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Part II: Policies to Promote Plant-Based Food Production and Consumption in Canada

Prepared for World Animal Protection

SUBMITTED TO

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About Us

Navius Research Inc. is an independent and non-partisan consultancy based in Vancouver. We operate proprietary energy-economy modeling software designed to quantify the impacts of climate change mitigation policy on greenhouse gas emissions and the economy. We have been active in this field since 2008 and have become one of Canada's leading experts in modeling the impacts of energy and climate policy. Our analytical framework is used by clients across the country to inform energy and greenhouse gas abatement strategy.

We are proud to have worked with:

- All provincial and territorial governments, as well as the federal government.
- Utilities, industry associations and energy companies.
- Non-profit and research organizations with an interest in energy, climate change and economics.

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Executive Summary

Project overview

In August 2022, Navius completed an analysis for World Animal Protection to examine the role of animal-sourced food consumption in achieving Canada's greenhouse gas (GHG) emission targets.[1] The resulting report can be found here. This analysis involved the development of a customized version of Navius' gTech model, which allows for simulation of Canada's agriculture sector and food consumption patterns. It identified that shifting towards a plant-based diet could significantly reduce agricultural emissions, and as a result, decrease the cost of achieving Canada's emissions targets of a 40-45% reduction in GHG emissions by 2030 and net zero emissions by 2050.[2]

The following analysis builds on this previous study, this time examining the effectiveness of policies that could support plant-based agriculture and increase the consumption of plant-based foods in Canada. In particular, this analysis quantifies the impact of several possible policies – including an agricultural emissions cap, animal agriculture production limit, and a subsidy on plant-based alternatives – that are being explored around the world as a solution to limit emissions-intensive animal agriculture. It explores the impact of these policies on agricultural emissions, the food system and economic indicators in Canada with the objective of helping to guide World Animal Protection's advocacy efforts.

Approach

gTech is Navius' in-house energy economy model used for this analysis. gTech provides a comprehensive representation of all economic activity, energy consumption and greenhouse gas emissions in Canada. gTech is unique among energy-economy models because it combines features that are typically found in separate models:

- A realistic representation of how households and firms select technologies and processes that affect their energy consumption and greenhouse gas emissions;

[1] Navius Research. (2022). *Animal-sourced food consumption and Canada's emissions targets.* Available from: https://www.naviusresearch.com/publications/world-animal-protection-emissions-targets/

[2] Government of Canada. (n.d.). *Net-Zero Emissions by 2050.* Available from: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html

- An exhaustive accounting of the economy at large, including how provinces and territories interact with each other and the rest of the world; and
- A detailed representation of energy supply, including liquid fuel (crude oil and biofuel), gaseous fuel (natural gas and renewable natural gas), hydrogen and electricity.

More information about gTech can be found in this report.

Policy scenarios

Four policy scenarios simulated for this analysis are discussed in this executive summary. These include:

1. Current policy

This scenario includes currently legislated provincial and federal policy including a carbon tax that rises to $\$170/tCO_2e$[3] and the Clean Fuel Regulations[4]. This scenario acts as a reference case against which the impact of all other policies can be measured.

2. Agriculture emissions cap

The federal government has proposed a cap on greenhouse gas (GHG) emissions from Canada's oil and gas sector.[5] A similar policy could be applied to the agricultural sector. Other jurisdictions have committed to reducing emissions in the agricultural sector through a GHG emissions cap - New Zealand, for example, has committed to a 24-47% reduction in biogenic

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[3] Government of Canada. (n.d.). *Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030.* Available from: https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html

[4] Government of Canada. (n.d.). *Clean Fuel Regulations, SOR/2022-140.* Available from: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2022-140/page-1.html

[5] Government of Canada. (n.d.). *Options to cap and cut oil and gas sector greenhouse gas emissions to achieve 2030 goals and net-zero by 2050 – discussion document*. Available from: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/oil-gas-emissions-cap/options-discussion-paper.html

methane emissions from agriculture by 2050 and net zero for all other agriculture emissions.[6]

This scenario caps GHG emissions from agriculture at levels that require a 30% reduction in emissions by 2030 and a 50% reduction by 2050 (from 2005 levels). This sectoral reduction requirement is less stringent than Canada's economy-wide emission reduction targets (40-45% reduction by 2030 and net zero by 2050).[7]

3. Animal agriculture production limit

Variations of a limit on animal agriculture production are being explored in other jurisdictions around the world. For example, there has been legislation tabled in the U.S. Senate which would ban new intensive livestock operations after 2025, with a full phaseout after 2040.[8] The Dutch government has also discussed cutting livestock numbers by a third to reduce emissions by 2030.[9]

This scenario uses a production limit on animal agriculture to simulate an effective moratorium on new animal agriculture production in Canada. Production is limited to current levels[10], ensuring no future growth in the animal agriculture sector. Instead, all new agricultural growth in Canada occurs in the plant-based agriculture sector.

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[6] OECD. (n.d). *New Zealand's plans for agricultural emissions pricing.* Available from: https://www.oecd.org/climate-action/ipac/practices/new-zealand-s-plans-for-agricultural-emissions-pricing-d4f4245c/

[7] Government of Canada. (n.d.). *Net-Zero Emissions by 2050.* Available from: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html

[8] *Farm System Reform Act of 2023*, 118th Congress 1st session. (2023). Available from: https://www.booker.senate.gov/imo/media/doc/farm_system_reform_act_of_20231.pdf

[9] Financial Times. (2022). *Dutch farmers in uproar over plans to curb animal numbers to cut nitrogen emissions.* Available from: https://www.ft.com/content/90e38fb5-e942-4afd-994d-048dc40579a2

[10] Modeled as a cap on animal agriculture production at the levels in the model's base year level (2015).

4. Subsidy on plant-based food alternatives

Investment in plant-based food alternatives is occurring around the world, including the Canadian government providing funding for manufacturing of plant-based alternatives in Canada.[11]

In this scenario, we simulate a subsidy on manufactured meat and dairy alternatives (e.g., beyond meat and oat milk) to incentivize their consumption by making them less expensive to consumers.[12] A 15% subsidy is provided to all manufactured meat and dairy alternatives.

Sensitivity analysis

For all policy scenarios described above, three different levels of meat and dairy consumption (low, medium and high) were simulated using a sensitivity analysis. The sensitivity analysis was used to explore the impact of behavioural changes on the effectiveness of these policies (i.e., what would the impact of the policy be if consumers are more or less likely to substitute animal-based products for plant-based products in the future).

Because gTech cannot directly simulate **behavioural policies**, such as education, awareness-raising, food labeling and advertising, this sensitivity analysis aims to capture the potential impact of policies that target consumer behaviour and make consumers more likely to shift their food consumption from animal-based to plant-based products. Note that unless otherwise specified, results are reported from the 'high animal consumption' sensitivity in which the likelihood of consumers to shift towards plant-based food consumption remains low (at current levels).

Results

Agriculture emissions cap

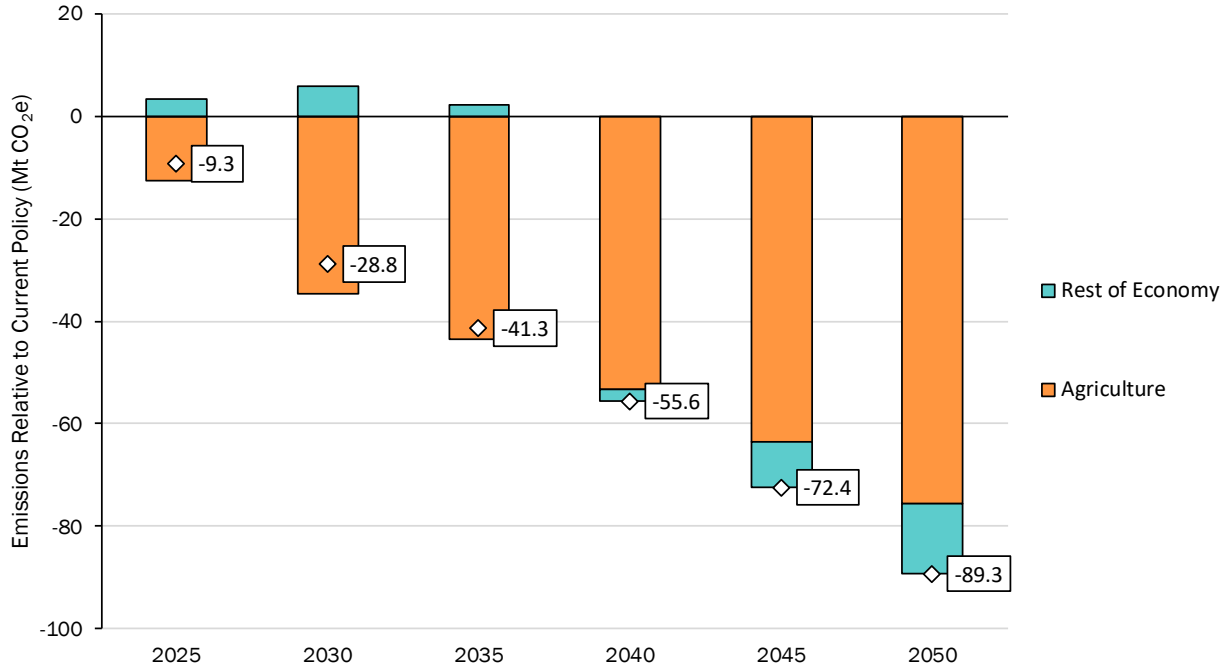
A GHG emissions cap on the agriculture sector is, by design, highly effective at reducing emissions. Capping agricultural emissions at a 30% reduction (from 2005 levels) by 2030 and a 50% reduction by 2050 results in a 29 Mt CO_2e reduction in

[11] Protein Industries Canada. (2023). *Protein Industries Canada receives federal funding for another five years.* Available from: https://www.proteinindustriescanada.ca/news-releases/protein-industries-canada-receives-federal-funding-for-another-five-years

[12] Plant-based food alternatives includes manufactured alternatives to meat and dairy such as plant-based meat or nut milks, however it does not include products such as fruits, vegetables, legumes or grains.

Canada's emissions in 2030 and a 89 Mt CO_2e reduction in 2050 relative to a current policy scenario, as shown in Figure 1.

Figure 1: Change in emissions in an agriculture emissions cap scenario (relative to current policy)



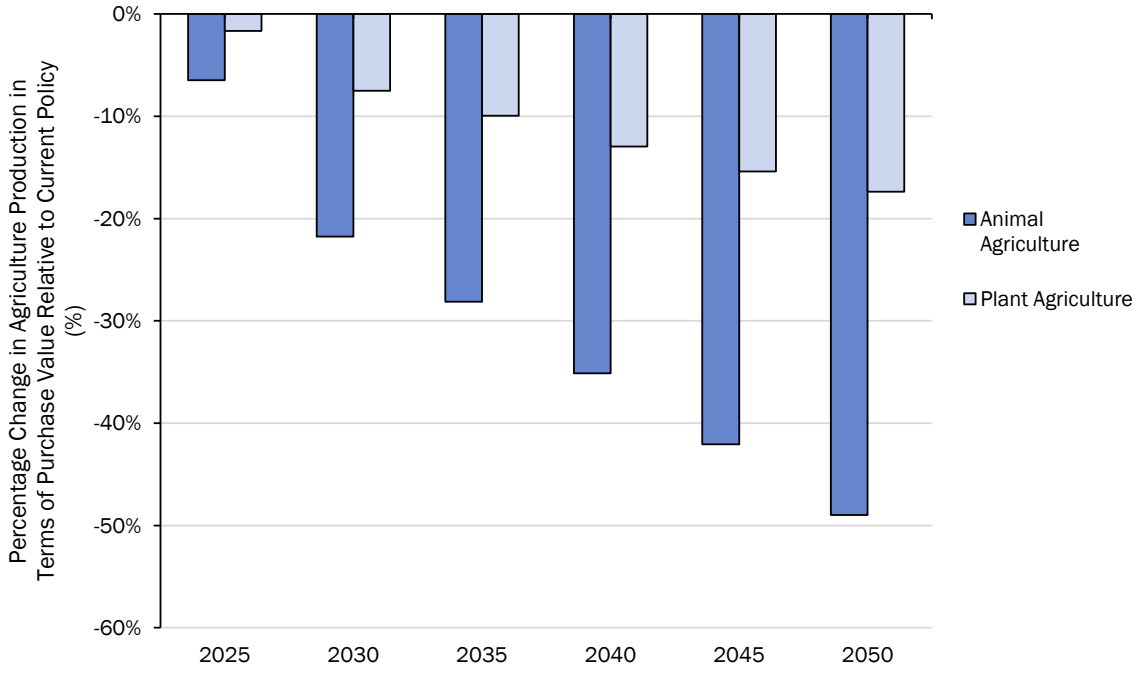
Most of these emissions reductions occur in the agricultural sector as abatement options such as electrification, bioenergy, and anaerobic digestors are adopted to reduce emissions to comply with the emissions cap. Additionally, the emissions cap incentivizes a shift away from animal agriculture towards plant-based agriculture. This is due to the high emissions intensity of animal agriculture relative to plant-based agriculture. In fact, recent research from the Canadian Climate Institute found that animal production and aquaculture is the most emissions intensive sector in Canada.[13]

As such, animal agriculture production in this scenario declines by 22% in 2030 and 50% in 2050 relative to current policy (Figure 2). The emissions cap also leads to a reduction in plant-based agriculture production. Plant-based production is 8% lower in 2030 and 17% lower in 2050 relative to current policy. This is due to a variety of factors, including a reduction in demand for animal feed, as well as a reduction in overall economic growth in this scenario (relative to a current policy scenario) leading

[13] Canadian Climate Institute. (2023). Calculating Emissions Intensity Across the Economy. Available from: https://440megatonnes.ca/insight/calculating-emissions-intensity-across-the-economy/

to a reduction in total agricultural production. Note that the economy continues to grow in this scenario, just at a slower rate than in the current policy scenario.

Figure 2: Change in agriculture production in an agriculture emissions cap scenario (relative to current policy)



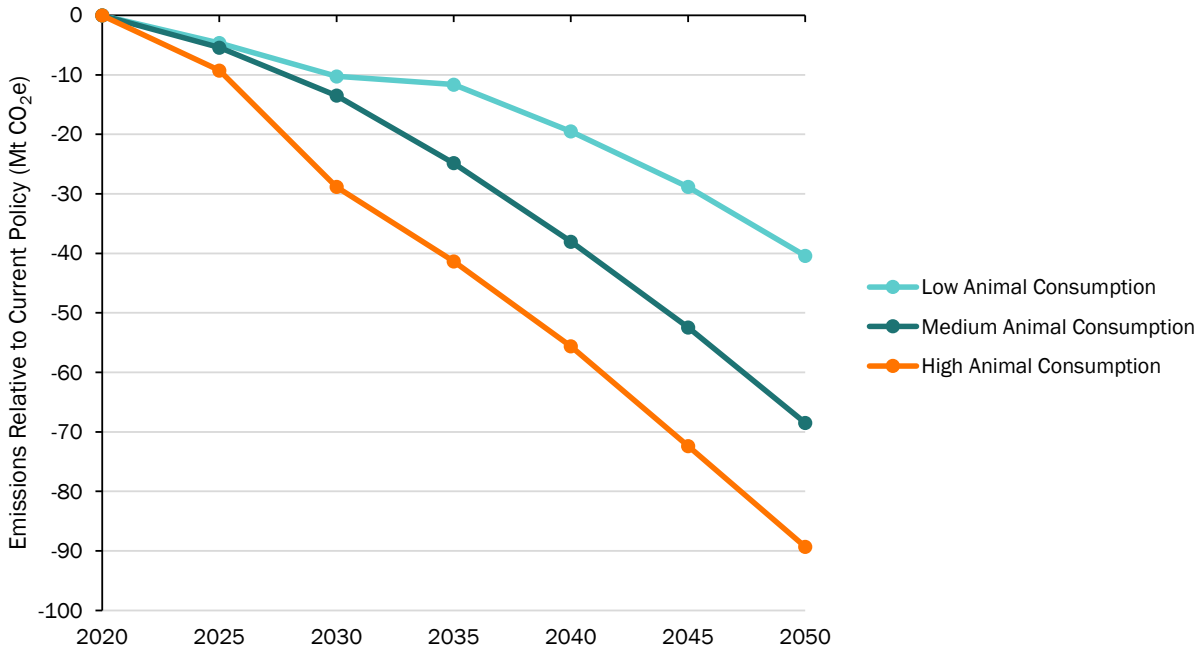
Different levels of meat and dairy consumption were modeled for each policy scenario in this analysis to explore the impact of behavioural change on the effectiveness of the policy instrument. In other words, what would the impact of an emissions cap on the agriculture sector be if consumers were more likely to substitute animal products for plant-based products? This sensitivity analysis helps us understand the potential interaction of an agriculture emissions cap with other behaviour-focused policies such as education or food labelling, which are intended to increase the willingness of consumers to shift away from animal products towards plant-based products.

The previous figures outline results of an agriculture emissions cap policy in a scenario where consumers are less likely to shift away from meat and dairy products to plant-based foods (high animal consumption sensitivity), which is intended to represent the current trajectory in absence of additional behaviour shifts (e.g., due to behaviour-focused policies such as education or food labelling). Simulating scenarios where consumers are more willing to shift their consumption towards plant-based alternatives has a significant impact on the effectiveness of an agriculture emissions cap, as shown in Figure 3 below.

Emissions reductions relative to current policy range from 10-28 Mt CO_2e in 2030 and 40-90 Mt CO_2e in 2050 in the agriculture emissions cap scenario depending on the animal consumption sensitivity. The policy has a smaller impact when consumers are more likely to shift towards a plant-based diet. This is because the reduction in animal agriculture that occurs in response to an emissions cap is to a greater extent already occurring under current policy due to reduced demand in a low animal consumption sensitivity. It is important to note however, that an agriculture emissions cap still has a large impact on emissions in a low animal consumption scenario.

This highlights that changing consumer behaviour could play a significant role in reducing emissions, as discussed in detail in our previous analysis for World Animal Protection.[14] Behavioural policies like informational campaigns or food labelling could play an important role in shifting consumer behaviour, which in turn influences Canada's food system and resulting emissions.

Figure 3: Change in emissions in an agriculture emissions cap scenario (relative to current policy) under three animal consumption sensitivities*



*The three animal consumption sensitivities represent different consumption trajectories that could be driven by behavioral policies like food labeling and education. The high animal consumption trajectory represents the current trajectory.

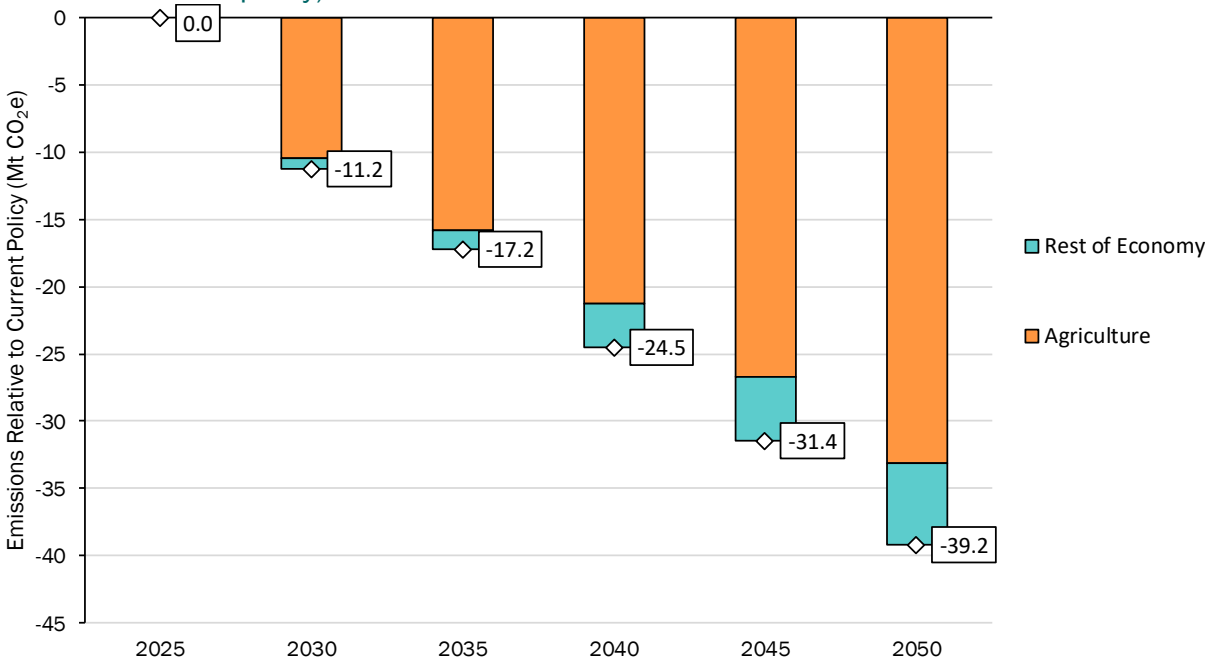
[14] Navius Research. (2022). *Animal-sourced food consumption and Canada's emissions targets.* Available from: https://www.naviusresearch.com/publications/world-animal-protection-emissions-targets/

Animal agriculture production limit

Animal agriculture has been identified as one of the most emissions intensive sectors in Canada.[15] Therefore, preventing growth of this sector has a significant impact on Canada's emissions. A policy that limits animal agriculture production to current levels results in a 11 Mt CO_2e reduction in Canada's emissions in 2030 and a 39 Mt CO_2e reduction in emissions in 2050, relative to current policy, as shown in Figure 4 below.

This is driven by a reduction in emissions from animals themselves, as fewer animals are farmed, as well as a reduction in emissions from input requirements to produce animals, including the growing of feed and use of fertilizer on that feed. Most emissions reductions in this scenario occur in the agriculture sector, and more specifically in the beef cattle sector (around 80% of total reductions), as this is the most emissions intensive agriculture sector. As such, reducing production in this sector relative to a current policy scenario has a large impact on Canada's emissions.

Figure 4: Change in emissions in an animal agriculture production limit scenario (relative to current policy)



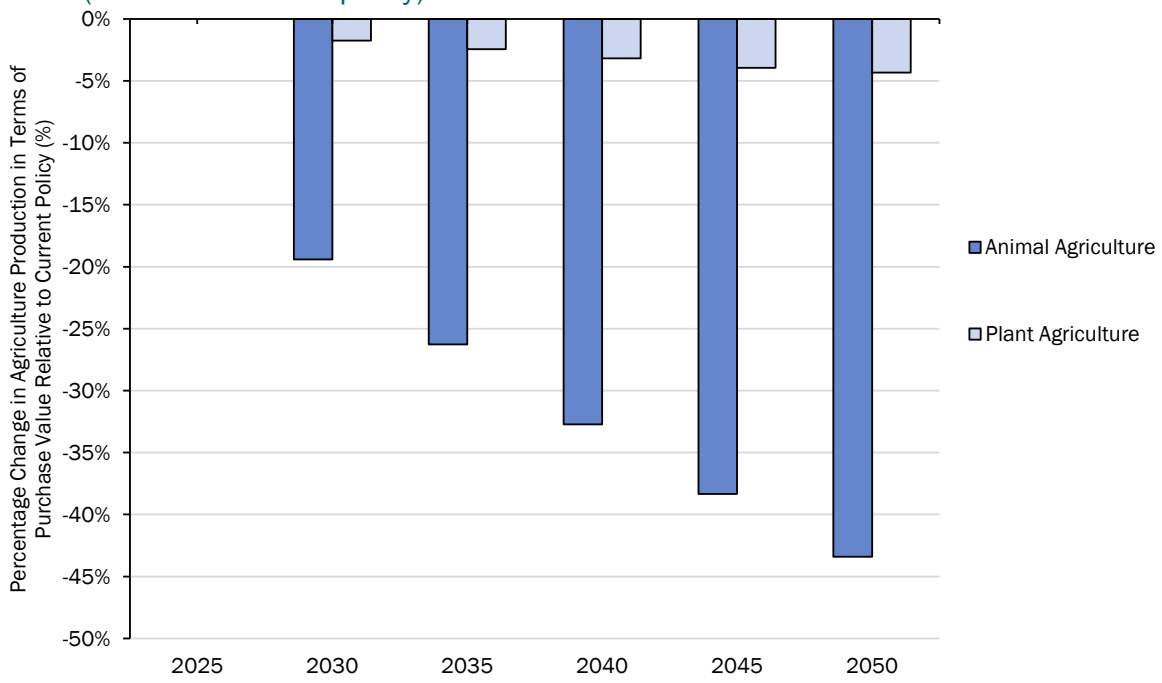
Limiting animal agriculture production has, by design, a significant impact on the number of animals produced in Canada. As shown in Figure 5, animal agriculture

[15] Canadian Climate Institute. (2023). *Calculating Emissions Intensity Across the Economy.* Available from: https://440megatonnes.ca/insight/calculating-emissions-intensity-across-the-economy/

production is 19% lower in 2030 and 43% lower in 2050 when production is limited to current levels relative to under current policy. The most significant reductions occur in the beef cattle sector. Beef cattle production is 23% lower in 2030 and 47% lower in 2050 compared to under current policy. Note that while animal agriculture production is lower in this scenario compared to the current policy scenario, animal agriculture production stays constant at current levels. In other words, production from the sector does not decrease.

Because farmed animals consume agricultural outputs from plant-based agriculture sectors as feed, a reduction in the number of animals produced (relative to current policy) also influences the level of output from plant-based agriculture. Additionally, as discussed in the next section, there is a reduction in overall economic growth in this scenario, leading to a reduction in total agricultural production. As a result, production from plant-based agriculture sectors is 2% lower in 2030 and 4% lower in 2050 in an animal agriculture production limit scenario relative to under current policy (Figure 5). Note that the plant-based agriculture sector continues to grow in the animal agriculture limit scenario, just at a slower level than in the current policy scenario.

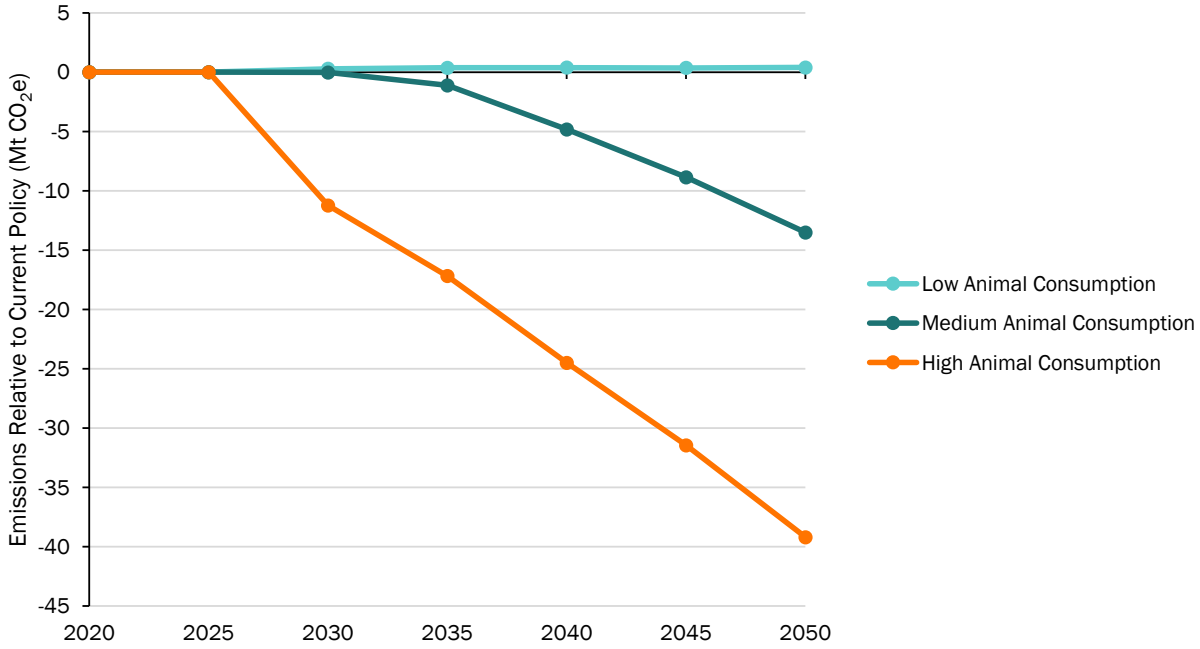
Figure 5: Change in agriculture production in an animal agriculture production limit scenario (relative to current policy)



The previous figures outline results of an animal agriculture production limit in a scenario where consumers are less likely to shift away from meat and dairy products to plant-based foods (i.e., high animal consumption sensitivity), which is intended to represent the current trajectory in absence of additional behaviour shifts (e.g., due to behaviour-focused policies such as education or food labelling). Simulating scenarios where consumers are more willing to shift their consumption has a significant impact on the effectiveness of an animal agriculture production limit, as shown in Figure 6 below.

Emissions reductions relative to current policy range from 0-11 Mt CO_2e in 2030 and 0-39 Mt CO_2e in 2050 in the animal agriculture production limit scenario depending on the animal consumption sensitivity. This policy has a smaller impact when consumers are more likely to shift towards a plant-based diet. In fact, in the low animal consumption sensitivity, when there is very high substitutability between plant-based products and animal products, a limit on animal agriculture production has no impact on Canada's emissions. This is because consumers are already shifting away from animal products in this sensitivity scenario, resulting in a decline in animal agriculture production over and beyond what the production limit policy requires. This suggests that if behavioural policies (such as informational campaigns or food labelling) could encourage consumers to shift consumption in line with the low animal consumption scenario, this could lead to a significant reduction in animal agriculture production and associated emissions in Canada.

Figure 6: Change in emissions in an animal agriculture production limit scenario (relative to current policy) under three animal consumption sensitivities*



*The three animal consumption sensitivities represent different consumption trajectories that could be driven by behavioral policies like food labeling and education. The high animal consumption trajectory represents the current trajectory.

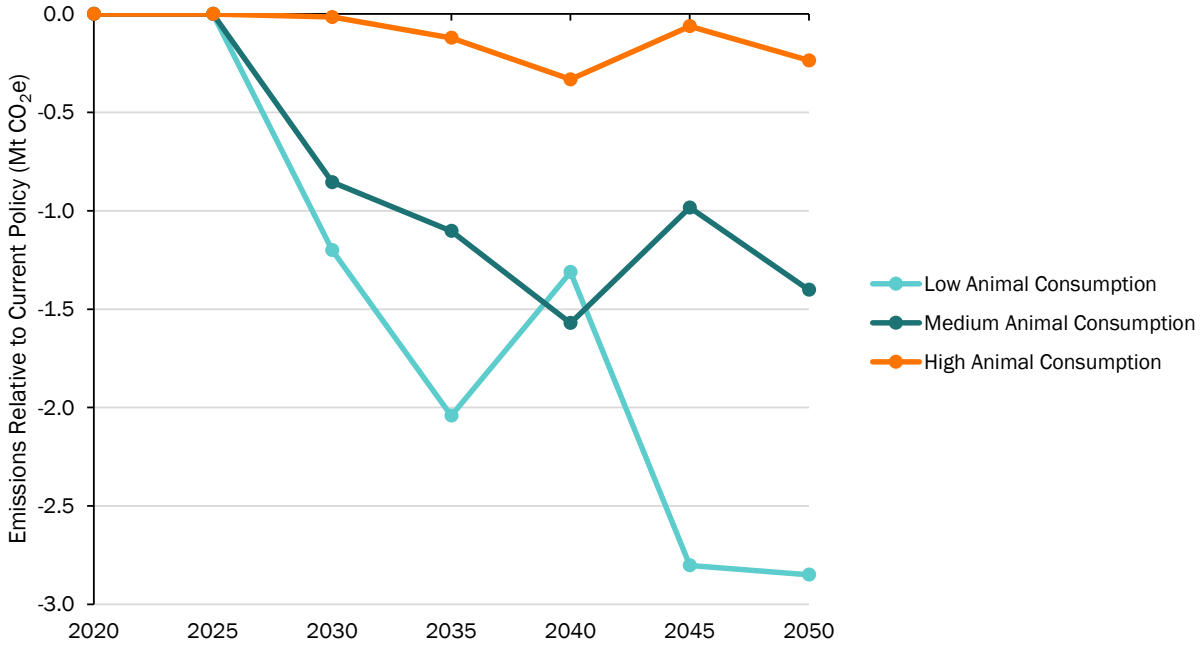
Subsidy on plant-based food alternatives

This analysis found negligible impact of a plant-based subsidy on emissions and animal agriculture production in the high animal consumption trajectory, which is intended to represent the current trajectory in absence of additional behaviour shifts (e.g., due to behaviour-focused policies such as education or food labelling). However, the impact is amplified if consumers are more willing to shift away from meat and dairy towards plant-based products.

Emissions reductions relative to current policy range from 0-1 Mt CO_2e in 2030 and 0-3 Mt CO_2e in 2050 in the meat and dairy alternative subsidy scenario depending on the animal consumption sensitivity (Figure 7). Emissions reductions are greatest in the low animal consumption sensitivity when consumers are already likely to choose plant-based alternatives over meat or dairy products. This suggests that a subsidy on plant-based alternatives, although not an effective policy on its own, could be an effective policy in conjunction with behavioural policies, such as informational campaigns or food labelling, by reducing the cost of meat and dairy alternatives for consumers who are willing to shift their consumption. Conversely, it is important to note that results

suggest a subsidy is likely to achieve very little unless the population is willing to shift towards a plant-based diet.

Figure 7: Change in emissions in an alternative food subsidy scenario (relative to current policy) under three animal consumption sensitivities*



*The three animal consumption sensitivities represent different consumption trajectories that could be driven by behavioral policies like food labeling and education. The high animal consumption trajectory represents the current trajectory.

Note that there are other reasons to implement a subsidy beyond impacts on emissions. For example, subsidizing plant-based production could promote production and innovation within Canada through initiatives such as the Protein Industries Canada Cluster.[16] This could in turn reduce prices of plant-based alternatives, increasing the likelihood of a future with 'low animal consumption' (see Figure 7).

Comparison of policy instruments

This section offers a comparison of the policy instruments described above. It is intended to compare the impact of each policy on Canada's emissions, animal agriculture production, and economy. Note, however, that each policy simulated differs in its design, level of stringency, and intended function. For example, a GHG emissions cap on the agricultural sector is intended to reduce agricultural emissions, while an animal agriculture production limit is intended to prevent increased animal agriculture

[16] Government of Canada. (n.d.). *Canada's Protein Industries Cluster.* Available from: https://ised-isde.canada.ca/site/global-innovation-clusters/en/canadas-protein-industries-cluster

production (which indirectly reduces emissions relative to current policies which allow for growth in the sector). It is important to keep these differences in mind when reviewing the results presented in this section.

While agriculture GDP continues to grow out to 2050 in all scenarios, policies aimed at reducing agricultural emissions do have cost implications, as Canada's GDP grows at a slower rate in these scenarios relative to current policy.[17] Table 1 shows the average annual GDP growth rate in Canada in the high animal consumption sensitivity. Note that the GDP impact is lower for most policies in a low animal consumption future, as behavioural shifts towards a plant-based diet is already occurring. For example, in the low animal consumption sensitivity, the economy grows at 1.55% per year in the agriculture emissions cap scenario compared to 1.50% in the high animal consumption scenario.

Table 1: Average annual GDP growth rate

Policy	Average annual GDP growth rate (2020-2050)
Current policy	1.59%
Agriculture emissions cap	1.50%
Animal agriculture production limit	1.54%
Subsidy on plant-based food alternatives	1.59%

However, all policy instruments differ in terms of design, stringency, and objective, so simply comparing the GDP growth rate in each policy scenario is not sufficient for comparing their effectiveness. We can make a direct comparison between the policies by calculating the cost of the policy (impact to GDP) relative to the emissions or animal agriculture production reductions achieved.

Table 2 provides an index describing the reduction in GDP resulting from each policy relative to the level of emissions reductions achieved by the policy. It suggests that the GHG emissions cap is the most efficient policy at reducing emissions, costing the least per unit of emissions reduced. The animal production limit is more expensive, costing 60% more in 2030 and 10% more in 2050. While this policy is not intended to reduce emissions directly, limiting growth of this sector has a significant indirect impact on emissions due to animal agriculture's emissions intensive nature. As described

[17] Note that due to the limited impact of the plant-based subsidy, the difference in GDP between current policy and the subsidy is very small.

previously, the subsidy on plant-based food alternatives has a limited impact on emissions and is not a cost-efficient policy on its own.

Note that this analysis is heavily focused on the emissions benefit of implementing policies that encourage more plant-based food production and consumption in Canada. A reduction in animal agriculture could have other benefits beyond emissions impacts that are not quantified here, including land-use[18,19,20,21], water[22,23,24,25], biodiversity[26,27,28], and pandemic risk[29],[30],[31].

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[22] Ibid.

[23] Springmann, M.; Wiebe, K.; Mason-D'Croz, D.; Sulser, T. B.; Rayner, M.; Scarborough, P. (2018). Health and Nutritional Aspects of Sustainable Diet Strategies and Their Association with Environmental Impacts: A Global Modelling Analysis with Country-Level Detail. *The Lancet Planetary Health, 2 (10), e451–e461.* Available from: https://doi.org/10.1016/S2542-5196(18)30206-7.

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[31] White, R. J.; Razgour, O. (2020); Emerging Zoonotic Diseases Originating in Mammals: A Systematic Review of Effects of Anthropogenic Land use Change. *Mam Rev, 50 (4), 336–352.* Available from: https://doi.org/10.1111/mam.12201.

Table 2: Index describing the amount of GDP reduced relative to emissions reductions achieved (reductions from the GHG cap =1)

Policy	2030	2050
Agriculture emissions cap	1.0	1.0
Animal agriculture production limit	1.6	1.1
Subsidy on plant-based food alternatives	23.1	1.6

The agriculture emissions cap is a policy that is designed to target emissions rather than production directly. Therefore, it is a more expensive option if the goal is to reduce animal agriculture production in Canada, compared to an animal production limit, as shown in Table 3 below.

The animal agriculture production limit has a 30% smaller impact on GDP in 2030 per unit of animal agriculture reduced, and a 40% smaller impact on GDP in 2050 relative to the emissions cap. This indicates that this policy, which targets animal agriculture production more directly, is more cost effective than an emissions cap if the policy objective is to reduce animal agriculture production in Canada. The alternative food subsidy is an expensive policy as it does not have a significant impact on the food system.

Table 3: Index describing the amount of GDP reduced relative to the amount of animal agriculture production reduced (reductions from the GHG cap =1)

Policy	2030	2050
Agriculture emissions cap	1.0	1.0
Animal agriculture production limit	0.7	0.6
Subsidy on plant-based food alternatives	7.5	5.1

Key insights for policymakers

Results from this analysis provide five key insights, summarized below.

1. **Canada's agriculture sector can play a role in helping Canada achieve its emissions targets.** Reducing emissions from agriculture can play an important role in meeting Canada's 2030 emissions target, but stringent policy will be required with cost implications. A recent analysis of Canada's Emissions Reduction Plan (ERP) found that there is a 9 Mt CO_2e gap between announced

policies and Canada's 2030 emissions target.[32] Capping emissions from agriculture at 30% below 2005 levels in 2030 or keeping animal agriculture production constant at current levels could close this gap to Canada's 2030 target.[33]

2. **Canada's agriculture sector can continue to grow out to 2050 while helping Canada reduce emissions.** All policies simulated in this analysis lead to a reduction in Canada's emissions, while agriculture GDP continues to grow out to 2050 in all scenarios. Policies aimed at reducing agricultural emissions do have cost implications, as Canada's GDP grows at a slower rate in all policy scenarios relative to current policy.

3. **An emissions cap on Canada's agricultural sector is the most cost-effective policy for achieving emissions reductions.** This policy is designed to reduce emissions in the agriculture sector by encouraging adoption of available abatement technologies as well as encouraging a shift away from emissions-intensive animal agriculture towards plant-based agriculture. Of the policies explored in this analysis, this policy is the most efficient at reducing emissions, costing the least per unit of emissions reduced.

4. **An animal agriculture production limit is the most cost-effective policy for transforming Canada's food system.** While implementing an emissions cap on the agricultural sector achieves significant emissions reductions in Canada, it is not as effective at changing how food is produced and consumed in Canada. An animal agriculture production limit, which directly targets the production of animals, is more cost efficient than an emissions cap at reducing animal production in Canada. It is important to acknowledge that there are many environmental benefits of reduction in animal production, beyond the impact on

[32] Canadian Climate Institute. (2022). Independent Assessment: 2030 Emissions Reduction Plan. Available from: https://climateinstitute.ca/wp-content/uploads/2022/04/ERP-Volume-2-FINAL.pdf

[33] Based on a 2022 analysis of the ERP. Additional information about policy design has been released since then.

GHG emissions, which are not explored in this analysis, including land-use[34,35,36,37], water[38,39,40,41], biodiversity[42,43,44], and pandemic risk[45],[46],[47].

5. **Policy design should consider interactions between the policy and future behavioural changes and consumption patterns.** Behavioural changes can play a significant role on the impact of the policies explored in this analysis, amplifying their impact in some cases and reducing it in others. The effectiveness of an emissions cap and production limit decline if consumers are more willing to shift towards a plant-based diet, as changes to Canada's food system are occurring to a greater extent in the absence of additional policy. On the other hand, the effectiveness of a subsidy on plant-based food alternatives

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[35] Poore, J.; Nemecek, T.(2018). *Reducing Food's Environmental Impacts through Producers and Consumers. Science, 360 (6392), 987–992.* Available from: https://doi.org/10.1126/science.aaq0216

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[37] Clark, M. A.; Springmann, M.; Hill, J.; Tilman, D. (2019). Multiple Health and Environmental Impacts of Foods. *Proc Natl Acad Sci USA, 116 (46), 23357–23362.* Available from: https://doi.org/10.1073/pnas.1906908116

[38] Ibid.

[39] Springmann, M.; Wiebe, K.; Mason-D'Croz, D.; Sulser, T. B.; Rayner, M.; Scarborough, P. (2018). Health and Nutritional Aspects of Sustainable Diet Strategies and Their Association with Environmental Impacts: A Global Modelling Analysis with Country-Level Detail. *The Lancet Planetary Health, 2 (10), e451–e461.* Available from: https://doi.org/10.1016/S2542-5196(18)30206-7.

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[41] Kim BF, Santo RE, Scatterday AP, Fry JP, Synk CM, Cebron SR, Mekonnen MM, Hoekstra AY, De Pee S, Bloem MW, Neff RA (2020). Country-specific dietary shifts to mitigate climate and water crises. *Global environmental change, 1;62:101926.*

[42] Machovina, B.; Feeley, K. J.; Ripple, W. J.(2015). Biodiversity Conservation: The Key Is Reducing Meat Consumption. *Science of The Total Environment, 536, 419–431.*

[43] Coimbra, Z. H.; Gomes-Jr, L.; Fernandez, F. A. S. Human Carnivory as a Major Driver of Vertebrate Extinction. (2020). *Perspectives in Ecology and Conservation, 18 (4), 283–293.* Available from: https://doi.org/10.1016/j.pecon.2020.10.002.

[44] Gerten, D.; Heck, V.; Jägermeyr, J.; Bodirsky, B. L.; Fetzer, I.; Jalava, M.; Kummu, M.; Lucht, W.; Rockström, J.; Schaphoff, S.; Schellnhuber, H. J. (2020) Feeding Ten Billion People Is Possible within Four Terrestrial Planetary Boundaries. *Nat Sustain, 3 (3), 200–208.* Available from: https://doi.org/10.1038/s41893-019- 0465-1

[45] Kim, H.; Rebholz, C. M.; Hegde, S.; LaFiura, C.; Raghavan, M.; Lloyd, J. F.; Cheng, S.; Seidelmann, S. B. (2020). Plant-Based Diets, Pescatarian Diets and COVID-19 Severity: A Population-Based Case–Control Study in Six Countries. *BMJNPH, 4 (1), 257–266.* Available from: https://doi.org/10.1136/bmjnph 2021-000272.

[46] Intergovernmental Science-Policy Platform On Biodiversity And Ecosystem Services (IPBES). (2020). *Workshop Report on Biodiversity and Pandemics of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES);* Zenodo. Available from: https://doi.org/10.5281/ZENODO.4147317.

[47] White, R. J.; Razgour, O. (2020); Emerging Zoonotic Diseases Originating in Mammals: A Systematic Review of Effects of Anthropogenic Land use Change. *Mam Rev, 50 (4), 336–352.* Available from: https://doi.org/10.1111/mam.12201.

is amplified when consumers are more willing to shift towards a plant-based diet.

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World Animal Protection Discussion of Results

Discussion of regulatory policies and potential reactions

An overwhelming body of evidence indicates that reducing animal agriculture production to support a transition to more plant-based diets will substantially reduce global greenhouse gas emissions (GHG) thus being an important pathway to climate change mitigation.[48,49,50,51,52] As highlighted earlier in the report, previous research from Navius also showed the potential positive impact of reduced meat and dairy consumption in helping Canada meet its 2030 and 2050 emission reduction targets.[53]

In this analysis, the impact of three policy scenarios on Canada's GHG emissions reduction targets were analyzed and explained earlier in the report: agriculture emissions cap, animal agriculture production limit and subsidy on plant-based food alternatives. The results indicate that reducing emissions from agriculture can play an important role in meeting Canada's emissions reduction targets by implementing policies that encourage less animal food consumption by Canadians.

While there are economic impacts associated with each of the three policy scenarios, this is generally the case across all sectors of the economy that must meet climate targets. And as the recent report by the Commissioner for the Environment and Sustainable Development notes, emissions from the Canadian agriculture sector have grown significantly, with the growth exceeding all other sectors except oil and gas.[54] There is a legitimate debate about the impacts of the policy scenarios, and this debate

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[48] https://www.thelancet.com/action/showPdf?pii=S0140-6736%2817%2931358-2

[49] https://www.uni-bonn.de/en/news/082-2022

[50] https://www.nature.com/articles/d41586-019-02409-7

[51] https://eatforum.org/knowledge/diets-for-a-better-future/

[52] What's cooking? As assessment of potential impacts of selected novel alternatives to conventional animal products. UNEP, 2023. https://www.unep.org/resources/whats-cooking-assessment-potential-impacts-selected-novel-alternatives-conventional

[53] https://www.worldanimalprotection.ca/sites/default/files/media/2022-08-30-World-Animal-Protection-Navius-FINAL.pdf

[54] https://www.nationalobserver.com/2024/06/05/opinion/Climate-change-factory-farming-emissions?utm_source=National+Observer&utm_campaign=226d4436a8-EMAIL_CAMPAIGN_2024_06_05_01_20&utm_medium=email&utm_term=0_cacd0f141f-226d4436a8-%5BLIST_EMAIL_ID%5D

should focus on how to mitigate the economic impacts on small- and medium-scale farmers, who are often among those most harmed by the effects of climate change.

In this context the following policy considerations should be taken into account:

1) Limiting the growth of animal agriculture need not take a 'one size fits all' approach. A sustainable food system is not simply about reducing the number of animals farmed, but addressing the nature of farming systems, the practices employed, and the scale of individual farms. This can be achieved by reducing animal numbers through targeted policies that limit the growth of large-scale, industrial operations. At the same time, promoting small-scale operations using regenerative, mixed farming, agroecology practices can help farmers maintain their autonomy and protect livelihoods. For example, The Farm System Reform Act reintroduced in the US House of Representatives and Senate in February 2023 would prohibit the construction of new large Concentrated Animal Feeding Operations (CAFOs) and the expansion of those currently operating. It would also require large CAFOs, defined as facilities exceeding a certain number of animals to cease operating above the animal limit by 2040 and establish grants to help farmers transition their practices. [55]

2) Canada's plant-based protein sector is expected to grow at 14% annually, with economic benefits estimated to be as high as 31 trillion USD or 13% of GDP by 2050 and presents a significant opportunity for agricultural and food innovation.[56] The government has already financially supported the sector but there is much more that can be done via incentives on the producer side such as funding support to first time farmers, funding to promote organic agriculture or subsidies to promote green farming initiatives (See *Danish Action Plan for Plant-Based Foods)*.[57] Financial support for farmers to encourage the transition to small scale livestock and/or crop production, other plant-based agriculture, and/or adopting agroecology methods is needed.

3) Behaviour change policies could help to reduce or mitigate the need for stringent regulatory approaches (e.g., emissions cap or limit on animal agriculture growth). A subsidy on plant-based food alternatives alone was not found to be an effective policy in encouraging the uptake of more plant-based diets (and less meat and dairy by default) and reducing agricultural emissions. However, in conjunction with behaviour change policies, it has the potential to shift consumer behaviour, thereby limiting the growth of animal agriculture and reducing the need for strong regulatory measures. The effects of

[55] https://www.booker.senate.gov/news/press/booker-introduces-package-of-bills-to-reform-us-food-system and https://awionline.org/legislation/farm-system-reform-act
[56] https://nrc.canada.ca/en/research-development/research-collaboration/programs/plant-based-protein-market-global-canadian-market-analysis
[57] https://fvm.dk/fileadmin/user_upload/Dokumentation/Danish-Action-Plan-for-Plant-based-Foods.pdf

the plant-based subsidy were amplified when consumers are more likely to shift towards more plant-based foods and consume less animal-based foods. Actions that may nudge consumers in this manner may include information campaigns around the benefits of following the Canada Food Guide, carbon emissions labelling, and increasing the availability of plant-based food in the marketplace. The federal government can lead by example by procuring more plant-based food in federal institutions and through federally-funded food programs like the National School Food Program.

Canada's agriculture sector must do more to contribute to the nation's emission reduction strategy.[58] Implementing low carbon, technological solutions on farms is important but not enough. What we eat and how it's produced must be critically examined and appropriate changes made to ensure a low carbon food system for the future. The policies assessed in this report offer a solution that aligns with Canada's climate goals and with Canada's Sustainable Agriculture Strategy currently in development.

Limitations of analysis scope

It is important to note that there are other environmental implications of shifting food consumption to be more plant-based beyond impacts to greenhouse gas emissions, which are not explored in this analysis. Although these impacts are not accounted for in the modeling, they will increase the environmental benefits of reducing animal consumption and are therefore worth mentioning.

Currently, agriculture land accounts for around half of all habitable land on earth, where 83% is used for animal agriculture including feed crops.[59] Switching to a more plant-based diet would partially free up these land areas -- including marginal lands that are often inefficient at producing food, but ecologically valuable -- which could become available for conservation, restoration and reforestation. In addition, agriculture is the leading cause of biodiversity degradation globally, mainly due to the production of crops needed for animal feed.[60] Research suggests that this degraded land can recover its original carbon stocks and biodiversity levels if transitioned away from agricultural

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[58] https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202404_05_e.pdf
[59] Poore, J.; Nemecek, T. Reducing Food's Environmental Impacts through Producers and Consumers. Science 2018, 360 (6392), 987–992. https://doi.org/10.1126/science.aaq0216 .
[60] Machovina, B., Feeley, K., & Ripple, W. (2015). Biodiversity conservation: The key is reducing meat consumption. Science of the Total Environment, 536, 419-431. doi:10.1016/j.scitotenv.2015.07.022

land.[61] Lastly, animal agriculture uses 43% of all the water consumed by the global food system and is responsible for a disproportional amount of water pollution.[62],[63] Switching to a lower animal consumption diet would therefore reduce not only greenhouse gas emissions, as quantified in this analysis, but could also reduce land use, water consumption, and water pollution, while increasing biodiversity levels. There are also substantial health benefits from reducing animal consumption.[64]

[61] Silver, W. L., Ostertag, R. & Lugo, A. E. The potential for carbon sequestration through reforestation of abandoned tropical agricultural and pasture lands. Restor. Ecol. 8, 394–407 (2000).
[62] Davis, K. F., Gephart, J. A., Emery, K. A., Leach, A. M., Galloway, J. N., & D'Odorico, P. (2016). Meeting future food demand with current agricultural resources. Global Environmental Change, 39, 125-132.
[63] Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992.
[64] https://www.lshtm.ac.uk/research/centres/centre-climate-change-and-planetary-health/news/416196/small-changes-diets-can-have-substantial-benefits-both-health-and-environment