

Summary: Understanding the Implications of Climate Change for Agriculture: Predictions and Policy Responses at a Federal, Provincial, and Municipal Level

Introduction

This summary provides an overview of a larger document by the same name. This research is intended to respond to one of the research objectives outlined by the Kamloops Food Policy Council. It provides information on climate change and its predicted impacts as they relate to agriculture and provides specific policy options and recommendations for responding to these predictions. This document focuses on British Columbia and Kamloops, while the complete document offers a broader view with information from each level of government.

Federal

IPCC Report

The IPCC's Special Report on *Global Warming of 1.5°C* from 2018 outlines the differences between global warming of 1.5°C compared to 2.0°C. Changes relevant to agriculture which worsen at 2.0°C warming include:

- Increased risk of droughts, lack of precipitation (IPCC, 2018, p. 9)
- Increased risk of forest fires, spread of invasive species (IPCC, 2018, p. 10)
- Increased risks relating to food security at 1.5°C and further at 2.0°C (IPCC, 2018, p. 11)
- Livestock production is anticipated to suffer from changing quality of feed, water availability, and the spread of disease (IPCC, 2018, p. 11)
- Even when warming is limited to 1.5°C trade-offs will be required, as reforestation and afforestation will be necessary on land needed for agriculture. This has the potential to undermine “food security, livelihoods, ecosystem functions and services and other aspects of sustainable development” (IPCC, 2018, p. 21).

Climate Change and Inequity

The IPCC stresses the importance of careful and rapid action in order to prevent the need for large-scale deployment of CO₂ removal (IPCC, 2018, p. 20). Climate change will have an uneven impact across the world and will impact “poor and disadvantaged population, in all societies” to a greater extent (IPCC, 2018, p. 20). Social justice and equity considerations are of the upmost importance in order to prevent exacerbating conditions for poor and disadvantaged populations (IPCC, 2018, p. 24). In addressing climate change, it is important that collaborative action occurs between all levels of government to create “rapid, systemic transitions in urban and rural areas” (IPCC, 2018, p. 21).

Climate Change and Indigenous Peoples

The Government of Canada states that an important part of climate change action is working with municipalities. They explain that municipal governments are “essential partners”, as the development and operation of cities has significant implications for energy usage (Government of Canada, 2016, p. 24). The Canadian government recognizes the importance of engaging with Indigenous

Peoples and recognizes the value of Traditional Knowledge, while also understanding the significant impact climate change will have on Indigenous Peoples and remote, northern communities (Government of Canada, 2016, forward). Indigenous Peoples will experience substantial changes due to a changing climate, and this has implications for social, cultural, ecological and economic aspects of Indigenous lives (Government of Canada, 2016, p. 27).

Implications for Canadian Agriculture

While warmer weather brings the benefit of longer growing seasons, these warmer temperatures will also bring increases in pests, the threat of damage from heat stress, and the outbreak of disease (Sarkar, 2018, p. 71). Extreme weather events also have the potential to reduce the benefit of a longer growing season by increasing the frequency and severity of frost in late spring (Lanza, 2016, p. 349). These late season extreme weather events present significant risk for less-hardy species within both agriculture and forestry (Lanza, 2016, p. 349).

For the following reasons, there may not be a significant change to the varieties of plants that can be grown (Lanza, 2016, p. 348-349):

- Climate change presents an increased risk of drought and lack of precipitation
- Warmer winters do not control pests that are naturally controlled by very cold winters
- Temperate plant species may require a certain degree of chilling, which may not happen in a warmer winter, therefore reducing crop yield
- Perennials may be damaged if they are not cold hardened during the fall, and face more winter thaws and less protective snow covers
- Canada has limited arable land; even if northern regions warm, these places frequently have little soil and the landscape is predominantly rock and muskeg which is unsuitable for farming

The OECD stresses the importance of mitigation and adaption across all levels in response to climate change. Agricultural actors must make changes on the farm, within the watershed, with regards to risk management, and within agricultural policy and markets (OECD, 2018, p. 7). Farmers may be required to change methods, such as seeding dates and the application of irrigation and fertilization, as well as changing the types of crops that are grown (Weber & Hauer, 2003, p. 164). Land use may also need to shift as climate types change, for example switching from crops to livestock (Weber & Hauer, 2003, p. 164). Sarkar explains that there must be innovation, the adoption of new technology, and a “coordinated approach” to climate change mitigation and adaptation (2018, p. 75). Using technology in farming can allow for more “data-driven decisions”, allowing a more precise approach to farming to minimize inputs and maximize outputs to respond to specific crop and soil property variations (Sarkar, 2018, p. 72). Additionally, “urban/peri-urban and vertical agriculture” provides opportunities for economic development while contributing to climate change mitigation and reducing environmental impacts on the food production system (Sarkar, 2018, p. 72).

Provincial

Current and Future Impacts of a Changing Climate

BC has already experienced many changes in its climate. BC has become warmer and wetter (BC Natural Resources, 2016, p. 1). Winter has warmed the most of any season, and has seen more extreme rainfall, dry conditions, and smaller snowpacks (BC Natural Resources, 2016, p. 1). Precipitation has

increased across the province, and peak river flow is now occurring earlier in the year (Ministry of Environment, 2016, p. 3). River ice has also been melting earlier in the year (Ministry of Environment, 2016, p. 3). The average temperature and night time temperature has increased and the average temperature across the province continues to increase at a rate of 1.4°C per century (Ministry of Environment, 2016, p.3).

It is anticipated that in the future there will be continued increase in the amount of rain that falls in winter and decrease in snowfall, causing the length of forest fire season to increase (BC Natural Resources, 2016, p. 1). By the end of the century it is predicted that BC could have a mean temperature that is 1.7°C to 4.6°C warmer than now (BC Natural Resources, 2016, p. 1). Fires are expected to become worse and more frequent (Climate Action Initiative, 2012, p. 15). Some rivers in southern BC may also begin drying up in summer and early fall (Ministry of Environment, 2016, p.4).

While small changes in average temperature may seem insignificant, the report provided by the Ministry of Natural Resources makes it clear that even seemingly small changes can have tremendous implications. The mountain pine beetle outbreak that has had a significant impact on the province was caused by an average increase in temperature of 1°C (BC Natural Resources, 2016, p.2).

The investment, innovation and application of new knowledge that is needed is unlikely to occur for multiple reasons. Industry has been struggling to make profits, which makes investments in new approaches or technology difficult to do (Climate Action Initiative, 2012, p. 7). Extreme weather, which is becoming ever more present, makes investment and innovation more difficult due to unpredictability (Climate Action Initiative, 2012, p. 7). Additionally, many ranchers are nearing retirement and the average age of a farmer is 53, which makes them less likely to invest and innovate (Climate Action Initiative, 2012, p. 8).

Municipal

Effective Municipal Planning

Research done by Stevens & Senbel reviewed Canadian municipal plans for key components of effective municipal climate planning. With a lack of these key components, these municipalities are demonstrating a lack of commitment and capacity for plan implementation (Stevens & Senbel, 2017, p. 10). There is a need for “mainstreaming” mitigation and adaptation in order to see success, which refers to changing the “dominant paradigm” through integrating climate mitigation or adaptation policy with sectoral policies (Wamsler, 2014, p. 190; Di Gregorio et al., 2017, p. 35, Kalafatis, 2018, p. 701).

Planning Documents in Kamloops

Kamloops planning documents provide minimal information relating to climate change and agriculture. The Sustainable Kamloops Plan does not mention specifically the impacts of climate change on agriculture but does support further food security initiatives such as community gardens, protecting ALR land and encouraging edible landscapes. The Food and Urban Agriculture Plan has an action item of working with TRU for adapting local food production to climate change” but no other information on the subject (City of Kamloops, 2015, p. 45). The Agriculture Area Plan has several action items that pertain specifically to climate change and agriculture. The KAMPLAN has nothing on climate change and agriculture.

Examples from the Prairies

The policy brief *Build a Climate-Resilient City: Agriculture and Food Security* by the International Institute of Sustainable Development and the University of Winnipeg provides valuable examples of policy responses to address climate change and agriculture. The policy brief argues for the value of short food chains because they are more resistant to shocks, which can be created through encouraging strong, local food networks (Temmer, 2017, p. 4). Policy responses that have been helpful in encouraging “robustness, redundancy and resourcefulness” include (IISD, n.d.):

- Creating “urban and community agriculture zones” that allow for selling produce in yards, market gardens, and supports communities, farms and nurseries (Temmer, 2017, p. 4)
- Creating “Planned Manufacturing Districts” or other forms of re-zoning can allow for more hydroponics and vertical farming (Temmer, 2017, p. 4).
- Implement city wide composting to improve soils, reduce methane, and build resiliency (Temmer, 2017, p. 5).
- An incubator farm was created in Brampton, Ontario which worked with the local immigrant community to grow ethnic foods and to share this knowledge so that cultural foods could be produced locally and provide market opportunities (Temmer, 2017, p. 6). This same concept could be used within the Kamloops context to find new varieties of popular crops that could better adapt to a changing climate.
- Creating a community food center for a food hub. This location can be used for many different food related purposes, including: a bulk buying food club, a small food bank, a kitchen to be used by the community for commercial food processing purposes, a soup kitchen, a location for community meals, a fruit and garden share program to connect those looking for food and land with those with extra, and for mobile grocers and produce vendors (Temmer, 2017, p. 6-7).
- Food security can be improved by supporting the cottage food industry, which are businesses with product development occurring in the home (Temmer, 2017, p.6-7). With less restriction’s, individuals can make food in more locations, therefore making small businesses more viable without the large upfront cost for a commercial food kitchen and equipment (Temmer, 2017, p.6-7). To make this happen, roadblocks must be understood to begin advocating for their removal, and there is a need to reduce confusion and risks around food safety regulations (Temmer, 2017, p.6-7).

Policy Recommendations for Kamloops

There are a variety of actions Kamloops can take to better address the stress of climate change on agriculture.

- Work should be done to further integrate climate action into urban plans. This includes creating a clear document outlining where Kamloops’ emissions come from and addressing these with clear emissions reductions targets.
- Information should be provided to urban gardeners and local farmers on how best to grow food under increasing climate uncertainty.
- Further research should be done on the impacts unpredictable and increased spring flooding and wildfire have on agriculture so local agriculture can be better prepared for uncertainty.

- The creation of an incubator farm could provide farmers with education opportunities to learn about innovative ways to farm in the face of climate uncertainty. A farm incubator could also encourage and assist young farmers entering the field.

Conclusion

Climate mitigation and adaptation can occur in ways that promotes partnerships and engaged Indigenous communities and Traditional Knowledge, as well as engaging different sectors, including public and private actors, institutions, civil society, universities and business (IPCC, 2018, p. 25). Going forward it is important to engage in collective action and capacity building, recognizing all communities and groups need to take climate action in a well rounded, ambitious way (IPCC, 2018, p. 25). Significant research exists on the climate changes we are already seeing, and what can anticipate in the future. Going forward, there is a need for research and innovation to determine the best practices and techniques for agriculture methods. As well, it is essential that we see collaborative action to strengthen and support local food networks.

References

- British Columbia Ministry of Environment. (2016). *Indicators of climate change for British Columbia 2016 update*. Retrieved from https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/reporting/envreportbc/archived-reports/climate-change/climatechangeindicators-13sept2016_final.pdf
- British Columbia Ministry of Forests, Lands and Natural Resource Operations. (February 22, 2016). *Adapting natural resource management to climate change in the Thompson-Okanagan Region: Considerations for practitioners and Government staff*. Retrieved from <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/toen160222.pdf>
- City of Kamloops. (2010). Sustainable Kamloops plan: Foundations for sustainability. Retrieved from <https://www.kamloops.ca/sites/default/files/docs/sustainablekamloopsplan.pdf>
- City of Kamloops. (2010). Sustainable Kamloops plan: Foundations for sustainability. Retrieved from <https://www.kamloops.ca/sites/default/files/docs/sustainablekamloopsplan.pdf>
- City of Kamloops. (2013). Agriculture Area Plan. Retrieved from <https://www.kamloops.ca/sites/default/files/docs/city-hall/13-12-18-aap.pdf>
- City of Kamloops. (2016). Sustainable Kamloops plan 2016 progress update. Retrieved from https://www.kamloops.ca/sites/default/files/docs/our-community/sus_sustainablekamloopsplan_update_2016.pdf
- City of Kamloops. (2017). KAMPLAN: City of Kamloops official community plan 2017. Retrieved from <https://www.kamloops.ca/homes-business/community-planning-zoning/official-community-plan-kamplan>
- City of Kamloops. (September 2015). Food and Urban Agriculture Plan. Retrieved from https://www.kamloops.ca/sites/default/files/docs/city-hall/15-09-food_urban_agriculture_plan_2015_285947.pdf
- Climate Action Initiative (2012). *Cattle production: Central interior: Snapshot report*. Retrieved from <https://www.bcagclimateaction.ca/regional/overview/risks-opportunities/>
- Di Gregorio et al., M. (2017). Climate policy integration in the land use sector: Mitigation, adaptation and sustainable development linkages. *Environmental Science & Policy* 67: 35-43
- Government of Canada. (2016). Federal Actions for a Clean Growth Economy – Delivering on the Pan-Canadian Framework on Clean growth and Climate Change. Retrieved from <https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/federal-actions-clean-growth-economy.html>
- Government of Canada. (2016). Pan-Canadian Framework on Clean Growth and Climate Change. Retrieved from http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf
- Government of Canada. (2016). Pan-Canadian framework on clean growth and climate change: Canada's plan to address climate change and grow the economy. Retrieved from <https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/climate-change-plan.html>

- Government of Canada. (2018). Pan-Canadian framework on clean growth and climate change: Second annual synthesis report on the status of implementation – December 2018. Retrieved from http://publications.gc.ca/collections/collection_2018/eccc/En1-77-2018-eng.pdf
- IISD. (n.d.). Building a climate-resilient city: Agriculture and food security. Retrieved from <https://www.iisd.org/library/building-climate-resilient-city-agriculture-and-food-security>
- IPCC. (2018). Summary for Policymakers. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva, Switzerland, 32 pp.
- Kalafatis, S. E. (2018). Comparing climate change policy adoption and its extension across areas of city policymaking. *Policy Studies Journal* 46(3): 700-720. doi: 10.1111/psj.12206
- Lanza. (2016). Climate adaptation in cities: What trees are suitable for urban heat management? *Landscape and Urban Planning* 153: 74-82. <http://dx.doi.org/10.1016/j.landurbplan.2015.12.002>
- OECD (2014). Climate change, water and agriculture: Towards resilient systems. OECD studies on water. OECD Publishing. <http://dx.doi.org/10.1787/978926409138-en>
- Sarkar et al. (2018). Enabling a sustainable and prosperous future through science and innovation in the bioeconomy at Agriculture and Agri-Food Canada. *New Biotechnology* 40(70-75). DOI: 10.1016/j.nbt.2017.04.001
- Stevens, M. R., Senbel, M. (2017). Are municipal land use plans keeping pace with global climate change? *Land Use Policy* 68:1-14
- Temmer, J. 2017. Building a climate-resilient city: Agriculture and food security. *International Institute for Sustainable Development & University of Winnipeg*. Retrieved from <https://www.iisd.org/library/building-climate-resilient-city-agriculture-and-food-security>
- Weber, M., Hauer, G. (2003). A regional analysis of climate change impacts on Canadian agriculture. *Canadian Public Policy* 29(2): 163-180. DOI: 10.2307/3552453