Presentation on the potential impacts of climate change on agriculture, agri-food and forestry sectors

Standing Senate Committee on Agriculture and Forestry

May 4, 2017

Good morning,

My name is Ted Bilyea and I am addressing you today in my capacity as Chair of the Board of Directors of the Canadian Agri-Food Policy Institute (CAPI). Accompanying me is Tulay Yildirim, Director of Policy Research Partnerships.

Thank you for the opportunity to present on this important issue for the agriculture and agri-food sector.

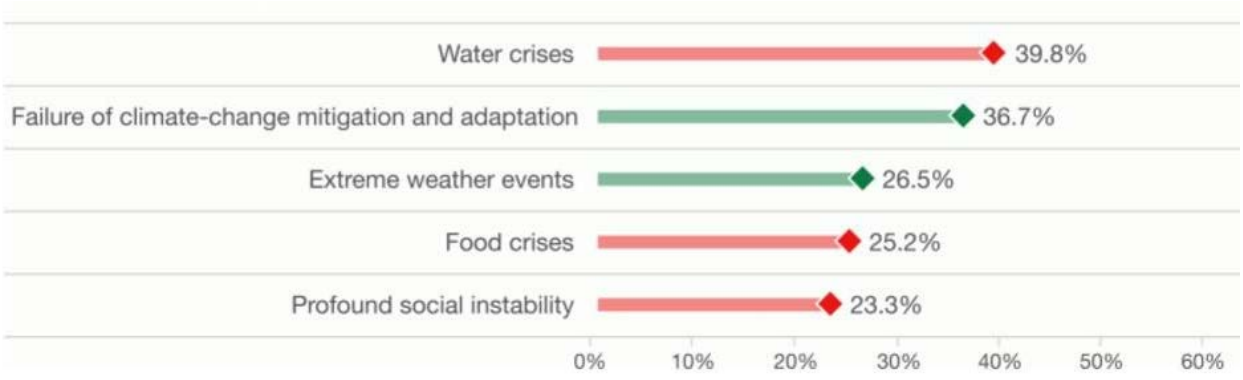
About the Canadian Agri-Food Policy Institute (CAPI)

The Canadian Agri-Food Policy Institute is an independent, non-partisan policy catalyst, brings insight, evidence and balance to emerging issues. CAPI provides a neutral place to hold dialogues and generate perspectives among leaders across the food system.

Climate Change represents the biggest risk to natural capital and future food availability globally

The World Economic Forum's 2016 list of the top five global risks of highest concern for the next 10 years reads as follows (Figure 1): water crisis, failure of climate-change mitigation and adaptation, extreme weather events, food crisis, profound social instability.

Figure 1: Top five global risks of highest concern for the next 10 years



Source: Global Risks Perception Survey 2015, World Economic Forum.

It is critical to understand that all 5 threats are closely linked and emanate from population and economic growth that until now has not meaningfully recognized or accounted for the depletion of natural capital (air, water, soil and biodiversity). I begin with this as it is central to the paradox of why a country so blessed as Canada with the most arable land and water per capita of anywhere on earth is not experiencing the economic growth in agri-food that one would expect with such bounty. Our substantial ecological surplus doesn't count if much of the rest of the world is content to externalize the cost of depletion or worst subsidize it.

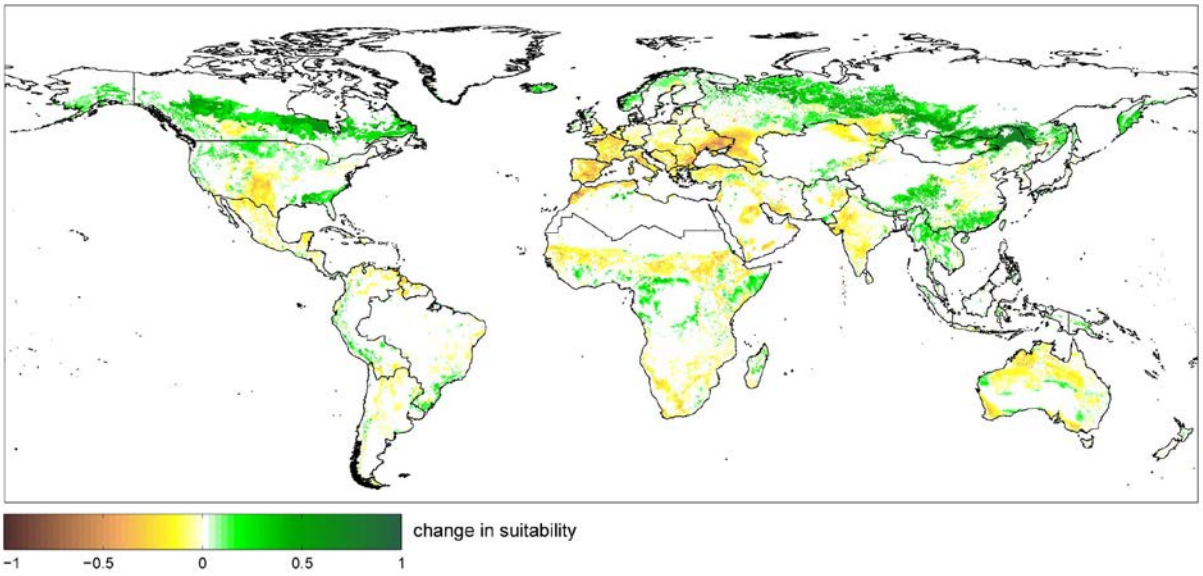
So as we reflect on how Canadian agriculture responds to climate change consider that the difference between surviving and thriving may well come down to the value the rest of the world puts on natural capital and how well we maintain that stock of natural capital.

Impacts of climate change on farmland and water introduces future opportunities and uncertainties for Canadian agriculture

Climate change is anticipated to benefit Canadian agriculture. Estimates of potential additional marginally suitable agricultural land in Canada range as high as 2.1M km sq. (Figure 2). Our own scientists question this estimate due to the productivity of the additional land and the investment required to clear and drain an area substantially larger than all current lands cultivated in Canada. Nevertheless, the Ontario Government is working on a one million acre pilot study to convert scrub forest to grassland in the Great Clay Belt which lies just south of the aforementioned area. The challenge will be to maintain or enhance ecosystems and biodiversity while increasing economic opportunity. The increase in degree days and growing season will be very familiar to the committee and is already producing new crops and higher yields particularly on the Prairies, corn, soybeans and quinoa to name a few. The change is also expected to benefit the livestock sector by reducing feeding costs.

However, the larger benefit to Canada is likely to be the decline of .8M km sq. of the globe's most suitable farmland to more marginal status as climate significantly impairs agricultural production elsewhere.

Figure 2: Global change in suitable agricultural land



Source: Zabel, *et al.*, 2014

Unfortunately, with these benefits come increased risks from extreme weather events, such as droughts, floods, storms, early winters. As of last week, we still had close to 1 million acres of 2016 crop on the prairies to harvest.

With more frequent droughts and increasing food demand non-renewable groundwater is now the source of over 20% of global irrigation of crops with a net depletion rate of 292 km^3 per year. "Rapid depletion of aquifers in key food-producing regions around the world (north-western India, the North China Plain, the central USA and California) ... is depleting the largest liquid freshwater stock on Earth and threatens the sustainability of food production" (Dalin et al. 2017). As climate change reduces suitable areas for agriculture the tandem effect of a growing water crisis will also positively impact Canada as 11% of food traded globally is reliant on depletion of non-renewable groundwater. (Dalin et al. 2017)

Figure 3: Top ten exporters and importers of groundwater depletion embedded in the food trade

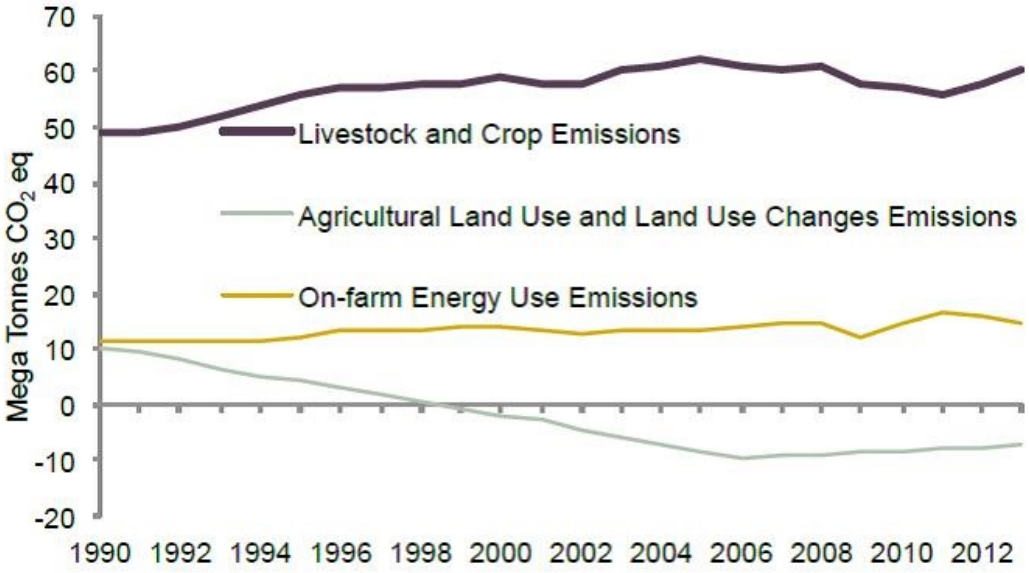
Source: Aldaya M.M., Nature, v. 543, March 30, 2017

The need to manage our natural capital sustainably while seeking better global governance around reduction of GHGs

"Canada will become the trusted global leader in safe, nutritious, and sustainable food for the 21st century"—this vision according to The Advisory Council on Economic Growth *"reflects the strength of our starting position, as well as the global trends we can exploit*." So how good is that starting position?

Emissions are a measure of waste and environmental inefficiency. Canadian farmers have increased production from $7.5 billion in 1981 to $16.2 B in 2011 (in constant 2007 prices) while keeping emissions fairly stable and thereby reducing GHG emission intensity (Figure 4), a key internationally measured benchmark. The learning from this is market forces drive efficiency through rapid adoption of beneficial management practices as fast as new knowledge/science is created and disseminated the visionaries and early adopters pick it up.

Figure 4: Emission Trends by Category, 1990-2013

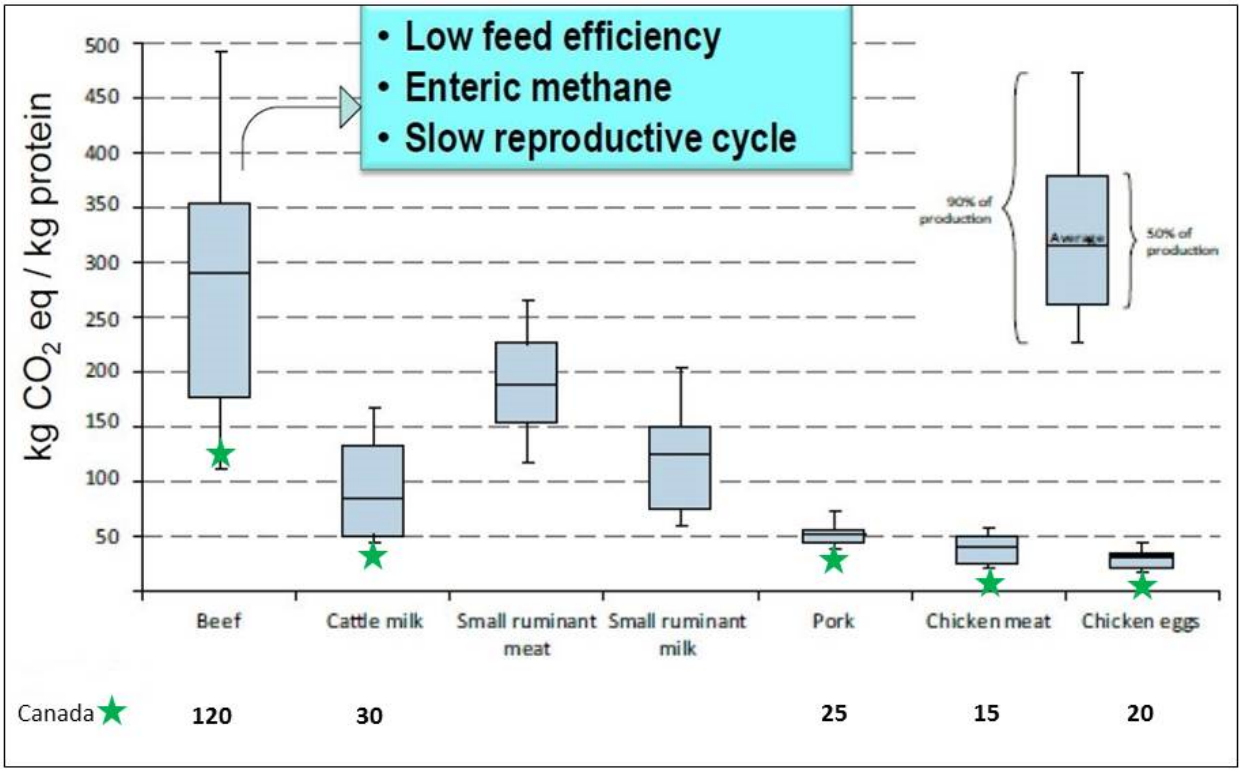


Source: Environment Canada, National Inventory Report 2015 and Natural Resources Canada, National Energy Database, 1990-2012

Canadian agriculture performs better than other countries in terms of GHG emissions from meat and crop production (Figure 5). This gives Canada an edge internationally, but we are yet to convert this to economic gains. I learned early in my career that it is not economically possible to move grain or forage to animals. That is why domestic subsides and high tariffs are required for grain deficient countries e.g. much of Asia and parts of Europe in order to engage

in animal agriculture. However, these subsidies lock in a higher CO_{2e} footprint. In addition countries with inadequate feed, poor genetics and animal health issues can produce 90% more GHG per animal protein unit created than Canada.

Figure 5: Global emission intensity of protein by commodity.
Canada is one of the most emission efficient producers of protein



Source: Global Livestock Environmental Assessment Model (GLEAM), FAO and AAFC

As you know agriculture accounts for only 8% of Canada's GHG emissions and fuel use accounts for only 15-20% of that, the rest is due to biological processes so a carbon tax would be rather ineffective in curbing agricultural GHGs. Canadian scientists see more potential if agriculture focuses on reductions in nitrous oxide than from CO2 (AIC Conference, 2017). Hence, a successful strategy would need to include various policy instruments including offsets, e.g. cap and trade, to address critical issues of sustainability. Alberta offers well-defined experience at scale with agricultural offsets which fit nicely into two major global initiatives which are forcing global compliance, 'The Carbon Disclosure Project' and the 'Global Reporting Initiative'. These organizations have over 6000 businesses and 500 cities worth over $33 trillion voluntarily disclosing their actions on sustainability and carbon. This is exactly the kind of process that will begin to put a value on natural capital. However, if countries like Canada with low GHG agricultural intensity unilaterally introduce measures to reduce GHG emissions, it could make

climate change worse as it simply incents production to move to countries without taxes on GHGs where deforestation is often also involved, and make global situation worse. (Golub et al. PNAS 2013). Hence it is critical to push other countries to move in the same direction.

What should FPT governments do?

For Canada to "become the trusted global leader in safe, nutritious, and sustainable food" Canadian agriculture must up its game as a solution provider by continuing to improve our soils capacity to sequester more carbon, continue lowering the emission intensity and by improving Canada's water quality through reduced impacts of agricultural production.

Key research priorities become:

1. Tackling issue such as agriculture's response to climate change or more generally agriculture sustainability by bringing together physical scientists with social scientists to assemble meaningful data and analytical capacity to better understand the risks and opportunities for Canadian agriculture.
2. Finding a way to continue increasing carbon sequestration in Canadian soils by at least 0.4% per year which is sufficient to offset our entire Ag Sector's emissions annually" (currently this is happening but there is concern it may be slowing)-Janzen et al., March 2016. Ideas to augment capacity include work on plant root phenology and use of biochar). (Paustian et al. Nature 2016)
3. Better understanding of role of healthy soil biomes in nitrogen and phosphate uptake, emissions abatement and plant immune systems. (Castrillo et al. Nature 2017)
4. Finding a way to support the visionaries and early adopters who drive change in the industry. One of the CAPI board members is a farmer from Manitoba who has very large land holdings. He is the poster of modern crop farming but has been shifting to focus on building healthy soils. He was proud to show us his results recently which have brought the farm well on the road to carbon neutrality while significantly increasing yields and reducing input costs. We need ways to support coffee shop peer networks to put the best of practices and science into rapid adoption
5. We need to increase our engagement in all international fora to draw attention not only to the threat of climate change to agriculture but the existential threats listed by the World Economic Forum which relate to the rapid depletion of natural capital.

References

Agricultural Institute of Canada (AIC) Annual Conference, 2017

Aldaya, M.M., "Eating Ourselves Dry". NATURE, vol. 543. March 30, 2017.

Castrillo, G., Lima Teixeira, P. J. P., Paredes, S. H., Law, T. F., de Lorenzo, L., Feltcher, M.E., Finkel, O.M., Breakfield, N. W., Mieczkowski, P., Jones, C.D., Paz-Ares, J. & Dang, J.L. "Root microbiota drive direct integration of phosphate stress and immunity". NATURE, vol. 543. March 23, 2017

CAPI-AAFC Synthesis Report on Strategies to Reduce Net GHG Emissions in Agriculture, December 12-13, 2016, Ottawa. http://www.capi-icpa.ca/pdfs/2017/Synthesis_CAPI-AAFC_GHG_Workshop_ENG.pdf

Dalin, C., Wada Y., Kastner, T., Puma, M.J. "Groundwater depletion embedded in international food trade". NATURE, vol. 543. March 30, 2017.

Environment Canada, National Inventory Report 2015 and Natural Resources Canada, National Energy Database, 1990-2012

Environmental Sustainability of Canadian Agriculture, 2016. http://publications.gc.ca/collections/collection_2016/aac-aafc/A22-201-2016-eng.pdf

FAO, Global Livestock Environmental Assessment Model, 2013.

Golub, A. A., Henderson, B.B., Hertel, T.W, Gerber, P.J., Rose, S.K., and Sohngen, B. "Global climate policy impacts on livestock, land use, livelihoods, and food security". PNAS, vol. 110, no. 52. December 24, 2013

Paustian, K., Lehmann, J., Ogle, S., Reay,D., Robertson, G.P. & Smith, P. "Climate-smart soils". NATURE, VOL. 532. April 7, 2016.

Specific Mitigation Opportunities Working Group Final Report. G_Report_SPECIFIC_MITIGATION_OPPORTUNITIES_EN_V04.pdf

World Economic Forum, Global Risks Perception Survey 2015.

Zabel, F., Putzenlechner, B., Mauser, W. "Global Agricultural Land Resources – A High Resolution Suitability Evaluation and Its Perspectives until 2100 under Climate Change Conditions". PLOS ONE, Volume 9, Issue 9. September 2014.