

Climate Change in Alberta

Climate change is the modification in the composition of the global atmosphere, due to a combination of natural climate variability over time and the direct and indirect effects of human activities on the environment.

According to the Intergovernmental Panel on Climate Change (IPCC), global temperatures have increased by 0.3 to 0.6 °C over the past century, with most of the rise occurring in the past 40 years. Central and Northwestern Canada has warmed by up to 0.5 °C in the past 30 years, while east of the Labrador coast, cooling of 0.4 °C has been observed. Summer temperatures in the Northern Hemisphere appear now to be the warmest since at least 1400AD.

How will it affect agriculture?

Agriculture will have both opportunities and risks. Longer growing seasons and warmer annual surface temperatures are predicted. This creates opportunities to grow new crops and diversify management. It may also mean more extreme weather, pest pressures and increased erosion risk. Adapting to the changing climate is essential for the long-term sustainability of agriculture.

Alberta's Past Climate - Shen et al. (2005)

- Surface air temperatures in Alberta have increased from 1.3 to 2.1°C in the period of 1895 to 1991.
- May – August precipitation increased by 14% from 1901 to 2002. The largest significant increase was in the northern and northwestern Alberta regions, ranging from 30 to 90 mm. A steady increase in May-August precipitation was documented after the 1920s.
- The 'length of growing season' became 3 to 9 days longer than it was 60 years ago in the southeast corner of the province and 0 to 3 days longer in the Boreal Transition and Aspen Parkland Ecoregions.
- The areas with sufficient Corn Heat Units for corn production extended north by 200 to 300 km since the 1910s and 50 to 100 km since the 1940s.
- Alberta's climatic normals (1901 to 2002) show the western part of the province having a larger increase in precipitation than the eastern part.

Alberta's Future Climate – An Assessment of Five Climate Models - Barrow and Yu (2005)

- The annual mean temperature is projected to increase between 3°C and 5°C by 2050.
- The annual precipitation changes will be in the range of –10% to +15% by 2050, however by 2080, annual precipitation is projected to increase up to 15%.
- Degree-days > 5 °C (or, the growing season for plants measured by the difference between the mean daily temperature and the plant growth temperature of 5.5 °C), are projected to increase by 30 to 50% by 2050. These increases are driven by a large increase in degree-day totals, rather than by large decreases in precipitation.
- The annual moisture index (ratio of annual degree day total to annual total precipitation) is projected to increase by 20 to 30% by 2050.
- By 2050, Calgary, Edmonton, Grande Prairie and Fort McMurray are projected to experience degree-day totals similar to Lethbridge and Medicine Hat's present degree-day totals.
- The following three tables show an average of annual, winter and summer temperatures from the five climate model scenarios combined with baseline (or, observed 1961 to 1990 climate information). (Tables sourced from Barrow and Yu, 2005)

Table 1. Annual mean temperature (°C) for the 1961-1990 baseline and average of all five scenarios for the 2050s

	Baseline	2050 ¹	
	1961-1990	Mean	Standard Deviation
Lethbridge	5.4	8.3	0.89
Medicine Hat	5.1	8.1	0.94
Calgary	3.4	6.1	0.87
Edmonton	2.5	5.2	0.96
Grande Prairie	1.6	4.0	0.87
Fort McMurray	0.1	2.9	1.20

¹ mean value of 5 future climate model and associated standard deviation.

Table 2. Winter (December to February) mean temperature (°C) for the 1961-1990 baseline and average of all five scenarios for the 2050s

	Baseline	2050 ¹	
	1961-1990	Mean	Standard Deviation
Lethbridge	-6.9	-3.5	1.22
Medicine Hat	-9.1	-5.6	1.36
Calgary	-8.2	-5.1	1.39
Edmonton	-12.3	-9.0	1.68
Grande Prairie	-13.1	-10.3	1.68
Fort McMurray	-17.5	-13.9	1.99

¹ mean value of 5 future climate model and associated standard deviation.

Table 3. Summer (June to July) mean temperature (°C) for the 1961-1990 baseline and average of all five scenarios for the 2050s

	Baseline	2050 ¹	
	1961-1990	Mean	Standard Deviation
Lethbridge	17.2	20.3	1.18
Medicine Hat	18.3	21.3	1.22
Calgary	14.5	17.4	1.05
Edmonton	15.7	18.2	0.84
Grande Prairie	14.6	17.0	0.61
Fort McMurray	15.4	17.8	0.69

¹ mean value of 5 future climate model and associated standard deviation.

Summary

Projected climate change in Alberta can greatly affect crop and livestock management decisions. Alberta has nine differing ecoregions and projected warming trends and climatic changes vary spatially and analysis of regional or local changes of climate is important for decision-making by the agricultural sector. Comparisons of historical climatic normals with possible future scenarios suggest there will be a longer growing season and more heat units during the growing season in Alberta. With an extended growing season, crop variety, crop yield and crop quality will also have the potential for expansion. However, the temporal changes also suggest that southern Alberta may have drier conditions. Agroclimatic parameters indicate that agriculture in Alberta has benefited from the last century of climate change (Shen et al. 2005). Climate change scenarios imply that Alberta will experience an increase in annual mean temperatures, growing degree-days, soil moisture index and a decrease in precipitation by 2050. These trends continue to 2080. Climate change has and will continue to create opportunity in the agricultural sector in Alberta.

References:

- Barrow, E.M. and Yu. G. 2005. *Climate Scenarios for Alberta*. A Report Prepared for the Prairie Adaptation Research Collaborative (PARC) in co-operation with Alberta Environment. University of Regina, Saskatchewan. Available at http://www.parc.ca/research_pub_scenarios.htm
- IPCC (2001): Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, U.K. and New York, Y.K., U.S.A. <http://www.ipcc.ch/pub/online.htm>
- Shen, S. S. P., H.Yin, K. Cannon, A. Howard, S. Chetner, and T.R. Karl. 2005. Temporal and Spatial Changes of the Agroclimate in Alberta, Canada, from 1901 to 2002. *Journal of American Meteorological Society*, 44:1090-1105.

For more information visit Agriculture and Climate Information Service (ACIS) at [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/All/acis10819](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/All/acis10819) For other climate change bulletins call (780) 422-4385 or go to <http://www.agric.gov.ab.ca> (Alberta Agriculture and Food) and click on "Weather and Climate" and follow the links.