State of Climate Adaptation

City of Nelson

APPENDIX – CLIMATE DATA

July 2020

Photo: Jesse Schpakowski

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City of NELSON

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Contents

This appendix is additional climate data that supports the State of Climate Adaptation for the City of Nelson. Please refer to the full report for more detail.

About the Climate Data

Climate data for the City of Nelson was provided by Climatic Resources Consulting, Inc. and comse from two main modeling sources. Technical information is presented below. Climate projections for the 2050s in this report include two scenarios: low carbon and high carbon. Climate projections for the 2050s indicate the average for the 2041-2070 period. The low carbon scenario (RCP4.5) is considered to be optimistic and, although insufficient to maintain global temperatures to below 2°C warming above pre-industrial temperatures, would require significant international cooperation that exceeds current commitments of signatories to the Paris climate agreement.[1] The high carbon scenario (RCP8.5) is also referred to as 'business as usual'. Global emissions are still moving along a trajectory that could lead to 3 to 5°C of global warming by the end of the century, highlighting the significant gap between the emission reductions pledged by Paris Agreement signatories and the reductions required to meet the 2°C global target.[2] Consequently, it is important to also consider the high global emissions scenario (RCP8.5) in planning for climate change in the Columbia Basin and Boundary regions. Climate trends, i.e. rates of change, are expressed in units per century, meaning the change per 100 years.

Technical Information

Historical climate data was prepared using climate reanalysis ERA5.[3,4] Climate reanalyses combine past observations with models to generate consistent time series of multiple climate variables.[5] They provide a comprehensive description of the observed climate as it has evolved during recent decades, on 3D grids at sub-daily intervals. The estimates are produced for all locations on earth, and they span a long time period that can extend back several decades or more. Adjusted and Homogenized Canadian Climate Data (AHCCD) from Environment Canada provides long-term (since the early 1900s) observed data. For total annual precipitation, data from climate stations in Creston, Kaslo, Castlegar, Fauquier, Warfield and Grand Forks was referenced in addition to ERA5 data. Climate projections are based on output from an ensemble of 12 statistically downscaled Global Climate Model (GCM) projections[6] from the Coupled Model Intercomparison Project Phase 5 (CMIP5),[7] and downscaled using Bias Correction/Constructed Analogues with Quantile mapping recording[8] to a resolution of 10 km by 10 km.

Representative Concentration Pathways (RCPs) are numbered (e.g. RCP8.5 or RCP4.5) according to the radiative forcing in W/m^2 that will result from additional greenhouse gas emissions by the end of the century. Modellers use RCPs to generate scenarios of future climate.

The following plots provide further insights on historic and projected climate for the City of Nelson. Seasons are defined as follows:

- Spring = March, April, May
- Summer = June, July, August
- Fall = September, October, November
- Winter = December, January, February

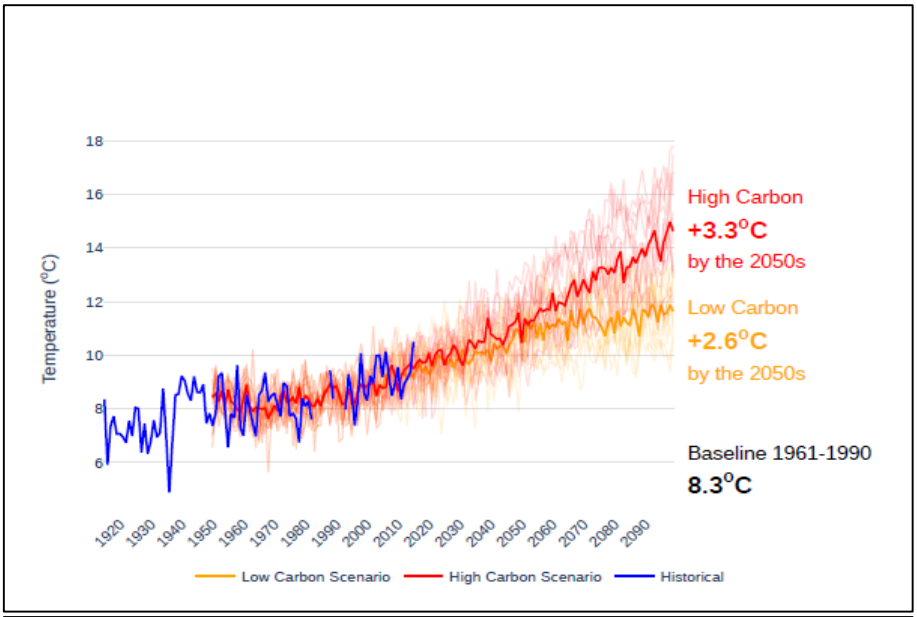

Figure A-1: Historic and projected average annual temperature

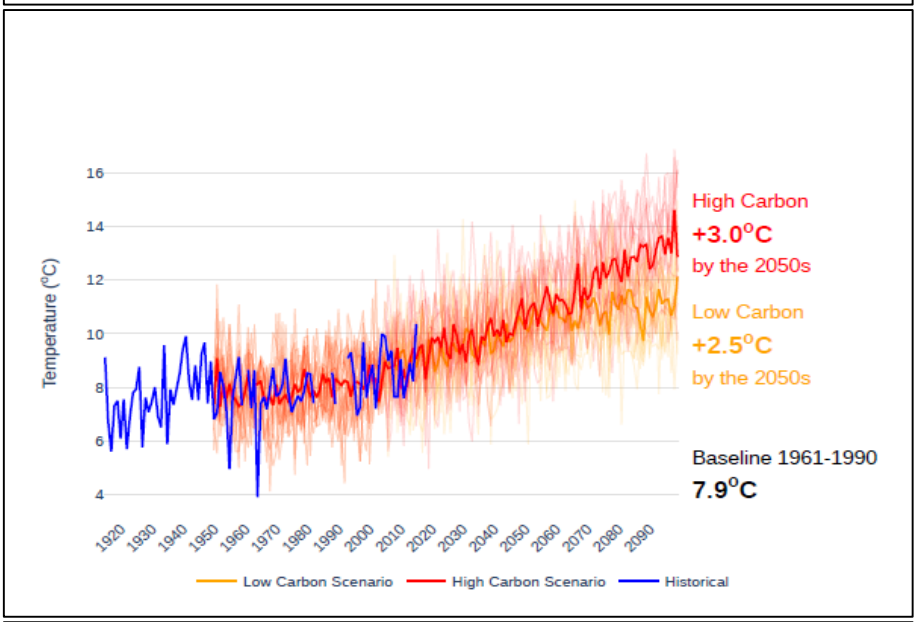

Figure A-2: Historic and projected average spring temperature

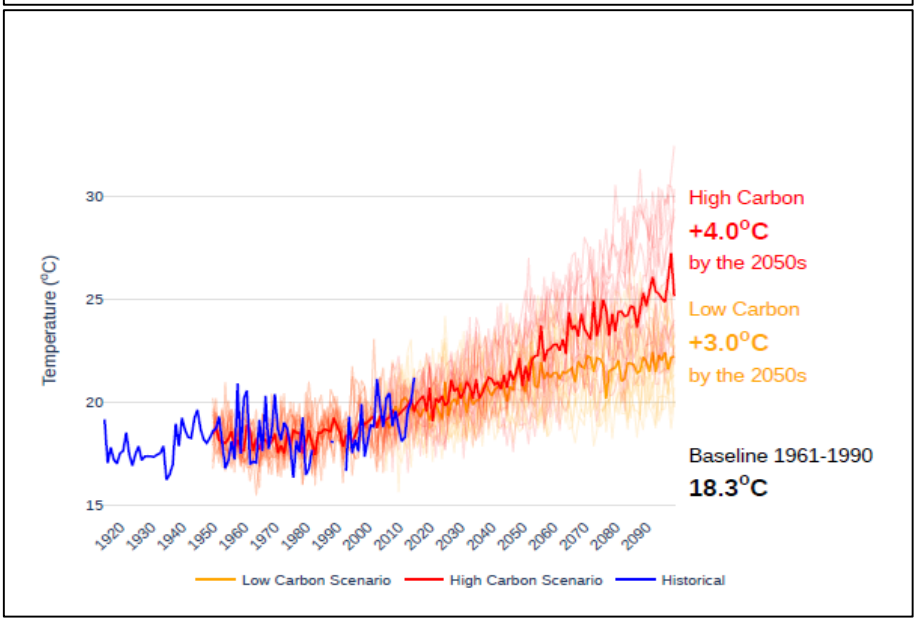

Figure A-3: Historic and projected average summer temperature

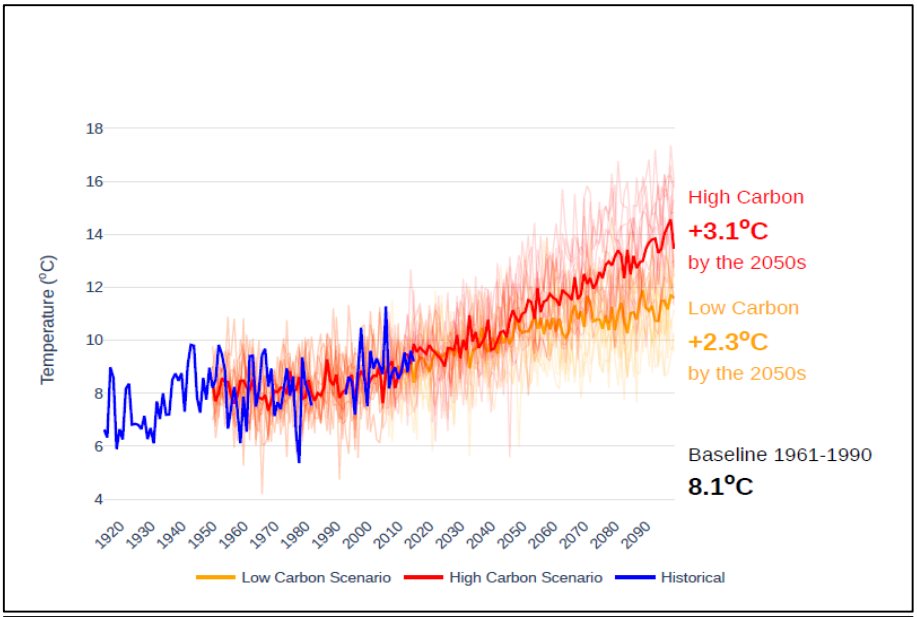

Figure A-4: Historic and projected average fall temperature

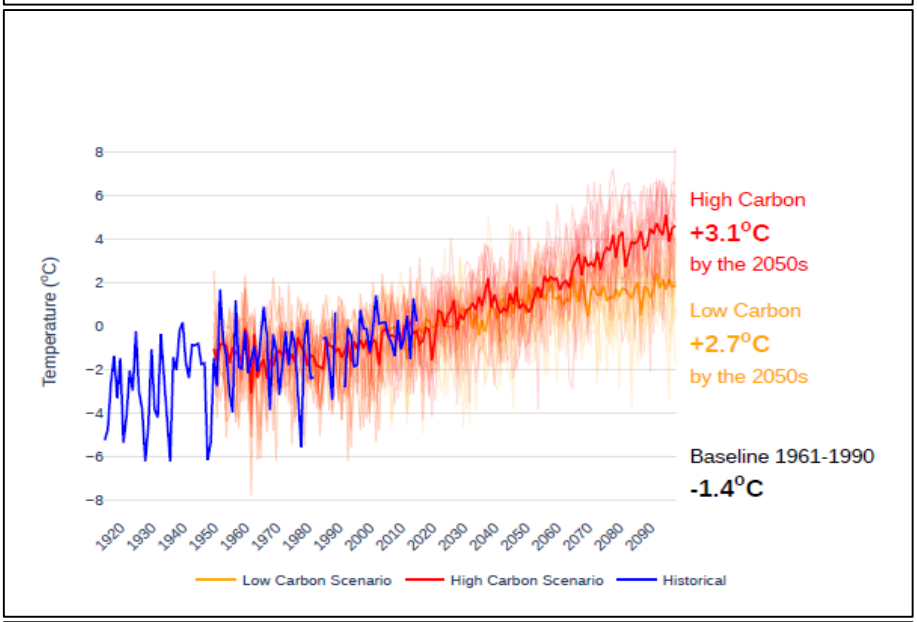

Figure A-5: Historic and projected average winter temperature

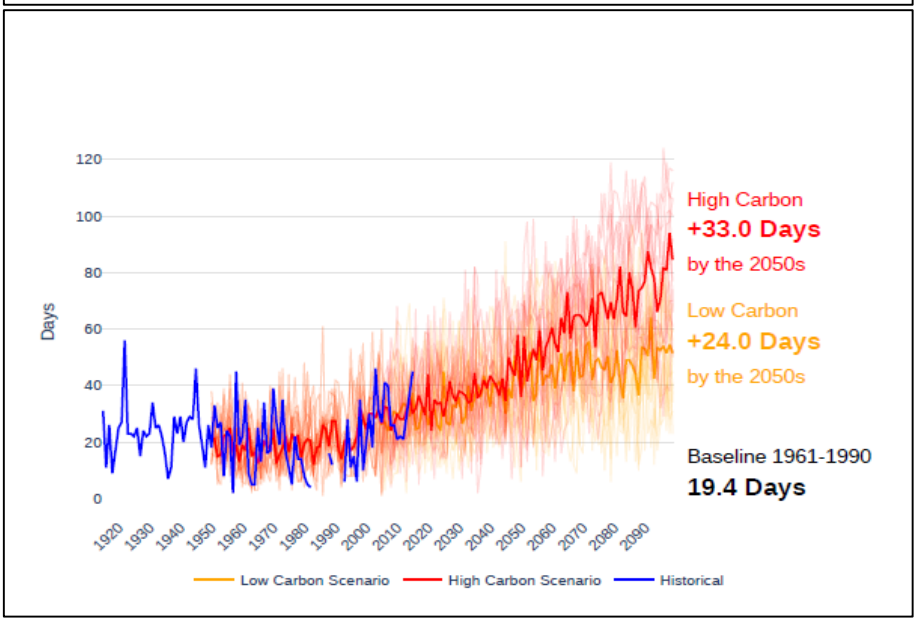

Figure A-6: Historic and projected annual number of days over 30 °C

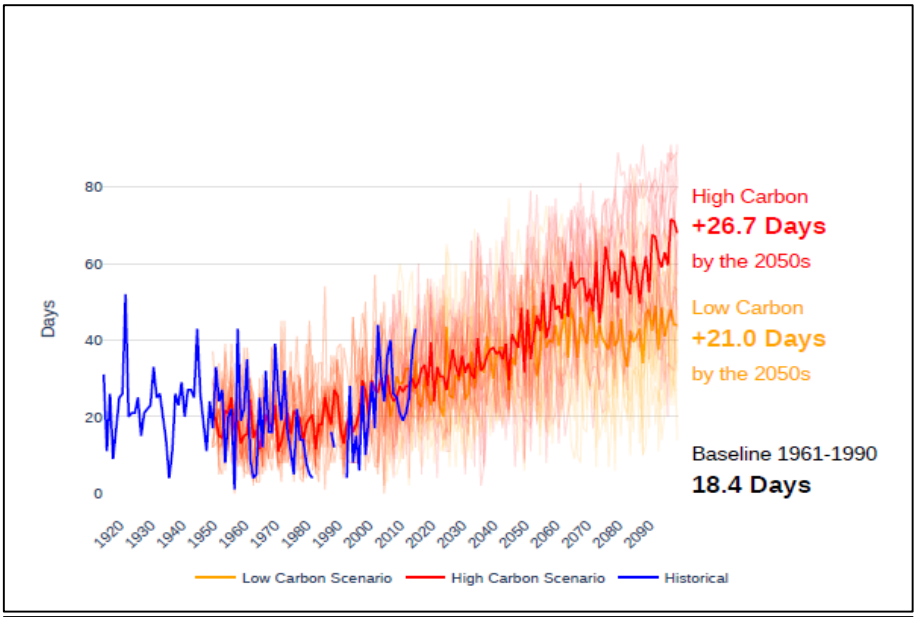

Figure A-7: Historic and projected number of summer days over 30° C

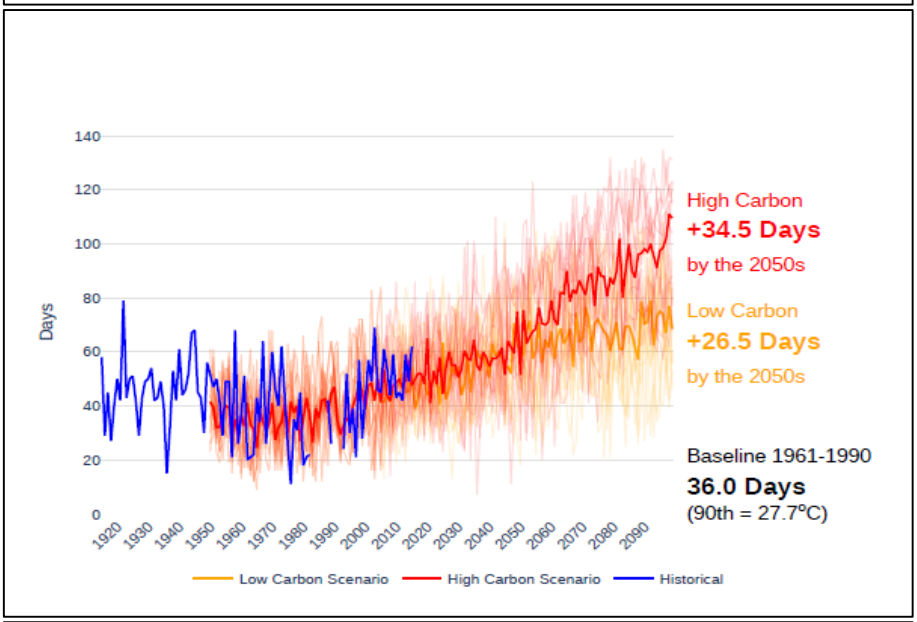

Figure A-8: Historic and projected annual number of days with maximum temperature over 90th percentile in the 1961-1990 period

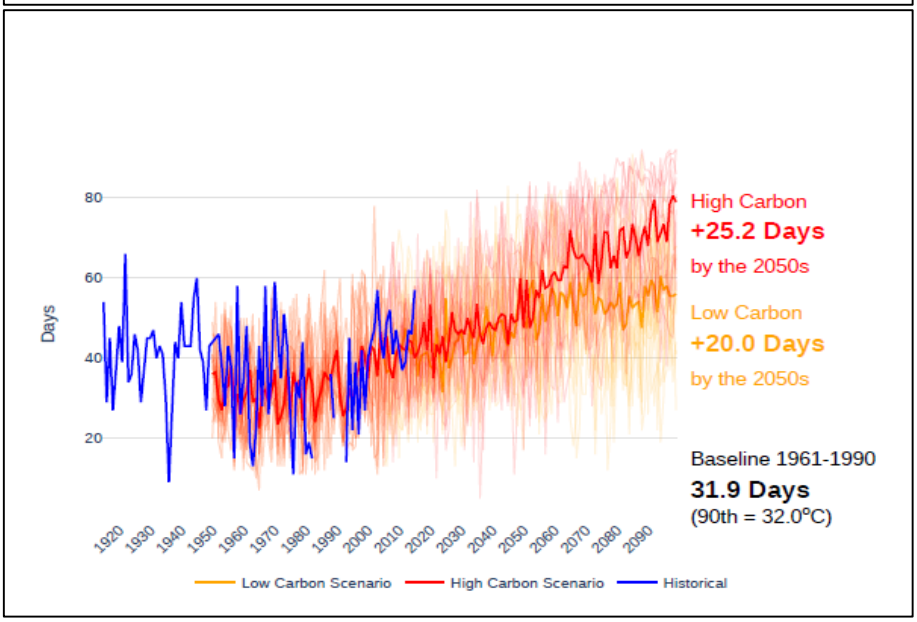

Figure A-9: Historic and projected number of summer days with maximum temperature over 90th percentile in the 961-1990 period

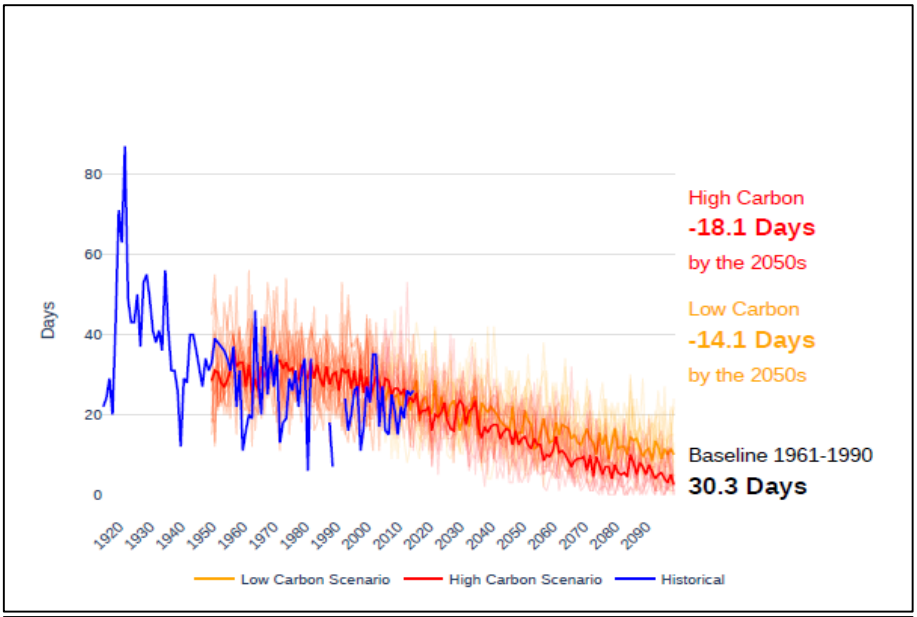

Figure A-10: Historic and projected annual number of daily freeze-thaw cycles

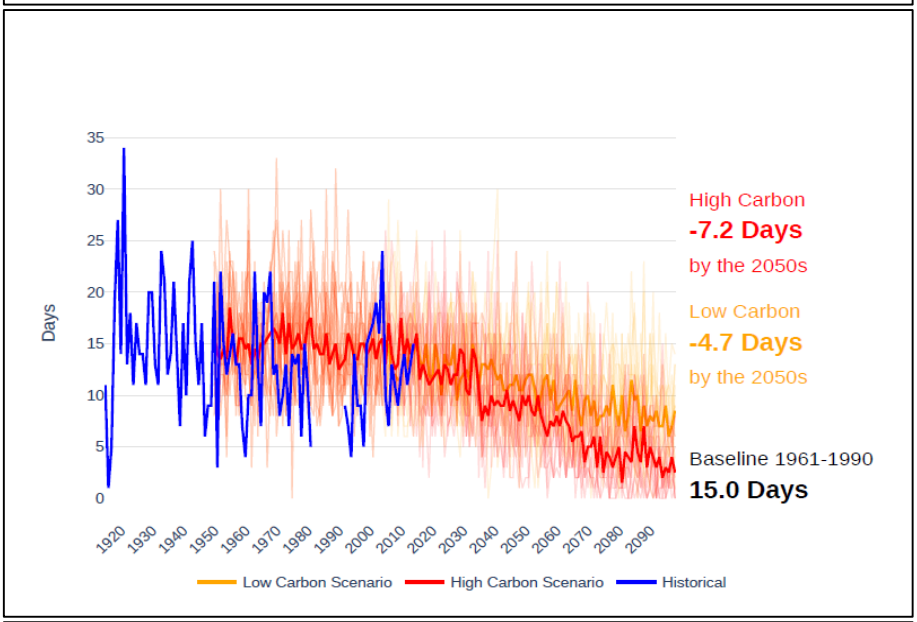

Figure A-11: Historic and projected number of daily freeze-thaw cycles in winter

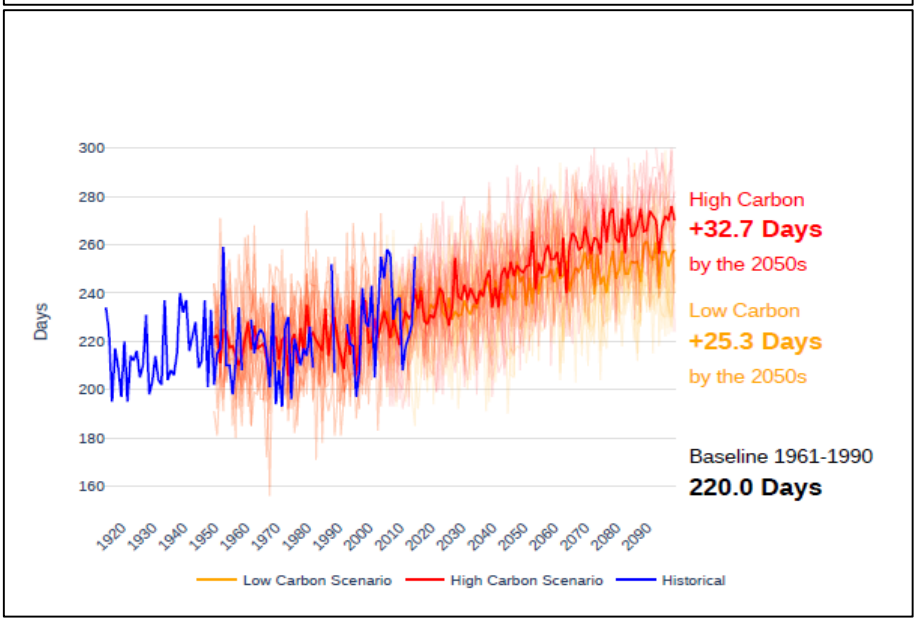

Figure A-12: Historic and projected growing season length

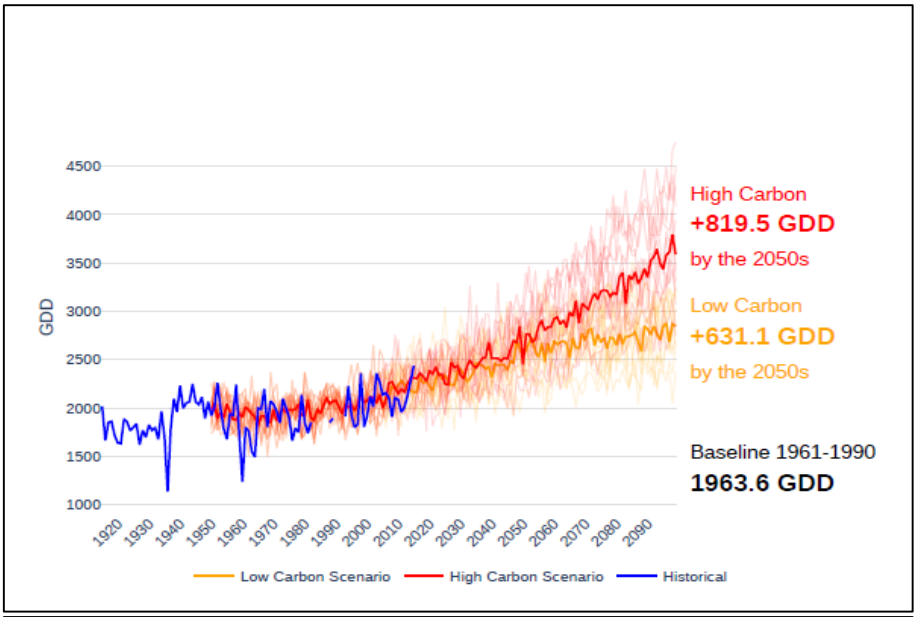

Figure A-13: Historic and projected growing degree days

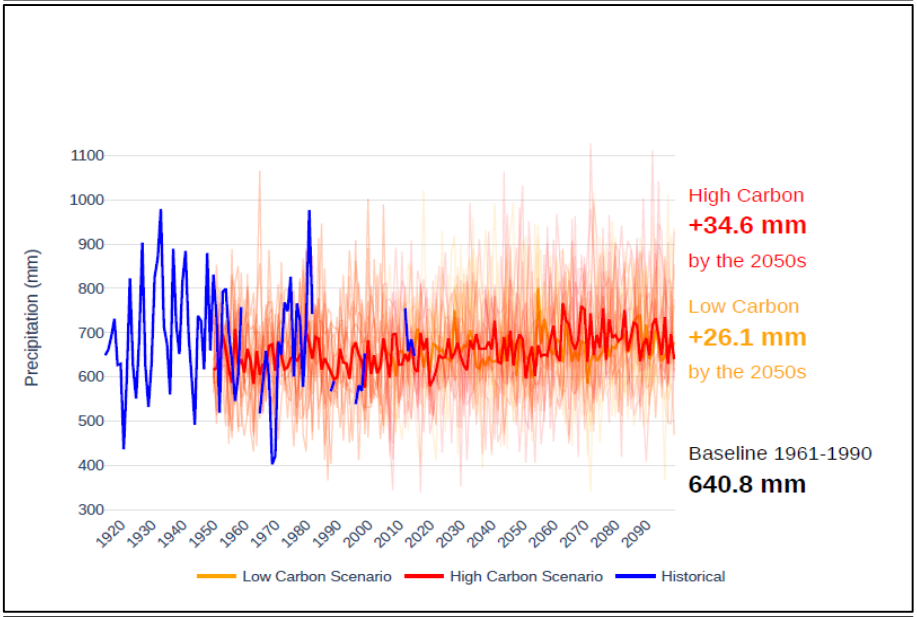

Figure A-14: Historic and projected total annual precipitation

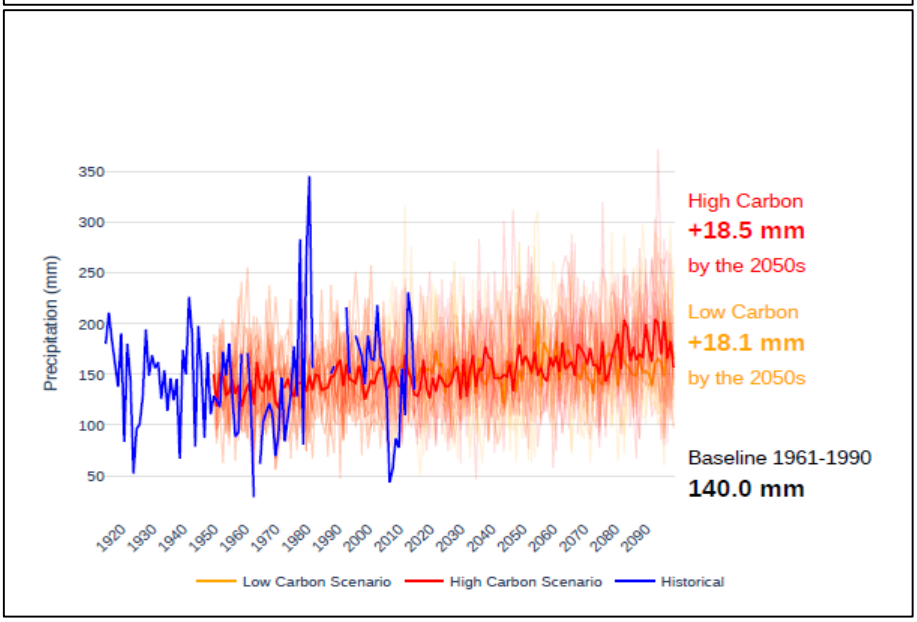

Figure A-15: Historic and projected total spring precipitation

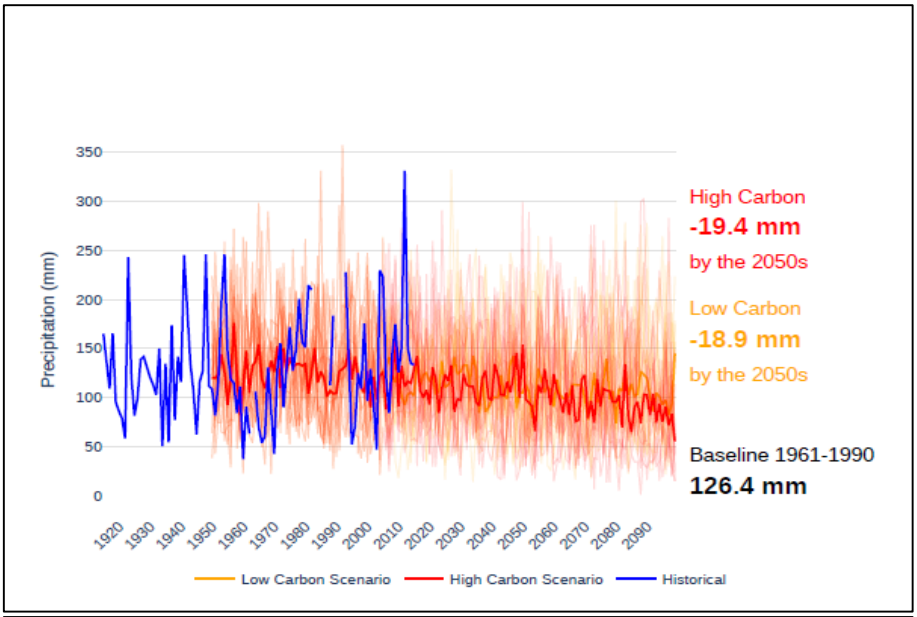

Figure A-16: Historic and projected total summer precipitation

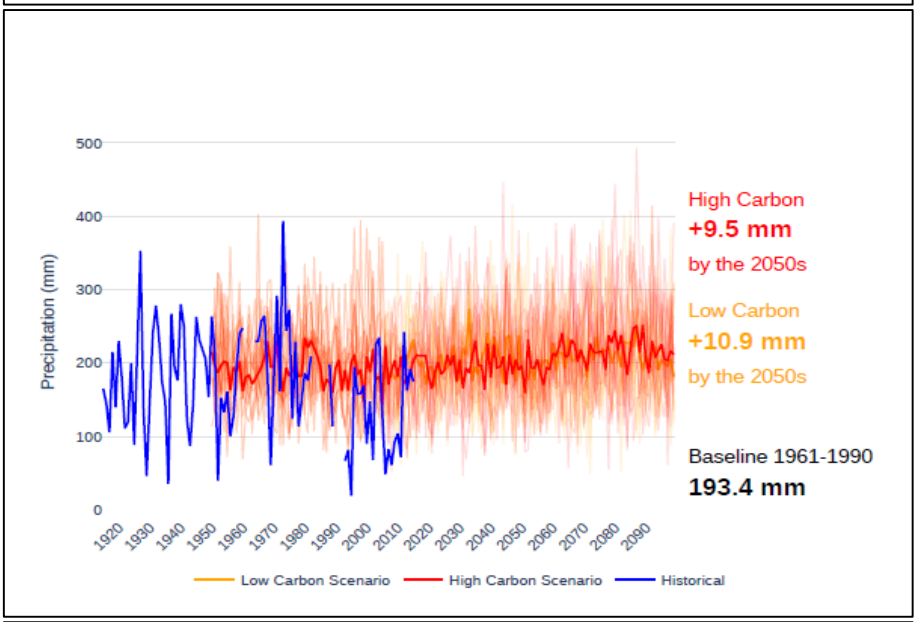

Figure A-17: Historic and projected total fall precipitation

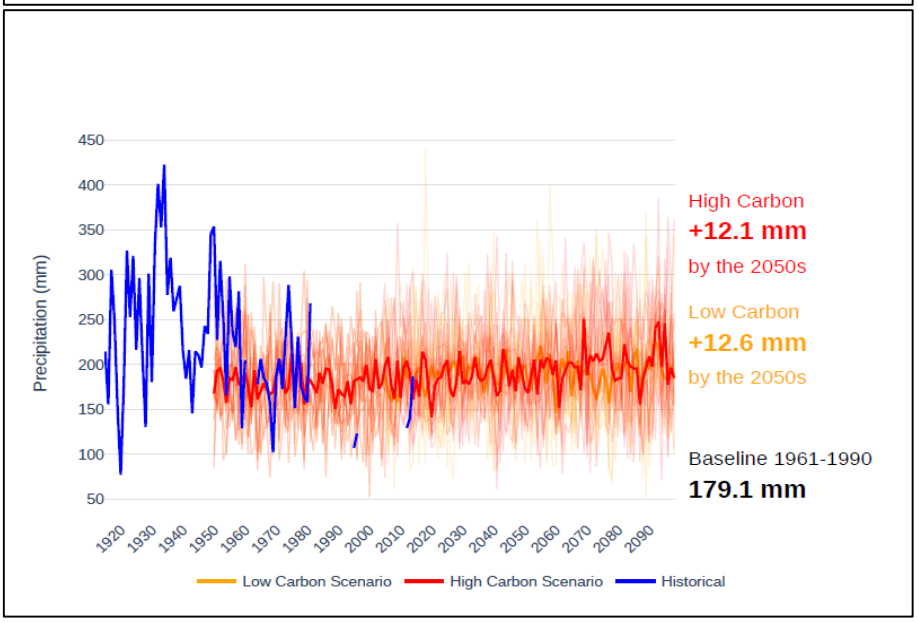

Figure A-18: Historic and projected total winter precipitation

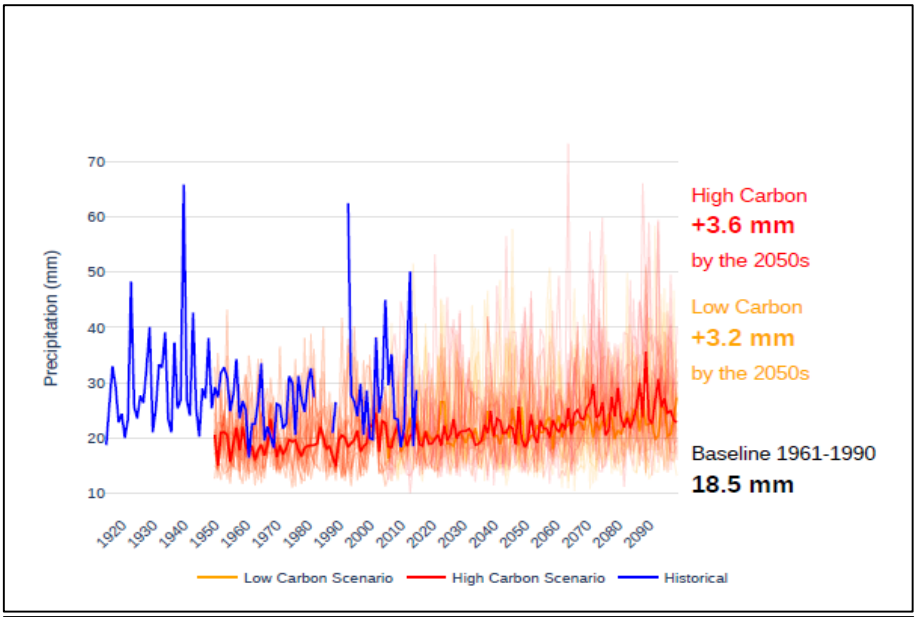

Figure A-19: Historic and projected maximum 1-day precipitation

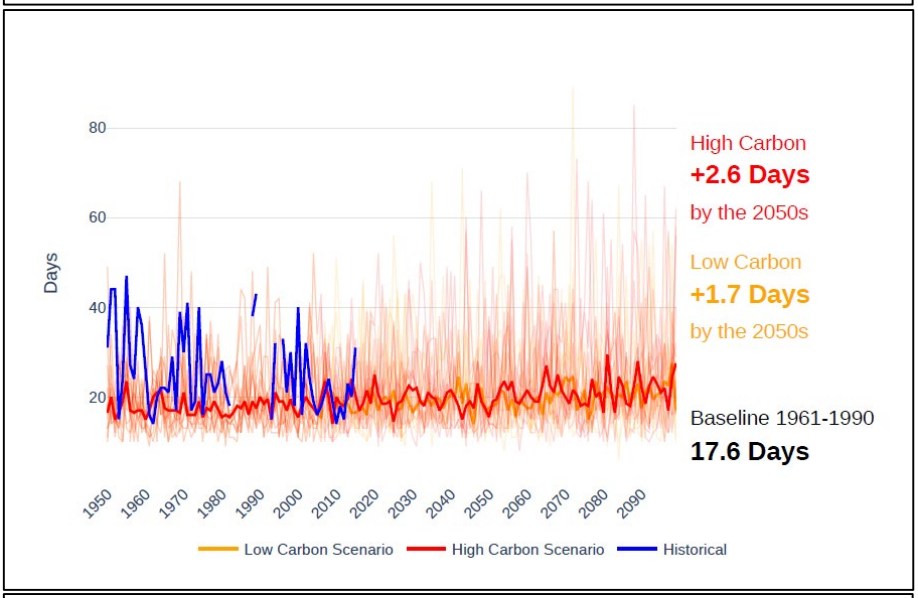

Figure A-20: Historic and projected maximum dry spell length

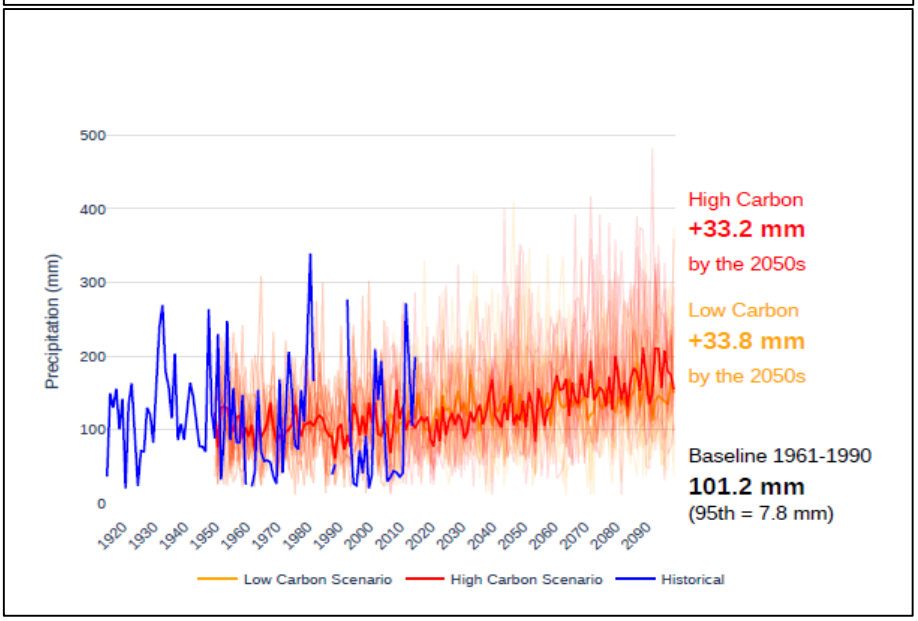

Figure A-21: Historic and projected annual precipitation above the 95th percentile in the 1961-1990 period

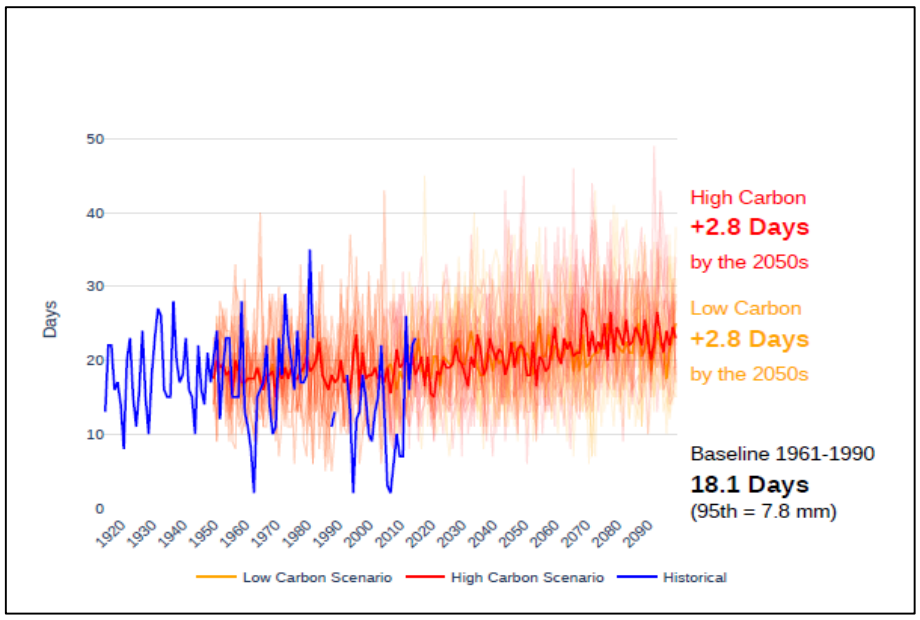

Figure A-22: Historic and projected number of days of precipitation above the 95th percentile in the 1961-1990 period

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[1] United Nations Framework Convention on Climate Change. (2019). *The Paris Agreement*. Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[2] Knutti, R., Rogelj, J., Sedláček, J. et al. (2016). A scientific critique of the two-degree climate change target. *Nature Geoscience, 9*, 13–18. doi:10.1038/ngeo2595

[3] European Centre for Mid-range Weather Forecasts (ECMWF). *ERA5 data documentation*. Retrieved from https://confluence.ecmwf.int/display/CKB/ERA5+data+documentation#ERA5datadocumentation-Introduction

[4] Copernicus Climate Change Service (C3S). (2017). *ERA5: Fifth generation of ECMWF atmospheric reanalyses of the global climate*. Copernicus Climate Change Service Climate Data Store (CDS), Accessed August 2019. https://cds.climate.copernicus.eu/cdsapp#!/home

[5] Climate Change Service. (n.d.). *Climate reanalysis*. Retrieved from https://climate.copernicus.eu/climate-reanalysis

[6] Pacific Climate Impacts Consortium. (n.d.). *Statistically downscaled GCM scenarios - BCCAQv2*. Retrieved from https://data.pacificclimate.org/portal/downscaled_gcms/map/

[7] Taylor, K.E., Stouffer, R.J., and Meehl, G.A. (2012). An overview of CMIP5 and the experiment design. *Bulletin of the American Meteorological Society, 93*, 485–498. doi:10.1175/BAMS-D-11-00094.1

[8] Werner, A.T. and Cannon, A. J. (2016) Hydrologic extremes – an intercomparison of multiple gridded statistical downscaling methods. *Hydrololgy and Earth System Sciences, 20*, 1483-1508. doi:10.5194/hess-20-1483-2016