canadian Food Inspection Agency (CFIA); ECCC; Global Affairs Canada; Health Canada; Infrastructure Canada; and Innovation, Science and Economic Development Canada; the Pest Management Regulatory Agency (PMRA); and Statistics Canada.

RECOMMENDATION 1

The Committee recommends that the Government of Canada, in collaboration with the provinces, conduct an in-depth analysis of the status of Canada's soils to measure compaction, degradation, element composition, and other important qualifying factors as well as an analysis to quantify the economic benefit of soil carbon sequestration.

The Government supports this recommendation. The Government recognizes the importance of maintaining healthy agricultural soils to ensure a sustainable and profitable agriculture sector and to support global food production.

Soil carbon provides multiple economic benefits to both producers and society. Producers recognize that soil health contributes to profitability and sustainability by lowering input requirements, enhancing the resilience of crops to periods of low rainfall, protecting their soil from erosion and compaction, and reducing nutrient runoff. These potential economic benefits vary across the country and by farm, depending on, for example, soil type and condition, and the farm management practice being used to add carbon to the soil.

AAFC currently has 35 research projects related to carbon sequestration and greenhouse gas emissions, such as researching carbon dynamics in greenhouse gas emissions, assessing the ability of agricultural systems to remove and store carbon, and evaluating the influence of agricultural land management on soil carbon reservoirs. AAFC worked with federal, provincial and territorial governments and academic partners to produce a national organic carbon map that was completed in 2017 that will contribute to the Intergovernmental Panel on Climate Change global carbon sequestration estimates. AAFC's soil organic matter indicator model also supports Canada's annual greenhouse gas reporting efforts under the United Nations Framework Convention on Climate Change in the form of the National Inventory Report, compiled by ECCC.

AAFC regularly measures soil health indicators including soil erosion, soil organic matter, soil salinization, and soil cover as part of its sustainability metrics work that is used by governments and the sector, for example, to assess the impacts of agricultural practices on soil health over time. AAFC also works with provincial governments and international agencies to improve data stored in the National Soil Database and to develop soil mapping methods and tools that allow producers, policy makers and government agencies to make more informed decisions related to soil management.

RECOMMENDATION 2

The Committee recommends that the Government of Canada examine quantitative water management techniques and invest in appropriate infrastructure initiatives to accommodate water excesses and deficits that meet the varying and unique geographic needs across Canada.

The Government supports this recommendation. An adequate supply of water is critical for agricultural production and a changing climate is expected to impact water availability including increased periods of extended drought and flooding throughout Canada. Managing water on the agricultural landscape is a key factor to the sustainable growth of the sector in the face of a changing climate.

While provinces have the primary responsibility for the management of water and major water quantity infrastructure, AAFC focusses its research, development and technology transfer activities in support of improving water use efficiency and building resilience. This includes work on the evaluation of irrigation management practices for improved water and energy use efficiency and methods of sustainably removing excess water. AAFC also conducts work on the evaluation of new and existing crops and varieties under irrigated and rain-fed conditions in a changing environment. AAFC works with ECCC to develop near-real-time tools to map the extent and severity of surface soil moisture including under drought and flooded conditions that informs producers' on-farm management decisions. These tools also support policies and programs related to water management including early warning systems for floods and droughts, food security, and public health and safety. In addition, these tools inform AAFC's Business Risk Management programs that are designed to help producers remain viable under difficult conditions including in response to severe risks brought about by climate change (e.g., flood and drought conditions).

Infrastructure Canada's investing in Canada Infrastructure Program, delivered through integrated bilateral agreements with provinces and territories, seeks to make Canadian communities more resilient to climate change and to address persistent challenges to air, water and soil quality. Up to \$9.2 billion for green infrastructure is available over the next decade to support public infrastructure projects prioritized by provinces and territories that will help increase the capacity to mitigate or adapt to the challenges of climate change, with the potential to positively affect the agriculture sector. This builds on the \$2 billion Clean Water and Wastewater Fund that was announced in Budget 2016 to support efforts to modernize and extend the life of water and wastewater systems.

In 2018, Infrastructure Canada also launched the Disaster Mitigation and Adaptation Fund, a national merit-based program that will invest \$2 billion to support large-scale public infrastructure projects to help communities better manage the risks of disasters triggered by natural hazards and climate change impacts. While Infrastructure Canada does not fund private infrastructure projects, broader public infrastructure projects meant to assist communities in addressing water issues, which could assist the agriculture sector address water quantity issues, may be eligible under federal programs.

RECOMMENDATION 3

The Committee recommends that the Government of Canada create incentives for farmers to adopt integrated watershed management and land use systems to improve downstream water quality in the interest of the public good.

The Government supports this recommendation. Canada collaborates with provinces, territories and other partners to protect water resources, including the quality of water that flows off of agricultural lands.

The \$3 billion Canadian Agricultural Partnership between federal, provincial, and territorial governments, launched on April 1, 2018, will help producers to continue taking action to protect water resources. Innovative and sustainable growth is one of three focus areas of federal Partnership programming with up to \$690 million available to enhance research, science and innovation, and adoption of innovative products and practices including those that protect water quality and quantity. An additional \$2 billion is dedicated to supporting cost-shared programs and activities by federal, provincial and territorial governments that will be tailored to meet regional priorities, including management of soil and water resources.

All provincial on-farm environmental stewardship programs under the Partnership provide funding to support beneficial management practices (BMPs) that protect water quality. Some provinces focus some of their on-farm environment programming to particular watersheds. For example, under the Partnership, Ontario recently launched the cost-shared Lake Erie Agriculture Demonstrating Sustainability (LEADS) program that provides producers operating within the Lake Erie and Lake St. Clair watersheds with funding to encourage the implementation of BMPs that will improve soil health, the health of waterways, and to reduce phosphorus loss in priority sub-watersheds. Other provinces, such as Saskatchewan, Alberta, and Prince Edward Island (PEI), also target resources to improve water quality in specific tributaries,

including support for watershed management, development and updating of environmental farm plans, and incentive funding to accelerate adoption of BMPs. Cost-shared funding programs and activities under the Partnership in other provinces and territories are in the process of being launched.

Budget 2017 supports the sustainability of Canadian agriculture by investing \$70 million over five years, starting in 2018-2019, to further support agricultural discoveries in science and innovation, with a focus on addressing emerging priorities, such as climate change and soil and water conservation. This includes support for AAFC's Living Laboratories initiative that will focus on the development of BMPs and other tools with local stakeholders and agencies, in agricultural landscapes and watersheds across Canada, to address agri-environmental concerns including soil and water conservation. This initiative will support the evaluation of these practices over larger areas.

The Government has also committed \$25.7 million over five years (2017-2022) for improving water quality and restoring the ecological health of Lake Winnipeg through stakeholder-driven nutrient reducing actions, including on-farm management practices, watershed-based planning, and Indigenous engagement. The Government has also committed \$44.84 million over five years (2017-2022) to Canada's Great Lakes Protection Initiative, \$26 million of which is allocated to prevent toxic and nuisance algae in Lake Erie. This includes development of watershed plans to identify priority areas for phosphorus management and implementation of phosphorus reduction measures outlined in the *Canada-Ontario Lake Erie Action Plan*, released in February 2018.

RECOMMENDATION 4

The Committee recommends that the Government of Canada take into account the realities of the agriculture and agri-food sector when implementing greenhouse gas emissions reduction measures in order to avoid making the sector less competitive.

The Government supports this recommendation. The Pan-Canadian Framework on Clean Growth and Climate Change (PCF), signed by First Ministers in December 2016, sets out a range of greenhouse gas (GHG) emission reduction measures, including pricing carbon pollution. Under the pan-Canadian carbon pollution approach, provinces and territories have the flexibility to implement the type of system that makes sense for their circumstances, aligned with the federal benchmark.

A federal carbon pricing backstop system is also being developed—it will only apply in jurisdictions that request it or that do not have a system in place aligned with the benchmark. The federal backstop system is designed to mitigate risks to competitiveness on agriculture and agri-food sectors in various ways:

- The carbon price does not apply to biological sources of emissions (inherent to crop and animal production), which constitute a significant portion of emissions from the agricultural sector;
- Diesel and gasoline fuels used in eligible farming activities will be relieved from the fuel charge; and

- Emissions-intensive, trade-exposed industries (including in chemicals, fertilizers and agri-food industries) will be covered under an output-based pricing system, designed to minimize competitiveness impacts while retaining a carbon price signal.

The Government of Canada has a number of programs that support competitiveness in the agriculture and agri-food industry, including funding for research, science and innovation delivered through the Partnership. Funding available under the AgriScience and AgriInnovate streams of the Partnership (\$690 million over five years) supports the adoption of innovative products and practices to encourage sustainability and clean growth in the agriculture sector. In addition, the Canadian Agricultural Adaptation Program (\$50.3 million from 2014 to 2019) is designed to help the agriculture and agri-food sector seize new opportunities, respond to new and emerging issues, and pilot solutions to adapt to climate change and remain competitive. The Agricultural Clean Technology Program (\$25 million from 2018 to 2021) also supports research, development and adoption of clean technologies including precision agriculture and agri-based bioproducts.

RECOMMENDATION 5

The Committee recommends that the Government of Canada continue supporting science, research and innovation in order to implement measures that are tailored to the local priorities of the agriculture sector, with the goal of strengthening its environmental sustainability.

The Government supports this recommendation. The Government supports science, research and innovation through a number of initiatives, including through the Canadian Agricultural Partnership (the Partnership) which includes environmental sustainability and climate change as a priority.

AAFC maintains a network of 20 research and development centers across Canada. Each center has scientific expertise, technical staff, and specialized equipment and facilities to conduct agricultural science research specific to the unique region in which they are located. This network provides AAFC with a coordinated interface with industry and other stakeholders in different regions across Canada. AAFC also engages with the Association of Canadian Faculties of Agriculture and Veterinary Medicine to strengthen and leverage science capacity and research.

The total federal investment for innovation and science activities and programs under the Partnership is up to \$690 million over five years. Two federal Partnership programs provide a significant proportion of this support: AgriInnovate and AgriScience. AgriInnovate is a \$128 million program that accelerates the demonstration, commercialization, and adoption of innovative agri-based products, technologies, processes or services.

AgriScience is a \$338 million initiative that supports industry-led activities that focus on leading edge discovery and applied science and innovation, including coordination of research activities across Canada and provision of decision-support tools for producers. For example, the Sustainable Beef and Forage Science Cluster will focus on improving the sustainability of

Canadian beef and forage production, growing beef exports and supplying high-quality Canadian beef. The Integrated Crop Agronomy Cluster will focus on resiliency to climate change, improving the sustainability of crops in multi-crop, whole-farm cropping systems, and knowledge and technology transfer.

Cost-shared initiatives under the Partnership are designed and delivered by provinces and territories, which enables programs to meet diverse regional needs while supporting common national outcomes. For example, this includes PEI's Beneficial Management Practices Program, Saskatchewan's Farm Stewardship Program, and British Columbia's Beneficial Management Program.

In addition to the Partnership, the Government delivers the Agricultural Greenhouse Gases Program and the Agricultural Clean Technology Program that support research on, and enhancing awareness and accessibility of, agricultural technologies, beneficial management practices, and other processes that can be adopted by farmers to reduce agricultural greenhouse gas (GHG) emissions in Canada.

Budget 2017 also included \$70 million to support the advancement of agricultural discovery science and innovation. Through this commitment, AAFC is accelerating the hiring of the next generation of scientists, and providing funds to undertake discovery science and innovation projects focused on climate change or environmental performance (soil and water conservation or habitat capacity and biodiversity). This includes AAFC's Living Laboratories initiative with local stakeholders and other agencies within agricultural landscapes and watersheds across Canada, which will collectively focus on developing new beneficial management practices (BMPs) and other tools to address agri-environmental concerns including improving soil and water conservation, greenhouse gas reduction and mitigation, and maximizing habitat capacity and biodiversity.

Finally, Budget 2018 contained the single largest investment in federal infrastructure in Canadian history with \$2.8 billion to support the next generation of researchers, while upgrading the tools they need to do the job. AAFC is working with Public Services and Procurement Canada and other science departments to better integrate some of its science programming and identify its future science infrastructure requirements. AAFC is also engaged with all science-based departments and agencies on information management and information technology requirements to address priority areas of genomics, precision agriculture and plant breeding.

RECOMMENDATION 6

The Committee recommends that the Government of Canada work with the Pest Management Regulatory Agency and industry to mitigate adverse effects on producers and the environment that may result from banning pesticides without establishing clear alternative solutions.

The Government supports this recommendation and continues to work with agricultural stakeholders and other partners to mitigate impacts on producers and the environment from removing pesticides from the market.

The Government works cooperatively with agricultural stakeholders, including through AAFC's Pest Management Centre (PMC) and Health Canada's Pest Management Regulatory Agency (PMRA), to improve Canadian growers' access to new pest control options, including biopesticides, which may replace uses that may be lost due to re-evaluation decisions. In addition, the PMC develops alternative pest management approaches which may reduce reliance on chemical pesticides. These include decision-support tools, cultural and physical pest management approaches (cover crops, insect netting), and biological tools (parasitoids and predators of pest species). These efforts continue to enable growers' adaptation in the face of both new pests and loss of chemical solutions.

The primary mandate of Health Canada's PMRA is to prevent unacceptable risks to Canadians and the environment from the use of pest control products. When unacceptable health or environmental risks are identified for a pesticide, for example during re-evaluation or a special review, the Minister is required under the Pest Control Products Act to take action to mitigate these risks, which may require cancellation or phase-out of the registration.

To provide transparency to these decisions, in March 2018, PMRA published a policy outlining the process and associated timelines for the phase-out of pesticides. Where no alternatives are available, cancellation and phase-out of the use of a pesticide can be delayed, if the risks can be shown to be acceptable during that time, and subject to any conditions considered necessary to protect human health and the environment. All regulatory decisions are based on a rigorous scientific evaluation of health and environmental risks, and PMRA consults Canadians on all major regulatory proposals before making final decisions.

RECOMMENDATION 7

The Committee recommends that Agriculture and Agri-Food Canada continue to support research into livestock production in order to improve animal genetics and diet with the goal of reducing greenhouse gas emissions.

The Government supports this recommendation. AAFC supports a variety of projects focused on reducing greenhouse gas emissions in livestock production. The research is led by AAFC or conducted in partnership with other federal and provincial departments, academia, and animal food value chain collaborators within Canada and internationally.

Along with partners, AAFC developed a method that uses genomic information to predict an animal's genetic merit based on DNA markers to assess feed conversion efficiency and meat quality. Such research can not only help to reduce production costs and improve beef quality but can also mitigate the environmental footprint of beef production by reducing methane emissions. AAFC researchers also worked on a three-year study with colleagues in Australia on a promising commercial cattle feed supplement that inhibits the enzyme responsible for creating methane in the animal's rumen. Research results from the study indicate a 30-50% reduction in methane production and a 3-5% improvement in feed conversion efficiency.

AAFC's research and development centers are contributing to studies aimed at reducing GHG emissions from milk production. Working closely with industry, AAFC scientists have developed two state-of-the-art models which estimate the carbon footprint of milk, and allow feeding strategies to be developed to lower the impact of dairy cows on greenhouse gas emissions. Scientists have developed dietary strategies to reduce methane emissions by 10-25%, depending on the feed strategy. AAFC scientists are conducting comprehensive assessments of forage production systems and manure management practices to maximize carbon sequestration and nutrient retention in the soil. AAFC also supports the Canadian Dairy Network which aims to advance dairy genetics and genomics research, provide better and increased selection values for traits for cows that are more disease resistant, have better immunity, digest feed more efficiently, and produce less methane.

AAFC researchers are leading an international collaboration to develop a new precision feeding system that has the potential to transform how pigs are fed, saving farmers feed and labour costs while reducing the environmental footprint of pig production. The system precisely estimates, in real time, the requirements of each pig in the herd, and then provides an optimal diet that caters to each pig's needs.

RECOMMENDATION 8

The Committee recommends that the Government of Canada improve the approval process for new crop varieties in order to help farmers adapt to climate change quickly and seize commercialization opportunities while staying competitive in the market.

The Government supports this recommendation. Crop varieties resilient to evolving growing conditions, such as new and increased pest and disease pressures and more variable temperature and soil moisture, are an important way the sector can adapt to climate change.

Canada's variety registration system is flexible, efficient, and focused on fostering innovation in the agriculture sector. The three streams of variety registration vary from minor ones that enable new varieties to come to market after an eight-week registration process, to the most rigorous stream, which requires multi-year merit testing to obtain registration. This merit-based variety registration system provides confidence to Canadian producers to rapidly adopt new varieties because of proven performance and value.

The variety registration system in Canada underwent a two-year national review and consultation that concluded in the spring of 2016. The review demonstrated that over 80% of affected stakeholders supported the existing registration system. Some key changes from stakeholders were adopted to improve efficiency and foster innovation. For example, as a direct result of the review, the model operating procedures for stakeholder variety registration recommending committees have been improved.

The Government remains committed to having a rigorous, science-based regulatory system in place to assess innovative ('novel') plant products, including those developed using modern biotechnology techniques. Health Canada assesses the safety of novel plant products for use as food, whereas the CFIA assesses the safety of these products for use as livestock feed and for

release into the environment. Canada's product-based regulatory system captures and assesses novel products based on their traits regardless of the method used to introduce the particular trait(s). This approach provides clarity and predictability for developers by subjecting novel products derived from biotechnology to the same level of oversight as other novel products.

The CFIA and Health Canada explore on an on-going basis changes that can be made to maximize the effectiveness of the regulatory system, while, at the same time, protecting human and livestock health and the environment. To this end, the CFIA and Health Canada have established an interdepartmental working group that focusses on priorities for increasing transparency and efficiency in the regulation and assessment of novel plant products. This working group's activities are typically well received by regulated parties. For instance, in 2018 the working group finalized guidance for industry on how to submit data derived from whole genome sequencing, to support novel plant product applications. This guidance, which was requested by industry, will increase transparency and efficiency in the regulatory review process.

The Government will continue to exchange ideas and information on emerging technologies through a number of industry and government fora, including the Agriculture and Agri-Food Value Chain Roundtables. The CFIA will also continue to consider changes to foster innovation and improve the flexibility and efficiency of Canada's variety registration system.

RECOMMENDATION 9

The Committee recommends that the Government of Canada increase investment in research and innovation in ecological and organic agriculture to better reflect that sector's growing proportion of the market, recognizing that this may yield benefits for agriculture in general.

The Government supports investments in research and innovation into organic agriculture and agro-ecosystem health, which are beneficial not only to the sector as a whole, but also to support the robust and expanding organic sector in Canada.

The Canadian organic market is the 5th largest in the world, showing a growth in demand both domestically and internationally over the past decade. Retail sales were estimated at \$5.4 billion in 2016, which was a \$1.9 billion increase from 2012. The organic agriculture industry has also helped contribute to a more diverse agricultural landscape in Canada as there is a slightly higher percentage of female and youth operators on farms that produce organic products than on conventional farms. This growing market is already supported by AAFC's investments both in internal research, development and technology transfer, as well as through partnerships with provincial governments, academia and industry.

Under the Canadian Agricultural Partnership, federal, provincial and territorial governments are pursuing a shared priority to improve science and innovation support for emerging parts of the sector such as organic production. Specifically, the federal government is again investing in the Organic Science Cluster with up to \$8.3 million to examine ways for the organic sector to enhance productivity through better soil health and fertility management, advance crop breeding

research, improve pest management, and evaluate the environmental impacts of organic farm practices. This investment represents an increase over those made under the previous agricultural policy framework, Growing Forward 2 (2013-2018) which included up to \$7.8 million for the organic sector. The Government is also continuing to help the sector further support its sustainability and growth by expanding markets, boosting yields, and streamlining the review of recognized product standards.

RECOMMENDATION 10

The Committee recommends that the Government of Canada provide full funding for the Organic Standards review beginning in March 2018.

The Government supports this recommendation. The Government recognizes the importance of the Canadian Organic Standards, which is why on January 26, 2018, AAFC announced that it will pay the costs incurred by the Canadian General Standards Board (CGSB) of Public Services and Procurement Canada to update these standards by 2020. On July 12, 2018, AAFC approved a \$292,555 project entitled Canadian Organic Sustainability Framework which aims to help the organic industry establish funding mechanisms to support national industry priorities and modernize and improve the standards review process.

In May 2018, AAFC and CGSB signed a memorandum of understanding that governs the completion of this work by 2020. The CFIA remains committed to supporting the Canadian organic regulatory regime by continuing to work with industry and our trading partners on organic standards review, interpretation and enforcement of the *Organic Product Regulations*. The efforts of AAFC and CFIA enable organic sector development, market access, export growth and consumer and environmental protection.

RECOMMENDATION 11

The Committee recommends that the Government of Canada support agroforestry as a way to increase soil carbon sequestration potential for Canada.

The Government supports this recommendation. Forests, wetlands, and agricultural lands can be enhanced as “carbon sinks” through actions such as planting more trees, improving forest carbon management practices, minimizing losses from fires and invasive species, restoring forests that have been affected by natural disturbances, and increasing adoption of land management practices like increasing perennial and permanent cover crops and zero-till farming. Protecting and restoring natural areas, including wetlands, can also benefit biodiversity and maintain or enhance carbon storage.

Agriculture’s contribution to the Pan-Canadian Framework on Clean Growth and Climate Change (PCF) will be primarily delivered through the Canadian Agricultural Partnership (the Partnership). Under the Partnership, federal, provincial and territorial governments collaborate in building capacity to mitigate agricultural greenhouse gas (GHG) emissions, enhance carbon sinks and conserve soils, protect the environment, and adapt to climate change.

Agroforestry practices are supported by various types of programs. Under the Partnership, cost-shared programs delivered by provinces and territories support on-farm actions to build producer awareness of environmental risks and identify actions to mitigate these risks, and provide financial support to farmers to adopt specific beneficial management practices (BMPs) which have multiple environmental benefits, including soil conservation, carbon sequestration and reduction of GHG emissions. Among BMPs eligible for funding under federal-provincial-territorial cost-shared programs for on-farm actions are agroforestry practices such as shelterbelts and riparian buffers.

In addition to Partnership programs, the Agricultural Greenhouse Gases Program is a \$27 million, five-year (2016-2021) program intended to enhance the understanding and accessibility of agricultural technologies, BMPs, and processes that can be adopted by farmers to mitigate agricultural GHG emissions in Canada. Agroforestry is one of four priority areas under the Agricultural Greenhouse Gases Program. The research and development undertaken under this priority focuses on understanding, developing and promoting agroforestry practices such as shelterbelts, riparian buffers, alley cropping, and silvopastoral systems to support GHG mitigation.

RECOMMENDATION 12

The Committee recommends that the Government of Canada support agricultural producers and processors in Canada by adopting policies and trade agreements that protect our producers and processors from economies that may not have the same environmentally rigorous standards as Canada.

The Government supports this recommendation. The Government is firmly committed to the principle that trade liberalization and environmental protection should be mutually reinforcing objectives of trade agreements. Fostering robust environmental governance as our trade relationships expand is important to promote sustainable development and to establish a level playing field for Canadian firms by helping to prevent our trading partners from reducing environmental standards to gain an unfair competitive advantage.

In bilateral and regional trade agreements, such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership and the Canada-European Union: Comprehensive Economic and Trade Agreement, Canada seeks ambitious and enforceable Environment Chapters that commit Parties to maintain high levels of environmental protection and robust environmental governance as trade is liberalized, and to not weaken their environmental laws to encourage trade or investment. Canada is also advancing commitments that support efforts to address global environmental challenges, including climate change. Canada continues to urge trading partners to adopt measures and regulations that are based on scientific evidence in order to provide a transparent and predictable trade environment for Canada's exporters.

RECOMMENDATION 13

The Committee recommends that climate change efforts be focused on adaptive measures and mitigation efforts, and providing a positive impact to economy, therefore building on Canada's competitive advantages and maintaining competitiveness for Canadian agricultural products.

The Government supports this recommendation. The Government, in partnership with provinces and territories, is taking action through the Pan-Canadian Framework on Clean Growth and Climate Change (PCF), building resilience to the impacts of climate change, and enabling clean growth and jobs through investments in technology, innovation, and infrastructure. The Canadian Agricultural Partnership (the Partnership) is the primary mechanism to help the agriculture sector contribute to the goals of the PCF and identifies environmental sustainability and climate change (covering both reducing greenhouse gas emissions from the sector and building sector resilience to climate change impacts) as one of six priorities.

Under the Partnership, federal, provincial and territorial governments are collaborating to support the sustainable growth of the agriculture sector through important investments in science, research and innovation on practices and technologies to reduce emissions and adapt to climate change as well as investments to accelerate the adoption of these practices and technologies by the agriculture sector. Up to \$690 million is available under the federal-only AgriInnovate and AgriScience programs to enhance the competitiveness of the sector through research, science and innovation, and adoption of innovative products and practices, with an emphasis on sustainable and clean growth.

In addition, federal investments in web-based, real-time climate information and decision support tools will help the sector better prepare for new opportunities and risks from changing growing conditions, helping maintain the competitiveness of Canadian producers. For example, AAFC's National Agroclimate, Geomatics and Earth Observation Service, provides an authoritative source for a wide variety of agroclimate data, indices, information, tools, and models for use by the agricultural sector to monitor drought risks and analyze changing land suitability.

Complementing these efforts, the Government has also committed to establishing a Canadian Centre for Climate Services to provide access to reliable, useful and timely climate data, information and tools to support adaptation decision-making across the country, and to foster regional climate service capacity. To this end, the Government is collaborating with provinces and territories to identify and work in cooperation with regional climate organizations that will help Canadians adapt to the impacts of climate change.

RECOMMENDATION 14

The Committee recommends that the Government of Canada continue to support and allow for extension that complements research activities, in order to help close gaps between researchers and producers.

The Government supports this recommendation. The Canadian Agricultural Partnership will build on prior investments in innovation and continue to support extension activities that transfer knowledge to producers. This will be accomplished in part by continuing to support cost-shared Environmental Farm Plan (EFP) programs, which build producer awareness of environmental risks on their farm or ranch and knowledge of the practices and technologies they can use to reduce these risks. Under the Partnership, federal, provincial and territorial governments have committed to expanding the number of producers who have completed or renewed an EFP.

AAFC is also enhancing its ability to close the gap between researchers and end-point users by researching and implementing best practices in knowledge transfer. Over the last few years, AAFC has put in place dedicated knowledge and technology transfer officers in research stations across the country to ensure clearer and faster pathways for AAFC-generated knowledge to reach the agriculture sector. AAFC has also invested in a National Knowledge Transfer Coordinator to review existing practices and determine more effective ways to accelerate the transfer of AAFC research results to end users. AAFC also transfers promising technologies to the sector through licensing agreements which can make available new technologies and plant varieties that can help address the challenges facing producers as a result of climate change.

AAFC will also be launching a new Living Laboratories initiative that is designed to facilitate communication and knowledge transfer between researchers and producers about sustainable farming practices. At Living Laboratories initiative sites across the country, producers and researchers will collaborate on identifying priority issues, designing research studies, and interpreting results. This close collaboration will help ensure results on sustainable management practices and technologies are meaningful to producers which will help drive adoption. In addition, because producers involved in the Living Laboratories initiative will be invested in the results, it is anticipated that they will be well positioned to share outcomes and learnings with peers and broader agricultural organizations.

RECOMMENDATION 15

The Committee recommends that the Government of Canada continue to support sharing of important information related to environmentally sustainable farming practices and adaptation.

The Government supports this recommendation. Building on efforts under past policy frameworks, the Government will work with provinces and territories under the Canadian Agricultural Partnership (the Partnership) to continue supporting programs and activities that share important information related to environmentally sustainable farming practices and adaptation. This will be accomplished through a variety of programs, some delivered by AAFC and some cost-shared and delivered by provinces and territories.

Provinces and territories design and manage the delivery of cost-shared on-farm environment programs, which allows activities to be tailored to each jurisdiction's environmental priorities. These programs build producer awareness and knowledge of environmental risks on their farm, and, based on these risk assessments, provide financial incentives to producers to adopt

innovative beneficial management practices and technologies to reduce these risks, including climate risks. Under the Partnership, a notional allocation of \$436 million is available to address environmental sustainability and climate change issues in the agriculture sector, through cost-shared, on-farm programming. As part of the governance of the Partnership, a federal-provincial-territorial working group on environment and climate change will, among other things, share information on federal, provincial and territorial agri-environmental initiatives, ensuring that best practices and lessons learnt related to sustainable agriculture are shared between jurisdictions.

Disseminating research results, such as through publications and communicating with commodity organizations, is an element of federal agriculture innovation programming that is funded through AgriInnovate and AgriScience programs, and the Agricultural Greenhouse Gases Program.

AAFC's new Living Laboratories initiative will also be another important opportunity to share information about sustainable farming practices. Results from sites across the country will be shared between sites and highlighted in AAFC communication products for the agriculture sector to foster greater awareness and adoption by the sector. AAFC has also taken steps under the Open Science Initiative to ensure that important information is easily accessible to the public. Each year AAFC uploads scientific data and information to the Treasury Board Secretariat's Open Government Portal. AAFC also publishes on its website a profile of each scientist with a list of peer-reviewed publications.

Finally, AAFC's general communications and outreach strategy highlights the benefits of the department's research to producers. For example, last year alone, over 1500 tweets and Facebook posts were issued regarding science achievements targeted towards producers, over 180 articles were written and shared with producer media, scientists responded to more than 200 media inquiries, and 48 open houses and extension days were hosted. Of these efforts, topics ranged from telling farmers about a new commercial decision support system to determine the optimum nitrogen dose on corn fields, to a new cattle feed supplement to reduce methane emissions.

RECOMMENDATION 16

The Committee recommends that the Government of Canada acknowledge the role that producers play as environmental stewards and the innovative ways they are adapting to climate change, as well as their contribution to the public good, in order to strengthen Canadians' understanding and build public trust.

The Government supports this recommendation. Canadian producers earn the confidence and trust of Canadians and consumers around the world by producing food in ways that are known to be safe, responsible and sustainable. The Government acknowledges the important, leading role producers play in responsible environmental stewardship and their ongoing efforts to be part of the climate change solution. This is demonstrated by the sector's solid track record in innovation and adoption of new technologies that have reduced greenhouse gas emissions through to increased adoption of conservation tillage and reduced summer fallow that have increased the amount of carbon stored in soil.

The Government supports producers under the Canadian Agricultural Partnership through investments in innovation, environment and climate change, traceability, biosecurity, animal welfare and food safety – all areas that contribute to maintaining public trust.

For instance, through the AgriAssurance program, AAFC is helping industry associations to develop and adopt systems, standards and tools that enable them to make credible, meaningful and verifiable claims about their products and the manner in which they are produced, including environmental sustainability. For example, AAFC support to Canada's dairy sector for their *proAction* on-farm excellence program will help Canadian dairy farmers collectively demonstrate responsible stewardship related to animal welfare, the environment and the sustainable production of high quality, safe and nutritious food.

RECOMMENDATION 17

The Committee recommends that the Government of Canada encourage new and established farmers to buy into best climate-resilient practices, equipment and technology that will increase agricultural efficiency, long-term resilience and sustainability.

The Government supports this recommendation. Canada will continue to support a variety of programs and actions to help inform farmers about climate change impacts and support farmers to adopt practices, equipment and technologies that will increase resilience and enhance the efficiency and environmental performance of the sector.

As part of Canada's actions under the Pan-Canadian Framework on Clean Growth and Climate Change (PCF), federal adaptation and resilience funding will help establish the Canadian Centre for Climate Services (CCCS). The CCCS will provide access to reliable, useful and timely climate data and information, as well as foster collaborative partnerships with Canadian regional climate organizations to shape and deliver decision support tools that will help Canadians, including farmers, understand their local climate risks and opportunities.

Through the Partnership, provinces and territories design and manage delivery of federal cost-shared environment programs, such as Environmental Farm Plan programs. These programs increase farmers' awareness and management of on-farm environmental risks and include financial incentives to encourage the adoption of beneficial management practices and technologies that reduce risks, including those affected by climate change. Examples of other cost-shared activities supporting climate resiliency include the development and implementation of regional climate change strategies by agricultural producers in collaboration with other stakeholders in British Columbia, improving water use efficiency by upgrading to low pressure or drip irrigation equipment in Alberta; and exploring precision fertilizer/seeding technology, improving soil data and increasing cover crops in Ontario. Under the Partnership, a notional allocation of up to \$436 million is available to address environmental sustainability and climate change issues in the agriculture sector.

AAFC will also deliver Partnership programs supporting the development and adoption of climate-resilient practices, and clean technologies. For example, the five-year, up to \$128 million, AgriInnovate program will target investments that demonstrate/commercialize new innovations that can increase agricultural efficiency and enhance sustainability. Agriculture inclusiveness programs, such as the five-year, \$5 million AgriDiversity program could also help support workshops and seminars for youth, women, Indigenous Peoples and other under-represented agricultural producers, to learn about climate-resilient practices, equipment and technology.

Budget 2017 committed \$200 million to support clean technology research, development and demonstration and the adoption of clean technology in Canada's natural resources sectors, including agriculture. Announced on March 19, 2018, the Agricultural Clean Technology Program will deliver the agriculture-specific portion of that funding through a \$25 million, three-year investment (2018-2021) which aims to support the research, development and adoption of agricultural clean technologies in the areas of precision agriculture and bioproducts. These technologies will help to reduce greenhouse gas emissions, generate a wide range of positive impacts, and promote sustainable and clean growth.

RECOMMENDATION 18

The Committee recommends that the Government of Canada work in collaboration with the provinces and territories to support greater recognition and measurement of ecosystem services.

The Government supports this recommendation. The Government is committed to continuing to work closely with provinces and territories to support the recognition and measurement of ecosystem services and explore innovative policy approaches to enhance ecosystem services provided by agricultural landscapes.

The Government supports a variety of program approaches as a way to recognize the importance of ecosystem services provided by agricultural landscapes and encourage greater on-farm action. For example, Environment and Climate Change Canada's (ECCC) Species at Risk Partnerships on Agricultural Lands program sponsors a number of pilot projects exploring innovative ways of increasing the ecological services, including habitat conservation, which farmland provides. Another example is AAFC's AgriAssurance program, which supports agriculture industry efforts to develop or respond to marketplace assurance initiatives, including with respect to environmental sustainability. Through industry assurance schemes, the agriculture sector can improve recognition of the ecosystem services the sector provides, and promote voluntary efforts to further enhance farm environmental sustainability (e.g., the Certified Sustainable Beef framework, developed by the Canadian Roundtable for Sustainable Beef).

Since 2001, AAFC has also been measuring and reporting on a series of agri-environmental indicators that provide a snapshot of the sector's environmental performance, and reflect on-farm management practices and natural processes (e.g., precipitation and soil type).

The science and models underpinning the indicators for soil, water, air quality, and biodiversity can also help measure ecosystem services provided by agricultural working landscapes (e.g., soil carbon sequestration and wildlife habitat).

Under the Canadian Agricultural Partnership, AAFC will continue to collaborate with provinces and territories and ECCC to advance the science behind, and use of, these indicators.

In 2017, ECCC, in collaboration with AAFC, Fisheries and Oceans Canada, Natural Resources Canada, Parks Canada, and all thirteen provinces and territories, published a comprehensive technical guide to enable governments and others to complete ecosystem services assessment and to use ecosystem services information in a wide range of policy-relevant activities.

The Ecosystem Services Toolkit can assist governments and stakeholders in measuring and integrating ecological services in policies and programs.

In November 2014, Statistics Canada published a study examining the ecosystem services used and produced by agricultural activities, and in 2018 a similar study examining the ecosystem goods and services associated with forests. These studies provide examples of how ecosystem services associated with the agriculture sector can be tracked and monitored and can serve as a starting point for discussions with provinces and territories regarding measurement of agricultural ecosystem services. Statistics Canada also produced a study on the changing landscape of Canadian metropolitan areas, with an emphasis on changes to the extent of ecosystems surrounding these settled areas between 1971 and 2011.

Greater recognition for ecosystem services by the Government is also evident in new opportunities for natural infrastructure investments under Investing in Canada Plan, led by Infrastructure Canada. To facilitate development of project proposals by provinces, territories, and others (where relevant) the Canadian Council of Ministers of the Environment's Climate Change Adaptation Policy Committee is developing a report addressing the business case for natural infrastructure choices, and a summary of the opportunities and current challenges in adopting them.

RECOMMENDATION 19

The Committee recommends that the Government of Canada develop business risk management programs that meet the needs of producers of all scales, including diversified producers, and that the government continues to develop risk management support programs that facilitate producers' innovative efforts to adapt to climate change.

The Government supports this recommendation. Business Risk Management (BRM) programs are designed to respond to the needs of all producers, regardless of their size or type of operation. Severe weather events have long been a serious risk for producers. BRM support, averaging over \$1.5 billion annually, has helped producers remain viable under difficult conditions. The programs are well-placed to continue to respond to any severe risks brought about by climate change. In addition, the programs are generally designed to not unduly impede adaptation or mask market signals, and ensure that producers are making the best decisions including innovating their operations and adapting to challenges as they arise.

Federal, provincial and territorial governments have completed a review of BRM programs and are undertaking further work as outlined in the recommendations from the Review's External Panel of Experts including ways to make the program as responsive as possible to producer challenges. Such approaches could include employing more modern premium-setting techniques, including the use of big data, to better reflect the risks of producers resulting in lower premium costs for those producers who employ conservation techniques, technological advancements, and other business practices to reduce risk in their operations.

BRM support is just one part of the overall support provided under the Partnership. Strategic initiatives under the Partnership complement BRM programs and include proactive investments in the sector in areas including innovation, science, and market development that can help the sector mitigate risk and adapt to changing conditions brought about by climate change. A coordinated approach on both BRM and strategic initiatives helps ensure the tools, technologies, information, and support necessary to facilitate adaptation to climate change are available to producers.