Stratford Emission Profile

Baseline Year of 2017

Rebecca Garlick
CITY OF STRATFORD

PARTNERS FOR CLIMATE PROTECTION

Figure 1 Partners for Climate Protection Framework (2016) [1]

The City of Stratford joined the Partners for Climate Protection (PCP) first in 2004, and rejoined again with the new tool platform earlier in 2019. Through the PCP platform, Stratford's community emissions were compiled and uploaded into the tool, which then assisted in calculating the total emissions from each sector. Now that the emissions, and baseline year have been selected, the reduction target can be set and the development of the community-based greenhouse gas reduction plan can begin. The steps involved in the next two milestones are community engagement, and establishing what actions and goals the community would like to see and will support.

[1] Ontario Climate Consortium (August 2016) Partners for Climate Protection Framework. Retrieved from: https://climateconnections.ca/news/peel-climate-change-partnership/attachment/partners-for-climate-protection-framework/

EMISSION PROFILE

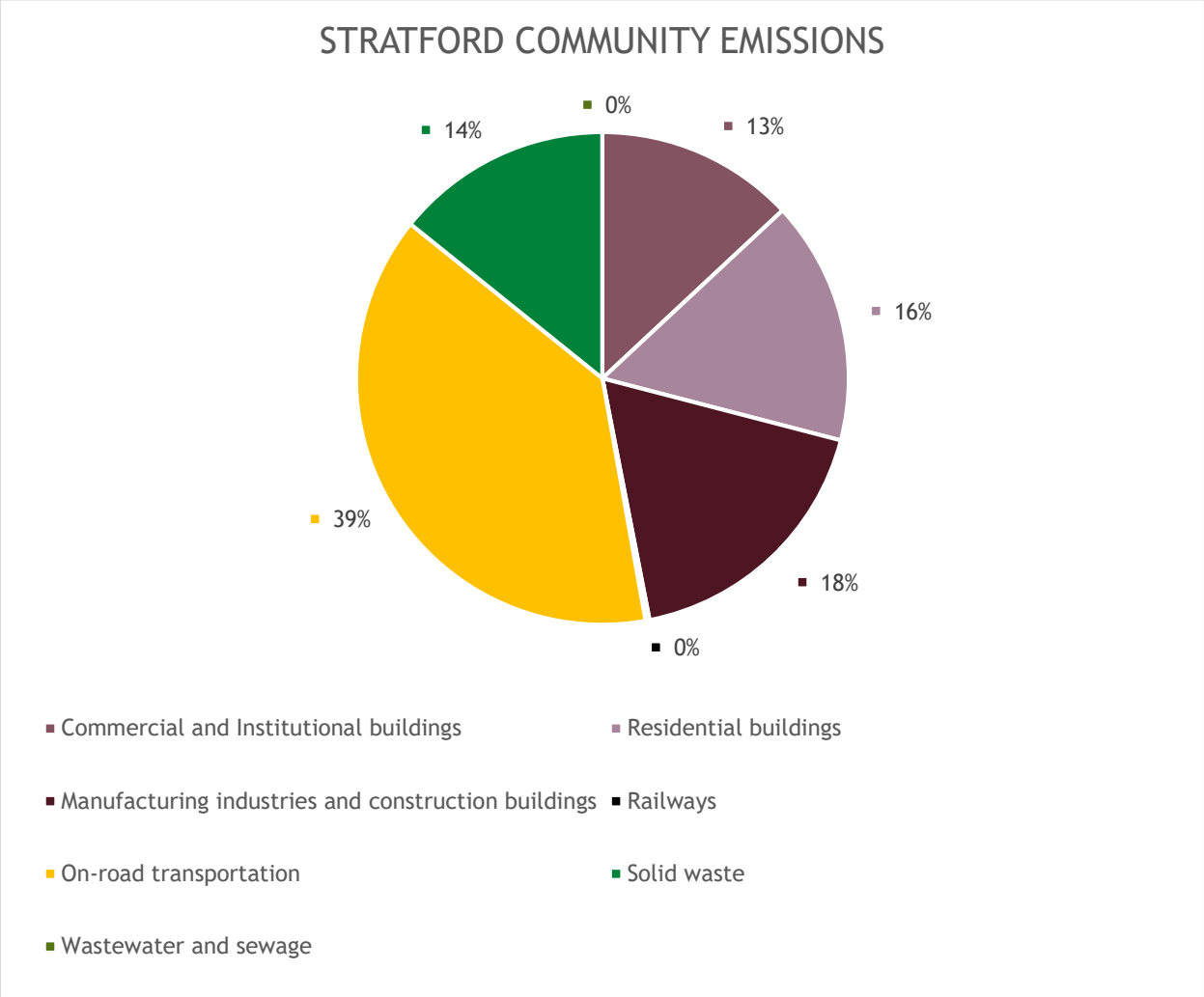

Figure 2 Stratford's Emission Profile

In 2017, Stratford emitted an estimated 277,156.55 tonnes of carbon dioxide equivalent (CO_2e), from the transportation, waste and building sectors. This amount of emissions is equivalent to approximately 59,878 cars driven for one year, or about 1,106,799,580.66 kilometers driven by one passenger vehicle[2].

With this total of emissions, the emissions per person in 2017 was equal to approximately 8.93 tonnes of CO_2e, which is comparable to about 2 passenger vehicles driven per year per person[2].

[2] Environmental Protection Agency (2018) Greenhouse Gas Equivalencies Calculator. Retrieved from: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Transportation

The transportation data within Stratford was extrapolated from the census data[3]. The average emissions per vehicle are approximately 4.6 tonnes of CO_2e per year[4]. It is assumed that Stratford residents need to own or have access to a vehicle to travel for various purposes due to the size of the municipality and access to resources. In 2016, Ontario's average vehicle per household was approximately 1.7 vehicles per household. Based on this assumption, there were approximately 13,675 dwellings in Stratford, meaning there were approximately 23,247.5 personal vehicles. This does not include vehicles that commute into Stratford for work or vehicles owned by tourists, this total also does not include freight or other work-vehicles. Emissions from personal vehicles make up about 39% of the City's total emissions, and emitted a total of about 106,938.5 tonnes of CO_2e in 2017.

The emissions from the train that travels through Stratford were also included in the emission profile. Emissions from the train were estimated through an approved methodology, where total emissions from the railway sector in Canada[5] were divided by the total length of tracks through Canada[6], this gave the tonnes per CO_2e per kilometer of track. Based on the length of the track and the average emissions per kilometer of track across Canada, the train emits approximately 0% of the City's total emissions. The total emissions are estimated to be 741 tonnes of CO_2e for 2017.

[3] Statistics Canada. 2017. *Stratford, CY [Census subdivision], Ontario and Perth, CTY [Census division], Ontario* (table). *Census Profile*. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E

[4] Environmental Protection Agency (2018) Greenhouse Gas Emissions from Typical Passenger Vehicle. Retrieved from: https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#:~:text=typical%20passenger%20vehicle%3F-,A%20typical%20passenger%20vehicle%20emits%20about%204.6%20metric%20tons%20of,8%2C887%20grams%20of%20CO2.

[5] Environment and Climate Change Canada (2019) Table A9-3: 2017 GHG Emission Summary for Canada, *Canada-National Inventory Report 1990-2017-Part3*, p.7. Retrieved from: http://publications.gc.ca/collections/collection_2019/ecce/En81-4-2017-3-eng.pdf

[6] Statistics Canada. Table 23-10-0051-01 Railway industry length of track operated at the end of the year, by company. Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310005101

Recommendations for future inventories could include purchasing the data of gas sales within Stratford, or if vehicle kilometer information could be collected from residents, this would also offer a more accurate emission count.

The greenhouse gas reduction plan will focus significantly on reduction of transportation emissions, and provide various recommendations on ways to reduce this source of emissions.

Possible recommendations could be to uplift the use of the train and public transit, installing charging stations, supporting carpooling, implementing bike lanes, and creating a more walkable community.

Buildings

Buildings in total create approximately 47% of Stratford's emissions. This sector emitted a total of approximately 130,072 tonnes of CO_2e.
Emissions from buildings were calculated through electricity, natural gas and propane consumption. Most of the emissions from buildings are associated with natural gas consumption.

Potential future recommendations could be to look at partnering with businesses to install solar, or other renewable sources of energy/heat. There is potential to work with homeowners and builders as well, on retrofits or new builds that are low-impact (i.e. Passive House or Net Zero homes), which could be made possible through grants or loans that subsidize retrofits for homeowners.

Manufacturing and Industrial Buildings

The industrial and manufacturing emissions make up about 18% of Stratford's emissions. These emissions are mainly associated with the natural gas consumption for heating the facilities. The manufacturing and industrial sector within Stratford is estimated to have emitted approximately 49,556 tonnes of CO_2e.

Commercial and Institutional Buildings

Commercial and institutional buildings emit approximately 13% of Stratford's total emissions. These include the local shops and school/University/College buildings. The

commercial and institutional sector within Stratford is estimated to have emitted approximately 36,175 tonnes of CO_2e.

Residential Buildings

Homes in Stratford emit approximately 16% of the City's total emissions. This includes propane, natural gas and electricity consumption. The residential sector within Stratford is estimated to have emitted approximately 44,341 tonnes of CO_2e.

Solid waste

Solid waste emissions make up approximately 14% of Stratford's emissions. This was calculated by the tonnes of waste sent to the landfill as well as the amount of landfill gas that is captured through the LFG system. Stratford sent 21,697.92 metric tonnes of waste to the landfill in 2017. The waste sent to the landfill emitted an approximate total of 39,401.75 tonnes of CO_2e in 2017. The Stratford landfill has a partial landfill gas collection system which covers about 50% of the landfill. If Stratford moves forward with the renewable natural gas plan and implementing the green bin program, then waste emissions will be substantially reduced.

Recommendations for reduction could be to look at potential partnerships to implement a green bin program to reduce waste going to the landfill (ie. Moving forward with the renewable natural gas project), or focusing on a zero or low-waste movement, where your community could create challenges to reduce their waste gradually as they move into a Zero Waste lifestyle. An example of this is the Zero-Waste Challenge hosted by Reep Green Solutions in Kitchener-Waterloo, where individuals in the community only fit their waste destined for landfill into a 1L jar.[7]

[7] Reep Green Solutions. (2019) Zero Waste Challenge Waterloo Region. Retrieved from: https://reepgreen.ca/zerowaste/

COMMUNITY GHG EMISSIONS FORECAST

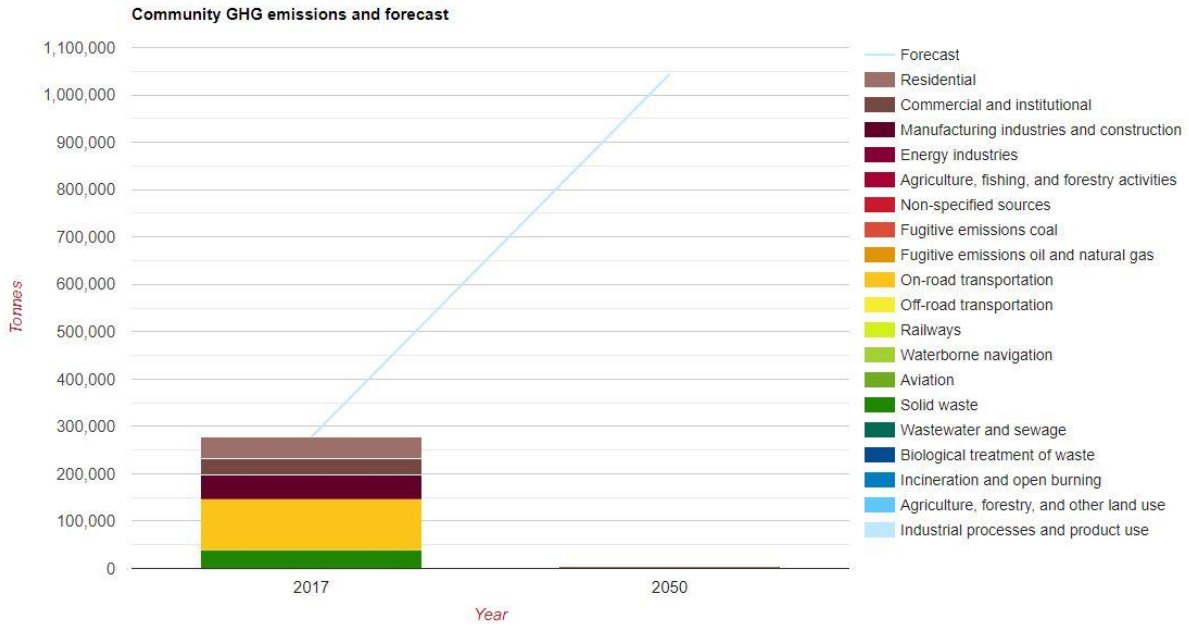

Figure 2 Community GHG Emissions and Forecast

Based on the demographic profile of Stratford, the growth rate per year is about 4.1%[8]. With this growth rate and the emissions from 2017, the increase of emissions if a business-as-usual scenario continues, could reach up to levels nearing 1 million tonnes of CO_2e per year, to a projected total of 1,043,756.57 tonnes of CO_2e. Which is equivalent to about 4,168,147,328.61 kilometers driven by an average passenger vehicle in one year, or about 225,497 vehicles driven for one year[2]

[8] City of Stratford (2014) Demographic Profile. Retrieved from: https://www.stratfordcanada.ca/en/dobusiness/demographicprofile.asp

CLIMATE PROJECTIONS

In the following pages, there are a few climate projections included. In these projections there are 3 coloured lines:

1. *Blue*: RCP 2.6 – Global CO_2 emissions peak by 2020 and decline to zero by 2080[9]
2. *Green*: RCP 4.5 – Global CO_2 peak around mid-century, about 50% higher than 2000 levels, then decline rapidly, then stabilize at half of what 2000's CO_2 levels were.[9]
3. *Red*: RCP 8.5 – Business-as-usual, emissions rise rapidly. By 2100, emissions would stabilize at around 30 gigatonnes of CO_2.[9]

RCP stands for Representative Concentration Pathway, and is the greenhouse gas concentration trajectory. In the year 2000, emissions were at about 8 gigatonnes of CO_2[9]

[9] Furphy, D. (2013) What on earth is an RCP? *Medium.* Retrieved from: https://medium.com/@davidfurphy/what-on-earth-is-an-rcp-bbb206ddee26

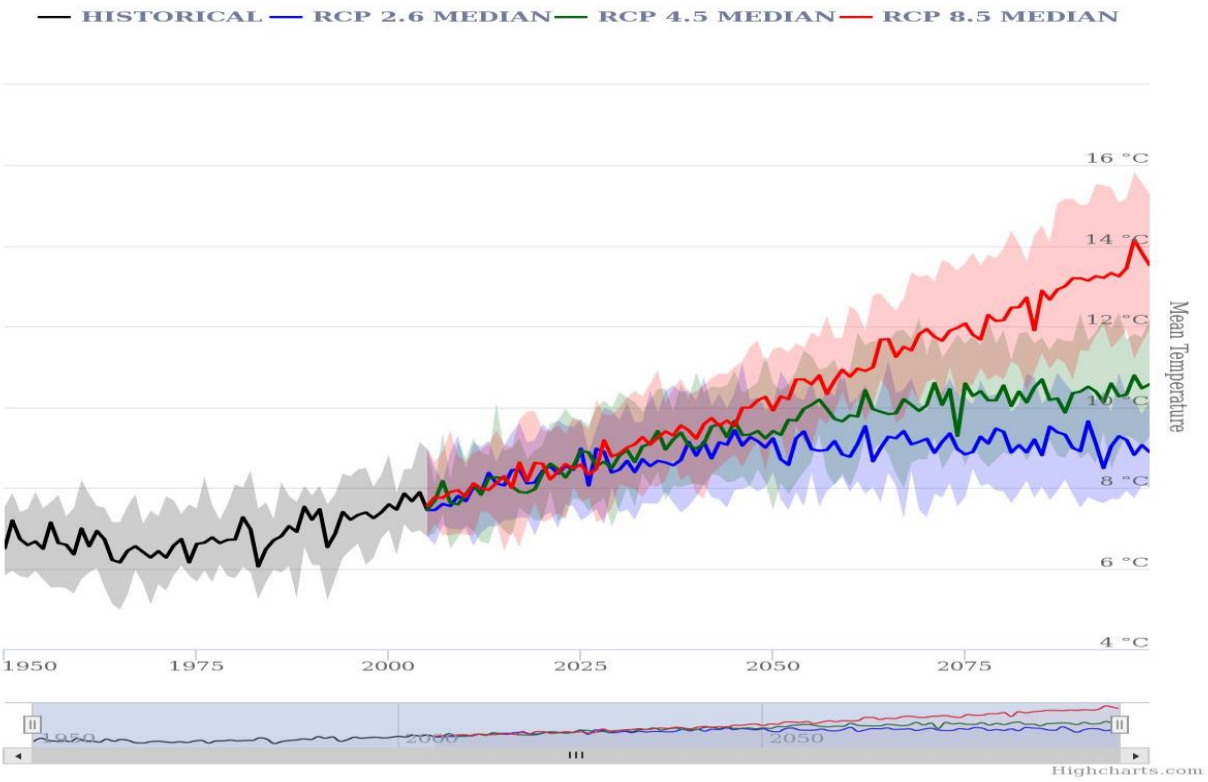

Figure 3 Climate Data (2019) Stratford, ON[10]

Year	Average Yearly Temperature (°C)[10]
1950-2005	6.1-9.3
2006-2020	6.9-9.9
2021-2035	7.7-11.2
2036-2050	8.5-11.7
2051-2065	9.6-12.9
2066-2080	9.9-14.2
2081-2100	11.4-15.6

Having a yearly average temperature as high as 15°C, could mean a similar climate to Greece or Portugal whose yearly average temperatures sit around 15°C.[11]

A yearly average temperature of around 11°C could mean a similar climate to France[11]. Within the past few years, France has seen an incredibly high rate of heat-related deaths, in the summer of 2019 alone, nearly 1,500 people died[12].

[10] Climate Data (2019) Stratford, ON. Retrieved from: https://climatedata.ca/explore/location/?loc=FCTBX
[11] Wikipedia. (2019) List of countries by average yearly temperature. Retrieved from: https://en.wikipedia.org/wiki/List_of_countries_by_average_yearly_temperature
[12] The Guardian. (September 2019) Summer heatwaves in France killed 1,500, says health minister. Retrieved from: https://www.theguardian.com/world/2019/sep/09/summer-heatwaves-in-france-killed-1500-says-health-minister

Cooling Degree Days per Year

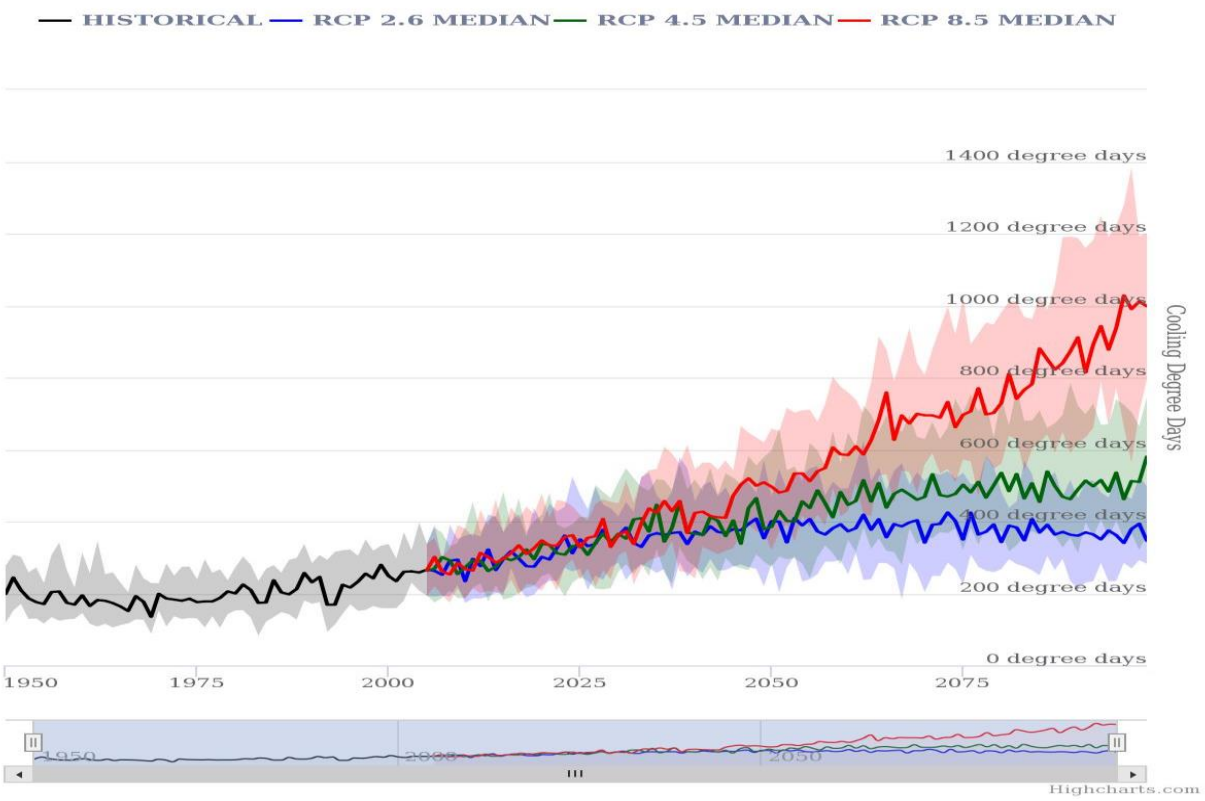

Figure 4 Climate Data (2019) Cooling Degree Days[10]

Year	Cooling Degree Days[10]
1950-2005	216-289
2006-2020	239-502
2021-2035	266-585
2036-2050	330-695
2051-2065	397-910
2066-2080	481-1016
2081-2100	671-1236

When the mean temperature of the day exceeds 18°C, cooling degree days are accrued (if the temperature is 24°C, then 6 cooling degree days are accrued)[10]

This indicates the amount of air conditioning needed to maintain a comfortable temperature in warmer months. An increase in cooling degree days is indicative of longer and more intense summers. This also means an increase in living costs as buildings will need to be air conditioned more often throughout the year.

Number of days over 30°C

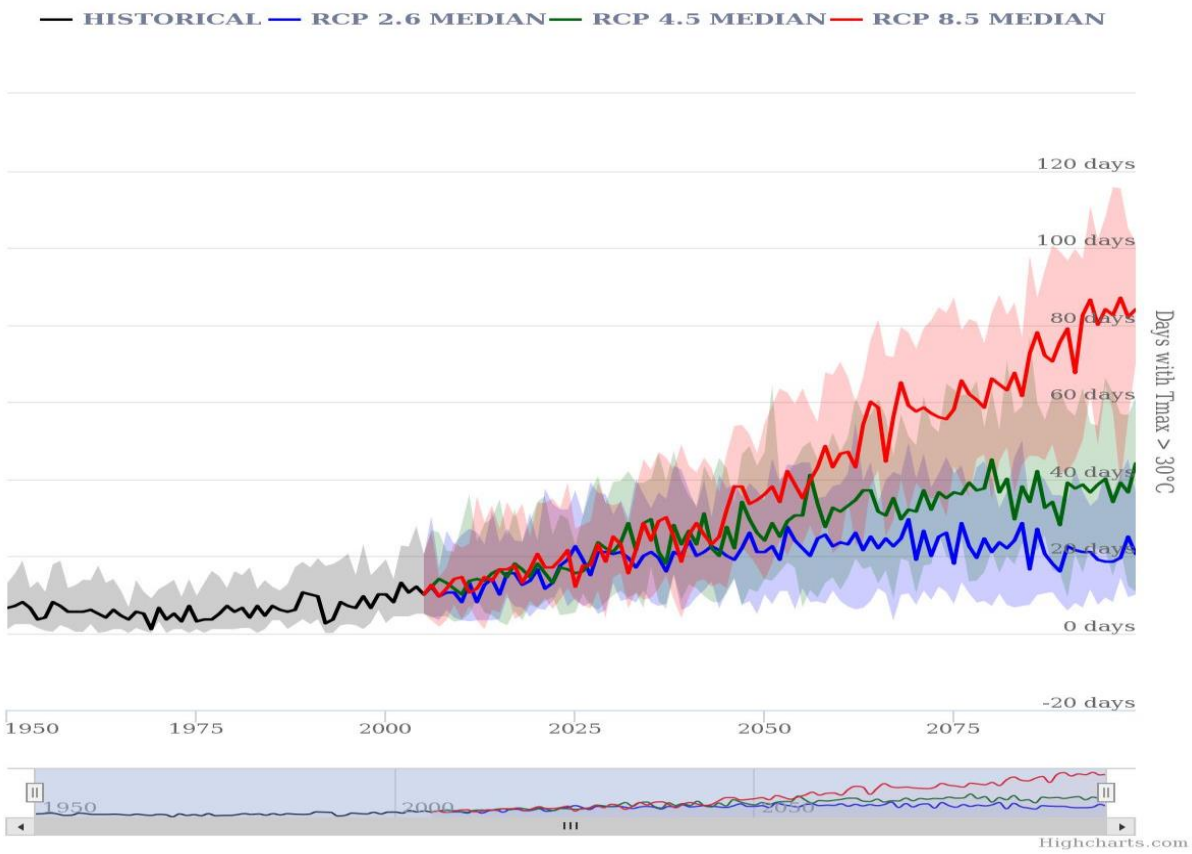

Figure 5 Climate Data (2019) Days over 30 degrees[10]

Year	Days over 30°C[10]
1950-2005	7-11
2006-2020	6-38
2021-2035	10-46
2036-2050	14-56
2051-2065	20-82
2066-2080	27-84
2081-2100	47-103

Days where the minimum temperature does not go below 30°C.[10]

This is an important indicator for health and environmental risks. Temperatures above 30°C can increase the risk of heat exhaustion and heat stroke, particularly in the elderly. Outdoor activities become dangerous to participate in as Canadians are not used to extremely hot summers.[13] The high temperatures will also bring new and unexpected risks with a very different season from the norm.[13]

[13] Climate Atlas (2019) Climate variables. Retrieved from: https://climateatlas.ca/variables

Average Yearly Ice Days

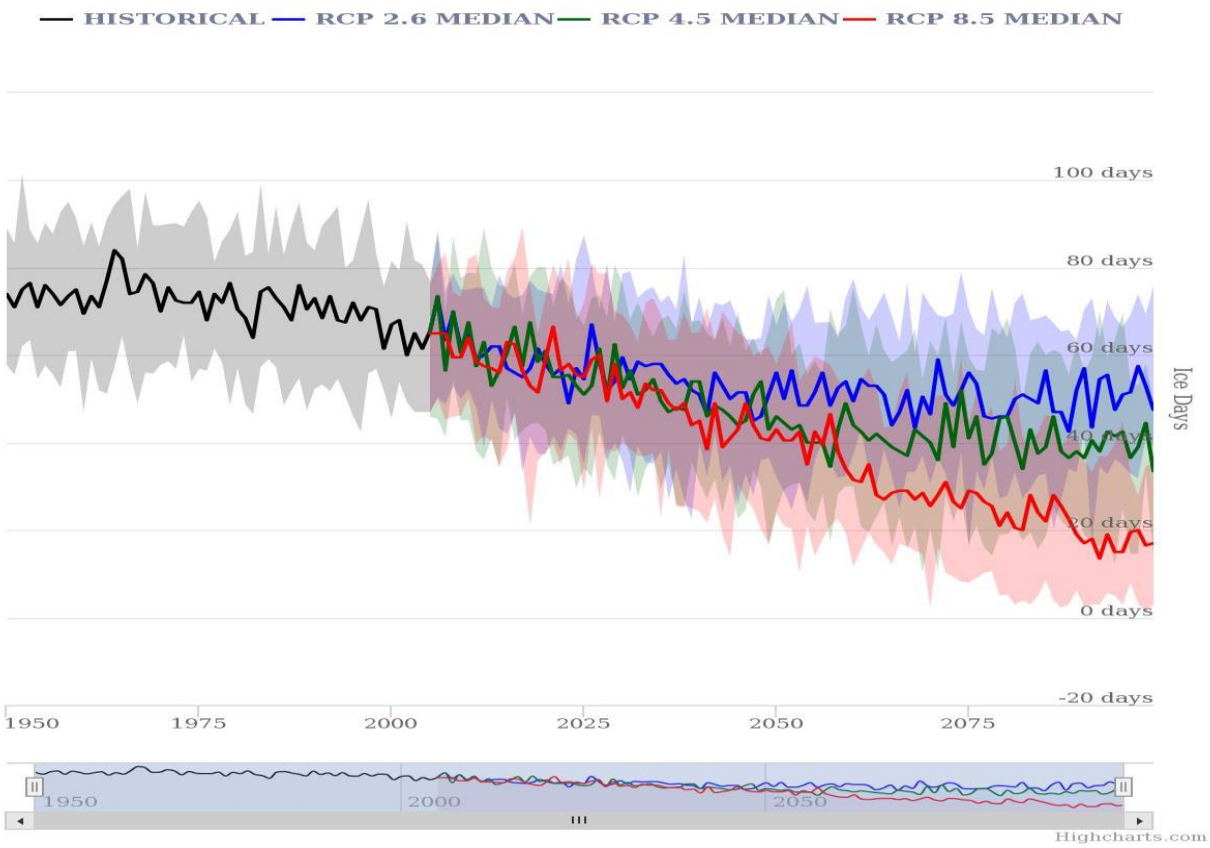

Figure 6 Climate Data (2019) Ice Days[10]

Year	Ice Days[10]
1950-2005	73-62
2006-2020	80-35
2021-2035	77-22
2036-2050	59-20
2051-2065	60-11
2066-2080	51-5
2081-2100	55-3

When the daily max temperature does not exceed 0°C[10].

This is an indication of the length and severity of the winter time. A decrease in frost days means that the growing season in the area will increase. This also means that there is likely going to be an increase in pests and the potential for increased vector-borne diseases becomes higher. Without frost days, pests do not die off and continue to be rampant throughout the year. Less frost days also will limit the types of plants and animals that can survive in the new climate, which means that normal species we see nowadays may not be able to survive in the future climate.