Climate Projections

for the Okanagan Region

February 2020

REGIONAL DISTRICT NORTH OKANAGAN

Regional District of Central Okanagan

REGIONAL DISTRICT RDOS OKANAGAN-SIMILKAMEEN

Pinna Sustainability

In partnership with

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Okanagan Basin WATER BOARD

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Acknowledgements

This work offers climate projections for the Okanagan region, which is located within the Traditional Territories of the Syilx Okanagan Nation and the Splatsin Band of the Shuswap Nation. This report is a collaboration between the Regional District of North Okanagan (RDNO), the Regional District of Central Okanagan (RDCO), and the Regional District of Okanagan-Similkameen (RDOS) that would not have been made possible without the participation of nearly 90 stakeholders from across the region, the support of Trevor Murdock, Steve Sobie, and Kari Tyler from the Pacific Climate Impacts Consortium in providing climate data and interpretation, and Gillian Aubie Vines, who served as the project facilitator and lead writer for this project.

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Executive Summary

Climate change is challenging ecosystems, communities, and the economy. Wildfires, flooding, and drought have already overwhelmed local infrastructure, caused economic losses, and posed health risks to communities. Significant effort to reduce the reliance on fossil fuels as quickly as possible will slow, and has the potential to curb, climate change by the late century, making greenhouse gas emissions reductions a central part of any long-term adaptation strategy.[1]

Designing to current and future climate parameters is markedly more cost effective than reacting to climate shocks and stresses over time. This report is intended to support a local understanding of how climate across the Okanagan is projected to change, and inform regional planning on how to prepare for future climate events. This work is critical to maintaining wellbeing, including robust ecosystems, a thriving community, and a vibrant economy. Early efforts to prepare infrastructure and communities to climate change will reduce regional reliance on continued emergency management activations and support the ability of the region to thrive over time.

> **Summers are getting hotter. By the later part of the century, the valley bottoms, where the majority of the population lives, can expect on average, almost triple the number of days with temperatures at or over 30°C as in the past.**

This report offers climate projections for both the 2050s and the 2080s. The 2050s projections are useful for medium-term planning purposes, while the 2080s provide guidance for long-term planning and decision-making. Findings indicate that the Okanagan can expect significant changes to climate in the coming decades, including:

- **Warmer temperatures year-round.** Temperatures will increase year-round. Summer and autumn daytime highs are increasing more rapidly than in other seasons. This will result in **longer warm seasons, and shorter cold seasons over time.**
- **Summers will be considerably hotter.** In the past, the Okanagan region as a whole experienced 6 days per year, on average, above 30°C. By the 2050s, the region can expect an average of 22 days above 30°C per year and 36 days per year by the 2080s. This change is more pronounced in the valley bottoms, with approximately 50 additional days above 30°C by the 2080s, on average, compared to the past. Temperatures can be expected to surpass 43°C on an annual basis in the populated areas of the Okanagan region by the end of the century. **These indicators of warming mark a considerable change**, and could lead to **significant human and ecosystem health impacts**.
- **Increased duration of growing season.** Across the Okanagan, growing season length is projected to increase from about 5.5 months to almost 7 months by the 2050s, and almost 8 months by the 2080s. While this longer season **may bring opportunities for new crops,** water management, weather variability, and extreme events **may reduce the productivity of the agricultural sector.**
- **Warmer winter temperatures.** Temperatures on the coldest nights are projected to rise in all seasons across the Okanagan. Winter nighttime low temperatures are projected to warm more than other seasons. By the 2050s, there will be 28% fewer frost days, which will have **implications for invasive species, agriculture, and streamflow.**
- **Increased precipitation across all seasons except summer.** Precipitation will increase during the spring and autumn months where, on average, the region can expect 17% more rainfall during these seasons by the 2080s. This can lead to **more frequent flooding and landslides,** as well as **stress to ecosystems and infrastructure.**

[1] Summary for Policymakers of IPCC Special Report on Global Warming of 1.5ºC approved by governments.

- **Summer is expected to remain the driest season, and become drier.** By the 2080s, the region can expect 23% less precipitation in the summer. Decreases in precipitation plus hotter temperatures (and thus increased evaporation) mean **drier, hotter summers, posing increased risk of wildfires and associated health impacts.**
- **Shifting seasons.** With warmer annual temperatures, the winter "season" is expected to shorten while the summer "season" will lengthen, causing spring-like conditions earlier and autumn-like conditions later in the year. Projections illustrate that **January temperatures of the future will feel like March temperatures of the past,** and future **May temperatures will be similar to August temperatures of the past.**

Climate change will cause significant changes in the region. Based on these changes, there is a need to plan for more intense and hotter fires, increasing water shortages, more smoke days, and a greater likelihood of spring flooding. These changes will have serious consequences on ecosystems, communities, and the economy.

The intent of this report is to enable community leaders and local decision makers to explore how to prepare the Okanagan for the interrelated impacts facing the region. This work provides detailed projections for temperature and precipitation for each participating Regional District, which help predict possible future instances of extreme weather events, such as wildfires, drought, and flooding. This report builds on these projections by offering preliminary insights into the impacts these projections will have on the region.

This document is intended to be used as a tool to support climate-informed planning and decision-making, and a thriving Okanagan over time. **This is a call to action for leaders across the Okanagan to work together and prepare for the changes ahead.**

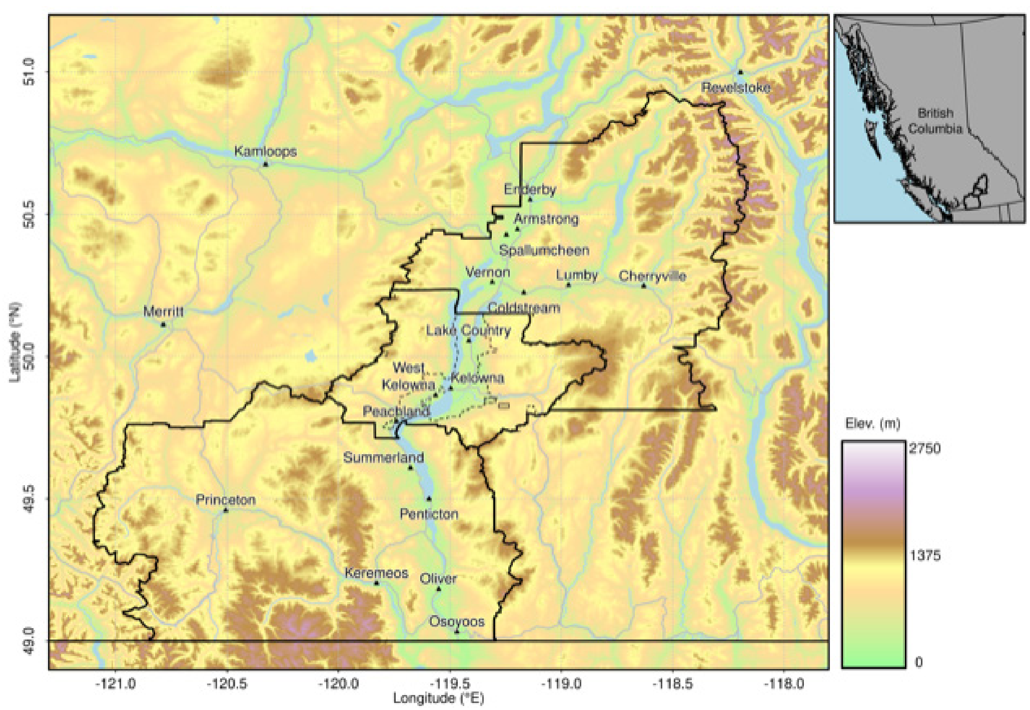
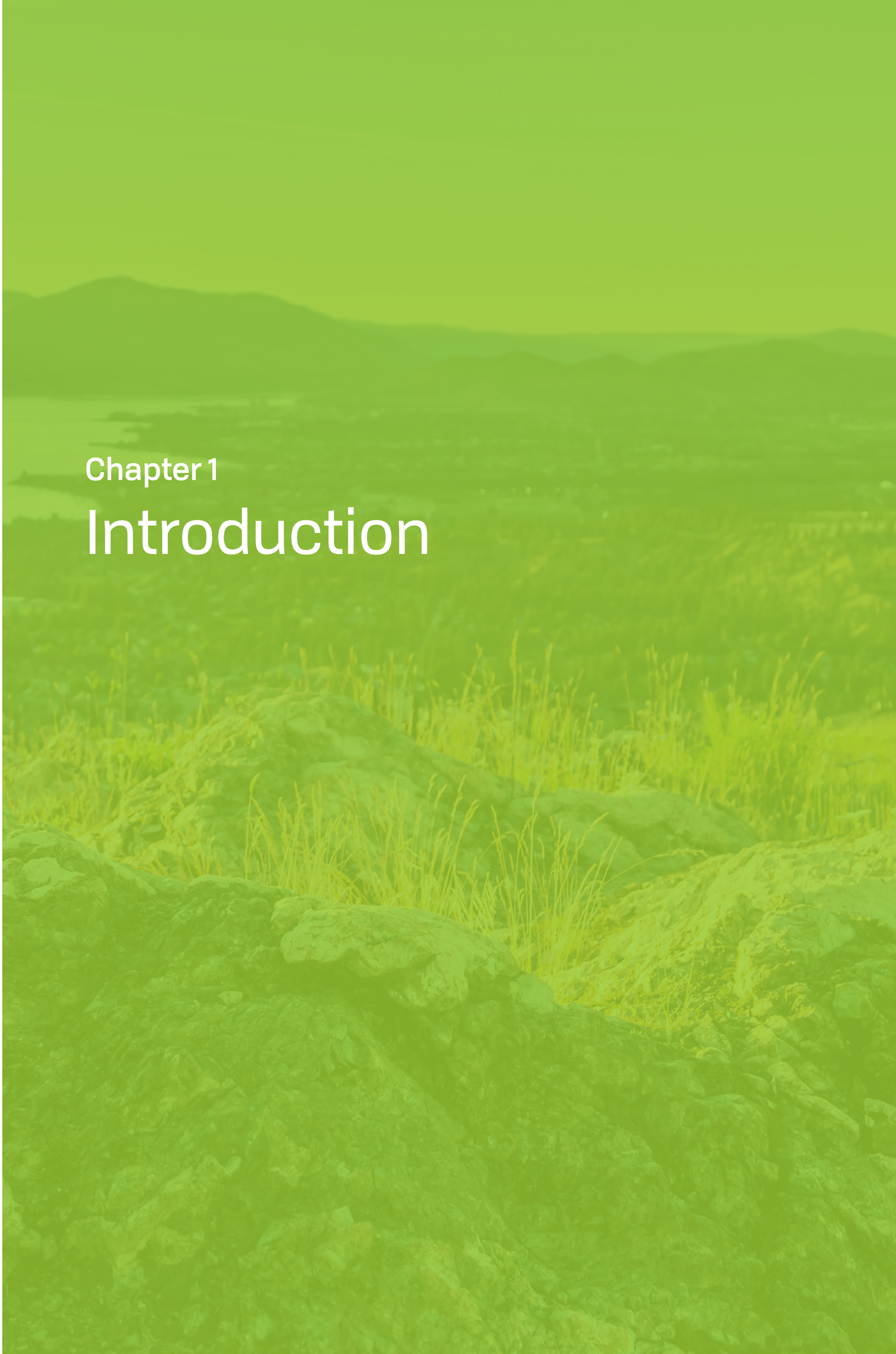


FIGURE E-1: STUDY AREA



Chapter 1

Introduction

Chapter 1

Introduction

Climate change is having an impact on industry, ecosystems, and communities across the Okanagan. Wildfires, drought, and flooding already challenge local infrastructure and pose health risks to communities. The three regional districts in the Okanagan Basin (North Okanagan, Central Okanagan, and Okanagan-Similkameen) have worked together to understand how climate change will affect the region over time, and this report is intended to raise awareness and assist communities in preparing and planning for the future.

The purpose of this report is to offer science-based information on how the Okanagan's climate is changing and expected to change over the 21st century. In the report, projections for the 2050s illustrate the likely trajectory of climate change regardless of global emissions reductions, and projections for the 2080s illustrate a future climate scenario, assuming little progress by late century on a global shift away from a fossil fuel–based economy.

This report is intended to inform community-level planning and decision-making, and to provide a starting point for conversations on the impacts of climate change. Through regional collaboration, and with thoughtful planning and investment, communities will be prepared for future climate and climate events, and will avoid excessively stressing emergency management systems, personnel, and infrastructure. While offering science-based projections, this report is not intended to offer a prediction of specific impacts or serve directly as design guidelines for future planning; however, it can support local exploration of climate impacts, and provide the basis to inform the development of organizational and regional climate action plans.

How Much Will the Climate Change?

The extent of how much the climate changes over time depends directly on how well the global community is able to reduce greenhouse gas (GHG) emissions in the near term. While various future trajectories of GHG emissions are possible, this report presents projections for a high GHG emissions scenario for the remainder of this century, known as Representative Concentration Pathway 8.5 (RCP8.5: red line in Figure 1 below). This represents minimal emissions reductions, without significant global cooperation and investment in reducing GHG emissions, and is the most commonly used scenario for planning in BC, in Canada, and globally. The RCP4.5 "medium stabilization" scenario (yellow line) represents mitigation efforts that result in about half of the emissions compared to the RCP8.5 scenario. To achieve RCP2.6 (blue line), the only pathway that would keep global warming below 2.0°C above pre-industrial temperatures, substantial and sustained reductions in GHG emissions are required—for example, extensive adoption of biofuels and vegetarianism, electrification of energy and transportation systems, along with carbon capture and storage.

The three RCP scenarios described above have somewhat similar GHG concentrations in the 2050s, with a moderate change in temperature and precipitation. The scenarios diverge considerably by the 2080s, resulting in considerable differences in climate by the end of the century. This illustrates the importance of **aggressive mitigation as a primary adaptation strategy.**

Additional information on climate scenario and model selection, and indicator derivation and interpretation can be found in Appendix 1 – Methodology.

It is important to note that climate change will not always result in consistent changes in weather across the region or over time. Annual and seasonal variations in temperature and precipitation will continue to occur (as shown by the red lines in Figure 2 below) resulting in unusual weather and more extreme events. Also, local differences will continue to influence microclimates in specific locations within the Okanagan. In light of this, planners and managers will need to prepare for a range of changes and for variability across seasons and from year to year.

Shifting Seasons

With temperatures warming, the winter "season" is expected to shorten over time, and the summer "season" to lengthen, causing spring-like conditions to occur earlier in the year, and autumn-like conditions to occur later. The box-and-whisker plots of monthly daytime high and nighttime low temperatures, provided in the Additional Indicators Appendix, offer a comparison of the range of year-to-year variability in the future to that experienced in the past, and illustrate these seasonal shifts over time. These plots indicate that: **January temperatures of the future will feel like March temperatures of the past and future May temperatures will be similar to August temperatures of the past.**

A Note on Data Interpretation

Data in the report is broken into the Okanagan region (representing RDNO, RDCO, and RDOS combined), and into each of the three Regional Districts. Within each Regional District, data is further broken into "the whole Region" (representing the entire boundary of the Regional District), and "valley bottoms" (representing the populated areas). The whole region averages are not identical to the average for the three Regional District values in tables because all of the regional averages are area averages and the three regional districts are not the same area as each other.

Results in the report are given by season, in some cases. Winter is defined as December, January, and February [DJF], spring represents March, April, and May [MAM], summer represents June, July, and August [JJA], and autumn represents September, October, and November [SON].

In the tables, "Past" refers to the historical baseline period of 1971–2000, which is a World Meteorological Organization standard time period most commonly used for climate projections in BC. Values are based on historical records and are averaged over this 30-year period to smooth out annual variability, and, as such, do not include a range.

Future projections are for the 2050s (which is an average of modelled values over the 2041–2070 time period) and 2080s (2071–2100 time period). The range for each is provided to help readers understand the variability of projections, and is based on 12 individual climate simulations.

Future projections for the 2050s and 2080s are often given as change from the past. **Changes are not new total values.** To determine the new total value, the past baseline value must be added to (or multiplied by, in the case of percent changes) the projected change. This is because the (relative) change is similar across all geographies, but the baseline values are often very different, depending, for example, on latitude, elevation, and local topography. Total values would only apply to one geographic point, while the change allows comparison of the projections across various locations.

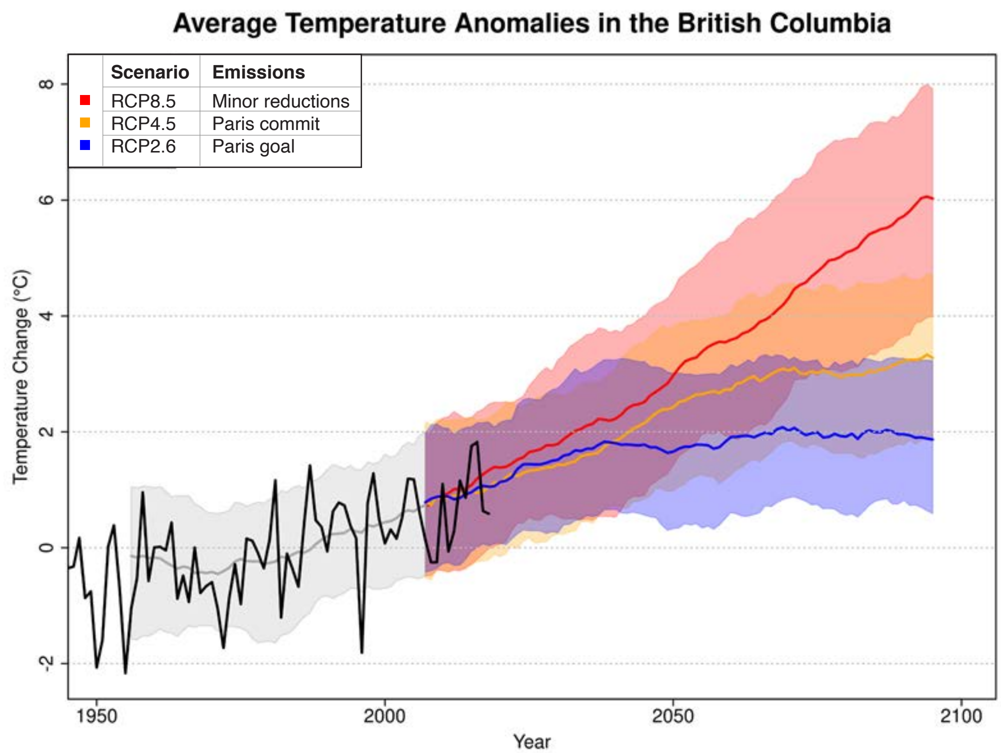


FIGURE 1: FUTURE TEMPERATURE BY EMISSIONS SCENARIO FOR BC

This plot shows the average annual temperature for BC. All values are shown as differences from the 1971-2000 historical baseline. The black line is historical observations from the Provincial Climate Data Set (PCDS - https://www.pacificclimate.org/data/bc-station-data). The rest of the lines and ranges on the figure are a set of 12 downscaled climate model simulations (https://www.pacificclimate.org/data/statistically-downscaled-climate-scenarios). Each of the lines are the average of the 12 simulations and the ranges are the 10th and 90th percentiles. The red line, RCP8.5, is a high GHG emissions scenario that begins minor reductions towards the end of the century. The blue line, RCP2.6, is an extremely low emissions scenario, roughly consistent the Paris Agreement aspirational goal of 1.5°C warming above a pre-industrial baseline globally. RCP4.5 is a scenario that represents considerable emissions reductions and is roughly consistent with the international commitments made at the Paris Agreement meeting, and represents warming roughly in line with 2.0°C warming above a pre-industrial baseline globally.

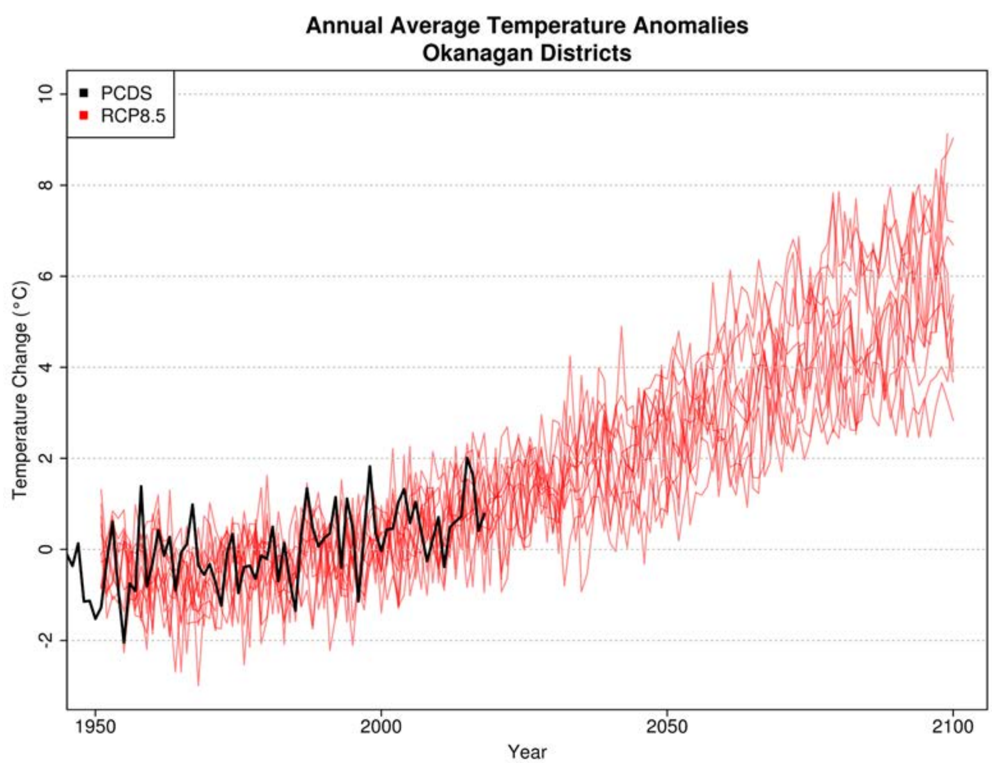
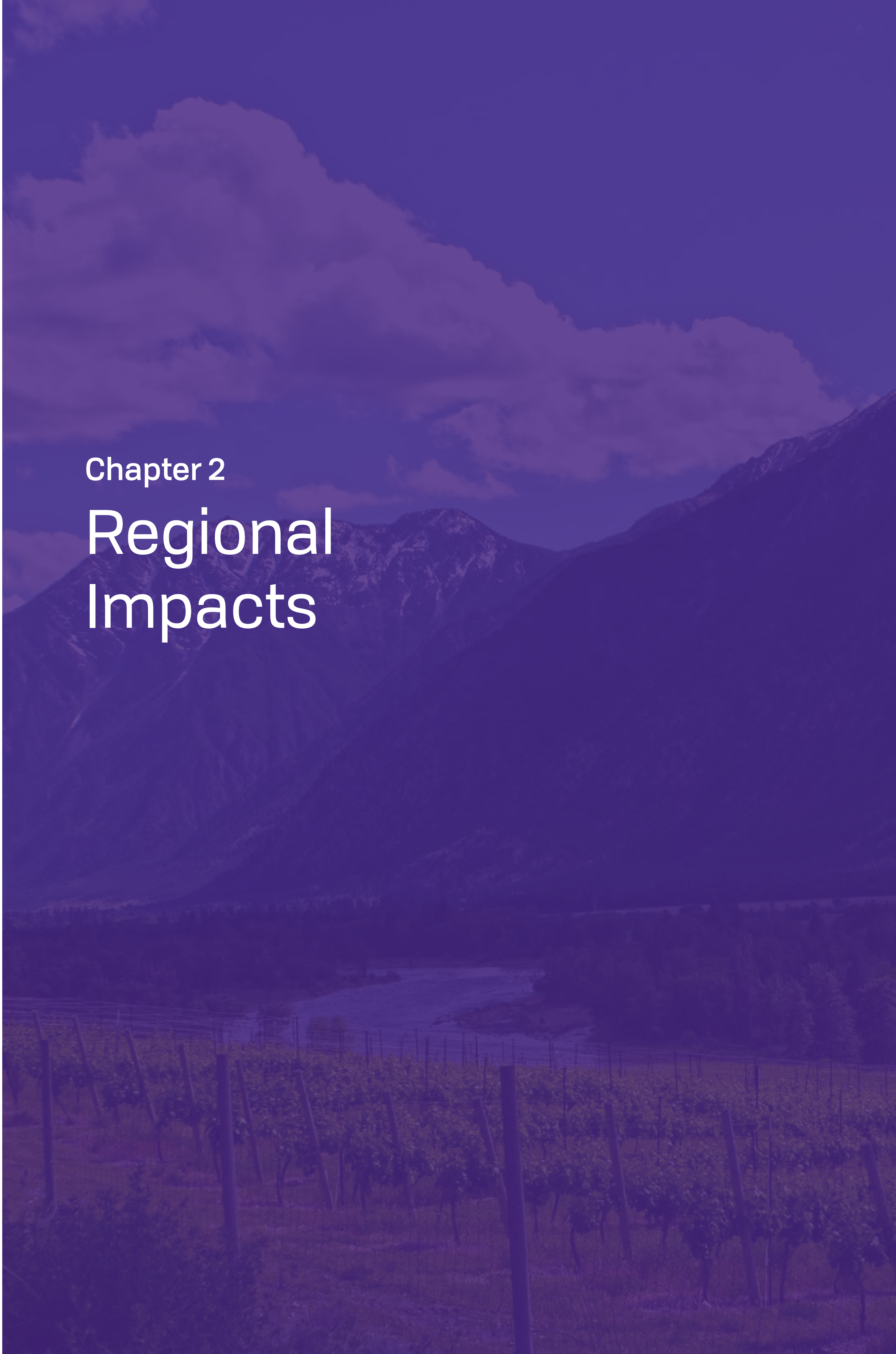


FIGURE 2: UNDERSTANDING THE VARIABLE PATH OF CLIMATE CHANGE

The black line is the Pacific Climate Data Set averaged over BC (historical observations – see https://data.pacificclimate.org/portal/docs/pcds.html for more information), reflecting natural variation in Climate data over time. The red lines are each of the 12 global climate model projections (for the RCP8.5 scenario), indicating that variation can continue to be expected over time.



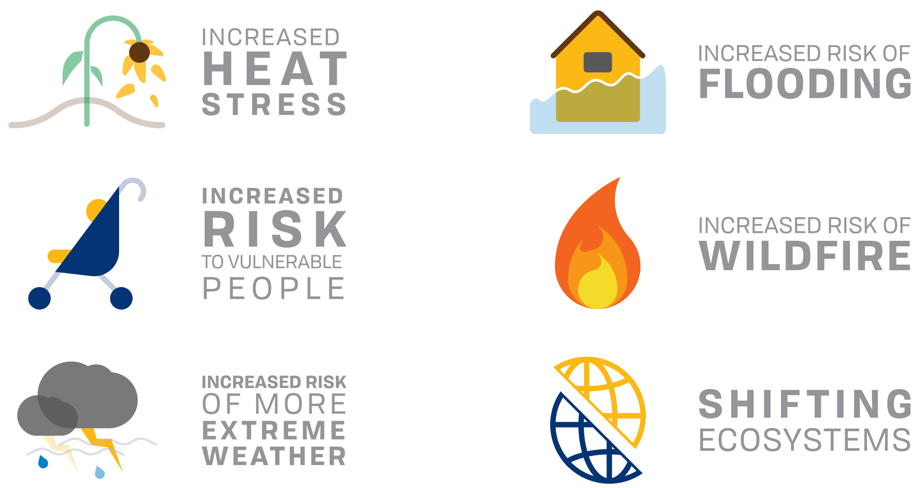
Chapter 2

Regional Impacts

Chapter 2

Regional Impacts

The Okanagan can expect a future climate that is unlike that of the past. While many communities have been learning to adapt to these changes over time, rising temperatures and a dramatic increase in variability of weather will continue to challenge the region, and the ecosystems that underpin the health and wellbeing of Okanagan residents. Recognizing the interdependency of environmental, economic, and social systems, and the interconnected impacts of climate change, supporting the vibrant Okanagan region over time will require regional stakeholders to take a systems approach to resilience and climate preparedness.



Past Climate Events

The regional impacts of climate change can already be seen on the ground. Each Regional District has experienced unique challenges, including, but not limited to the following:

- The Central Okanagan experienced the catastrophic wildfires of 2003 in Okanagan Mountain Park, where 33,000 people were evacuated and 238 homes were lost.
- In the North Okanagan (May of 2017), flooding on Kalamalka Lake and the Shuswap River had an impact on residents and local infrastructure.
- Year-on-year flooding of Okanagan Lake and flash flood events along creeks and streams.
- The RDCO, RDNO, and RDOS experienced over 190 wildfires, burning 44,000 hectares of land combined, in 2018;[2]
- The spring freshet and wildfire season of 2018 activated the RDOS Emergency Operations Centre for 170 days and engaged over 450 staff from across the Okanagan.

These events, and others like them, have caused the region to trigger emergency management protocols more frequently. While some warming of the climate has brought opportunities, events like those noted above often have devastating impacts on local ecosystems, residents, and businesses, and cause ongoing emotional and financial stress.

[2] Statistics Canada (2018). British Columbia Forest Fires, 2018. Retrieved from https://www150.statcan.gc.ca/n1/pub/16-508-x/16-508-x2019002-eng.htm

This section provides a brief overview of the types of impacts expected across various sectors. It reflects regional discussions on climate change that took place in each participating Regional District in September 2019, and is intended to continue a dialogue among decision makers and community leaders to explore how to prepare for the interrelated impacts facing the Okanagan.

Based on the outcomes of regional conversations held in autumn 2019, the impacts of climate change were organized into the following nine categories:

- Ecosystems and Biodiversity
- Health
- Water Quantity and Quality
- Transportation Infrastructure
- Stormwater Infrastructure
- Recreation
- Agriculture
- Local Economy
- Buildings, Land Use, and Energy Systems

Ecosystems and Biodiversity

Context

The Okanagan is one of the most biologically diverse and ecologically significant regions in British Columbia. The Okanagan region is home to ponderosa-pine and Douglas-fir ecosystems, low-lying grasslands, semi-arid desert lands, and alpine highlands. This diversity brings with it a wide range of flora and fauna, including many species at risk that need protection (e.g., the Great Basin Spadefoot, the American Badger, and the ecological communities of antelope-brush and sagebrush steppe). The Okanagan Basin consists of a series of snowmelt-fed freshwater lakes, which are part of the Columbia River Basin. These natural assets provide connectivity and ecosystem services that are essential to social, cultural, and economic systems in the valley.

Impacts

There is a strong concern that climate change will cause far-reaching damage to the ecosystems that support plant, animal, and human life. As climate change occurs, ecosystems and species can be expected to experience stress, resulting in changes to biological diversity. Reduced summer precipitation, combined with warmer summer temperatures, will likely result in the depletion of water resources, loss of wetlands, stress on local fisheries, and depletion of aquatic species. Warmer temperatures and increased variability are likely to upset the timing of biological cycles and strain sensitive habitat, leading to ecosystem shifts and the introduction of new species. Warmer temperatures will also enhance the potential for invasive species, pests, and pathogens to increase across the region, compromising the ability of native species to survive and triggering a loss of biodiversity. Extreme events such as flooding, wildfires, and landslides are likely to compromise natural landscapes, limit the function of natural assets, and reduce ecosystem connectivity. These impacts describe a future that is markedly different from the past and underline the imperative for action to reduce GHG emissions and prepare communities to adapt to the future climate.

Health

Context

The Okanagan has a growing population, including an active retiree demographic, and a growing population under the age of 19. The population in the region is predominantly located in the valley bottoms, where flooding and heat stress most commonly occur. These events will continue to challenge infrastructure and emergency response systems.

Impacts

The region has already been experiencing increased exposure to heat, which causes disproportionate health risks to vulnerable populations, including children, seniors, those who are isolated, and those experiencing homelessness. Air quality in the summers will become a major concern, and as smoke from wildfires increases, particulate matter and warmer temperatures will lead to breathing problems, trigger asthma, reduce lung function, and increase the risk of lung disease. Compromised air quality and extreme heat will impact the ability to spend time outside, and lead to increased mental health issues. These impacts will cause additional stress on existing health facilities and resources, and without additional resources, are likely to negatively affect the quality of healthcare in the region.

Individuals can be expected to experience increased anxiety and compromised mental health due to the shock of extreme events, the loss of local food and cultural values, and other stresses related to the changing climate. Emergency responders will also likely experience additional mental and physical stress as they work long hours for extended periods of time.

During winter months, fewer colder nights and an increase in daytime temperatures may reduce air quality impacts from wood-burning stoves, and put less pressure on vulnerable populations seeking to avoid the cold during the winter months.

Recognizing the critical health impacts posed by climate change, now is the time to prepare communities and emergency responders for the changes ahead. Citizens and institutions need to be educated on the impacts of climate change, in order to develop climate literacy in the Okanagan region. Whenever possible, positive impacts should be included in educational materials.

Water Quantity and Quality

Context

The Okanagan has the highest water consumption per capita in Canada, and water consumption continues to grow as the population increases.[3] There is a high demand for water use from intense agriculture and landscaping, and the current level of water demand results in stress on the regional water supply.[4]

Within each Regional District, there are many large and small utilities providing water to users. Many water sources in the Okanagan region are over-allocated, and with a changing climate, water conservation is the most sustainable approach to handling water shortages, rather than through costly upgrades to storage and infrastructure.[5]

Impacts

Warmer winters will on average result in less snow accumulation on the valley uplands, reducing water availability and increasing the need for water storage. Groundwater and aquifer recharge will also be compromised as drought conditions increase, and soils become impermeable and less able to accept intense rainfall. This, along with spring flooding, may also cause wastewater and stormwater infrastructure to fail, leading to reduced water quality and contamination of drinking water. Flooding and water shortages are likely to decrease water quality and will likely trigger higher water restrictions and water use conflicts, particularly in years where water demand increases to manage wildfire activity.

While water supply is decreasing, additional annual demand increases and competition for water use from users can be expected. Allocation decisions will be required to meet domestic, agricultural, industrial, and ecosystem water needs and additional resources to monitor and manage water supply will likely result in increasing water-related costs. Going forward, agricultural stakeholders, major commercial water users, local governments, regional water regulators, and provincial governments will need to engage in close dialogue to avoid undue stress from global and regional water shortages.

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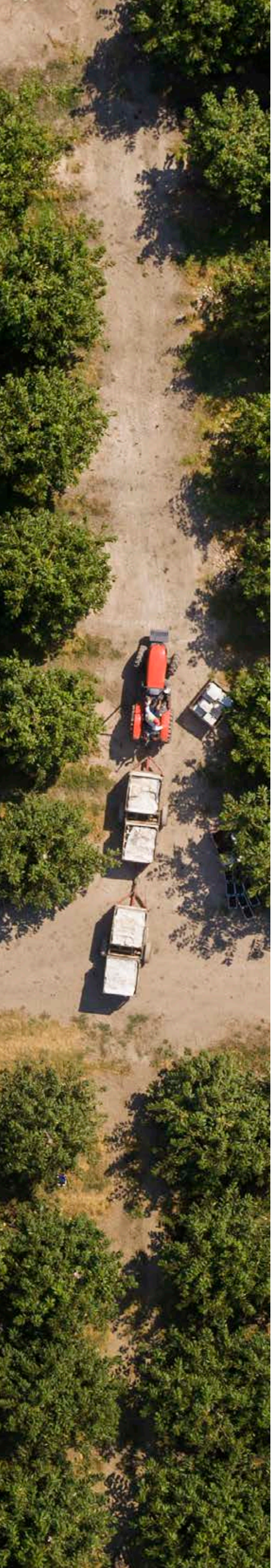
[3] https://www.obwb.ca/wsd/water-usage/residential-water-use

[4] https://www.obwb.ca/wsd/wp-content/uploads/2011/08/OBWB_Local_Government_Guide_OWSD_Project.pdf

[5] https://www.obwb.ca/newsite/wp-content/uploads/Okanagan_Sustainable_Water_Strategy_Action_Plan_2_0.pdf



Transportation Infrastructure

Context

The Okanagan is a provincial transportation hub, home to the Kelowna International Airport, and a series of major connecting highways. Traffic increases can be expected during the summer tourism season, putting additional stress on the transportation network. Locally, stressors to regional transportation are expected to grow as population increases over time. While cycling infrastructure is increasing around urban areas, and along regional Rail Trails, the Okanagan has the highest car ownership per capita in BC, in part due to the low-density development, and minimal public transportation services in rural areas.[6] Many communities have limited access routes, causing added stress during transportation network disruptions and emergencies.

Impacts

With warmer winter temperatures, highways will likely be safer for winter travel later into the autumn and earlier in spring, increasing economic activity in the region. With precipitation falling in more extreme events, increases in maximum flows are likely to overburden existing drainage infrastructure, may threaten roads and bridges, and can be expected to cause debris and water to pool on and near existing transportation infrastructure. These impacts will cause interruptions to local commercial transportation and may result in a temporary loss of transportation corridors. With limited egress routes for emergency evacuations, access to hospitals during extreme events will become more challenging. Increased precipitation and extreme heat will mean fewer people participating in active transportation. In addition to ensuring transportation infrastructure can perform during future heat and storm events, the region must also identify solutions to encourage the use of low-carbon transportation (through technology and land use planning).

Stormwater Infrastructure

Context

To accommodate stormwater retention the majority of the Okanagan region relies on natural assets (such as ditches, creeks, wetlands, and other natural features). This is enhanced with hard infrastructure in more developed areas. Flooding and extreme weather events of the past have illustrated that the regional stormwater system can be overwhelmed during extreme events.

Impacts

Increases in storm intensity in the autumn and spring seasons are expected to put major pressure on stormwater management and drainage systems across the Okanagan region. Extreme precipitation and an increase in the intensity of rain events will likely overwhelm drainage systems and cause streams to overflow, leading to fully saturated soils and causing flooding along drainage systems, creeks, lakeshores, and low-lying areas. Flooding may also cause wastewater infrastructure to fail, leading to reduced water quality and contamination of regional waterways. These impacts can also affect slope stability, leading to increased risk of landslides and road washouts. These impacts would cause damage to private property and public infrastructure, as well as have negative impacts on drinking water quality and aquatic ecosystems.

[6] https://www.kelownacapnews.com/news/shocking-statistics-show-just-how-car-centric-kelowna-has-become

Recreation

Context

The region has an active population, and is known locally and across the province as a "four seasons" playground. Recreation occurs outdoors and on the natural landscape, is an asset to community wellbeing and a key economic driver throughout the region.

Impacts

Increased wildfire and flooding events will reduce air and water quality, and will negatively affect the ability for people to recreate outside. Reduced water quality could have a negative impact on water recreation, and compromised air quality from wildfire smoke is likely to result in less camping and cycling, and reduce the region's ability to host major sporting events, like the Oliver triathlon or the Penticton Ironman competition. Warmer winter temperatures could have a negative impact on mountain-based recreation and sporting events. Conversely, ski resorts may be able to take advantage of a longer summer season with enhanced all-season recreation activities as residents and tourists seek the cooler temperatures at higher elevations. Any changes in recreational activities will have important impacts on economic activities and cultural practices in the region.

Agriculture

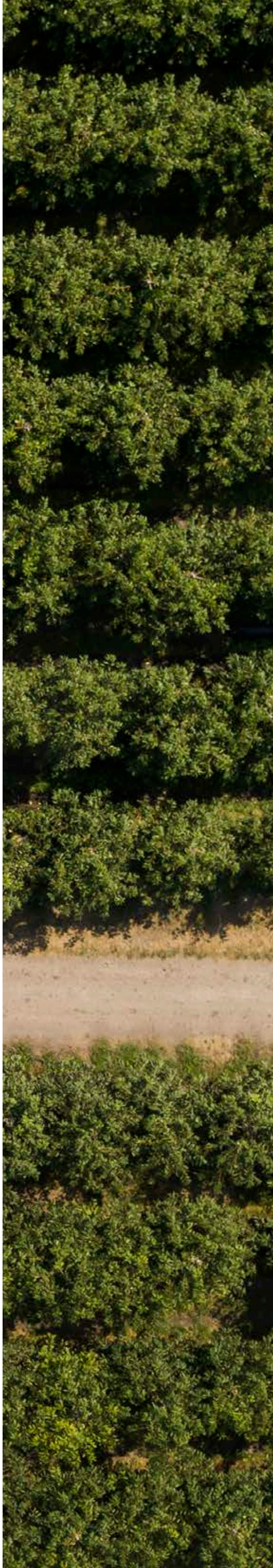
Context

Agriculture is a major contributor to the Okanagan's economy and social heritage. It includes a mix of crops, tree fruits, livestock, and processed products, as well as high value products including organics, cider, wine, and beer. In addition to providing jobs across all three Regional Districts, the agricultural sector creates opportunities to access locally grown foods and products and enhances local food security.

In the northern areas of the Okanagan, forage, dairy, and cattle ranching are common, while tree-fruit and grape production dominate the central and south areas. The majority of BC's tree fruit is produced here, and the recent expansion of late-season grape and cherry farming is further enlarging the sector. Other products of note include sheep, goats, horses, poultry, berries, nuts, and greenhouse production.[7]

Impacts

Warmer temperatures have already brought new economic activities to the Okanagan, including an expanding agricultural sector. As the growing season extends and temperatures continue to warm, the impacts of climate change will pose challenges to the agricultural industry, including flooding and drought, increased instances of disease, heavy rain storms during traditional harvest times, wind damage, and heat stress.[8] In addition to exploring how to protect the agricultural sector from these threats, a better understanding of the available water supply, drought management, and the retention of healthy soils will be required to capitalize on a longer growing season. The agricultural sector will also experience stress as warmer winters and fewer frost days are likely to result in more invasive species being introduced to. Ongoing dialogue between water purveyors, land use managers, and large water users will be important to ensure the viability of the local agricultural sector and protection of farmland over the coming decades.



[7] https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-regions/okanagan
[8] https://sencanada.ca/content/sen/committee/421/AGFO/Briefs/2018-03-19_GlenLukas_e.pdf

Local Economy

Context

The region is currently the largest trading area between Metro Vancouver and Alberta, with a diverse economy, comprised of agriculture, tourism, construction, retail trade, healthcare, manufacturing, and forestry. Key growth industries include information and technology, film, aviation, and health care.

Impacts

Warmer temperatures have already brought new economic activities to the Okanagan, including a growing agricultural sector and increased tourism.[9] With warmer winters, over time, many travellers may opt to stay local and spend their recreation dollars at home, further enhancing the local economy. The Okanagan region can expect a decrease in winter ski and snow sports due to warmer winters, and a transition to a summer mountain tourism regime.

Warmer summers with dry conditions will also bring more severe wildfires, compromising air quality and reducing tourism in the Okanagan in heavy smoke years. Flooding caused by extreme rain in the shoulder seasons will compromise the quality of soils, overburden transportation and stormwater management infrastructure, and reduce water quality in the region's lakes, further limiting the tourism sector.

The forestry sector will likely continue to experience stress as warmer winters and fewer frost days will result in more invasive species being introduced to the region. This will impact timber supply and result in additional job losses in the forestry sector. The changes described above will have impacts on business development and attraction and retention, in addition to causing fluctuations and uncertainty in the real estate market. Supporting local industries and identifying opportunities to adapt to these changes will help to secure a healthy, resilient economy.

Buildings and Energy Systems

Context

Energy in the Okanagan region is provided by BC Hydro (electricity), FortisBC (electricity and natural gas), and municipally owned electric utilities. In rural areas where gas is not available, energy for heating is provided by electric or wood heating systems. In many areas, the rising cost of air conditioning is becoming an issue. BC Hydro is currently upgrading their transmission line servicing West Kelowna, as the existing single line currently runs through rough terrain that is susceptible to the increasing threat of wildfires and landslides, and in an effort to prepare for ongoing increasing energy demand related to summer cooling.

The Okanagan building stock is largely older commercial and institutional buildings, and single-family homes in suburban neighbourhoods and rural areas. Many of these buildings were designed when energy costs were low, and winters were reliably cooler. The majority of the building stock performs below ideal energy efficiency standards.[10]

As new families move to the region from other parts of BC and Canada, development pressures are increasing in urban centres, rural areas, and on agricultural land. A growing construction sector brings with it opportunities to invest in high quality, resilient buildings. Buildings designed to perform well in future climate will mean improved occupant health and long-term cost savings.

Impacts

Warmer temperatures year-round will reduce heating demand in the winter months, and could lead to summer cooling demand outpacing winter heating demand in the coming decades.[11] This will result in shifting energy costs, and increased peak energy requirements during the summer months. In valley bottoms that currently experience the warmest temperatures, the inefficient building stock will likely lead to increased energy use for cooling, high costs during heat waves for those with cooling, and increased risks to vulnerable people who do not have access to cooling during heat waves.[12]

Future heavy rains are likely to cause an increase in storm and flood damage to homes, and when combined with additional energy costs, will likely cause economic stress to property owners. While current buildings are not well prepared to address current or future climate-related challenges, new buildings are also not being designed to perform efficiently in the future climate, further limiting the ability of residents to buffer themselves from increasing heat waves, compromised air quality, and expected water shortages.[13] This issue, along with the preservation of agricultural lands and natural areas, is sure to be exacerbated as development pressures increase to accommodate more in-migration.

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[9] https://www.investkelowna.com/about-the-okanagan/business/industries/

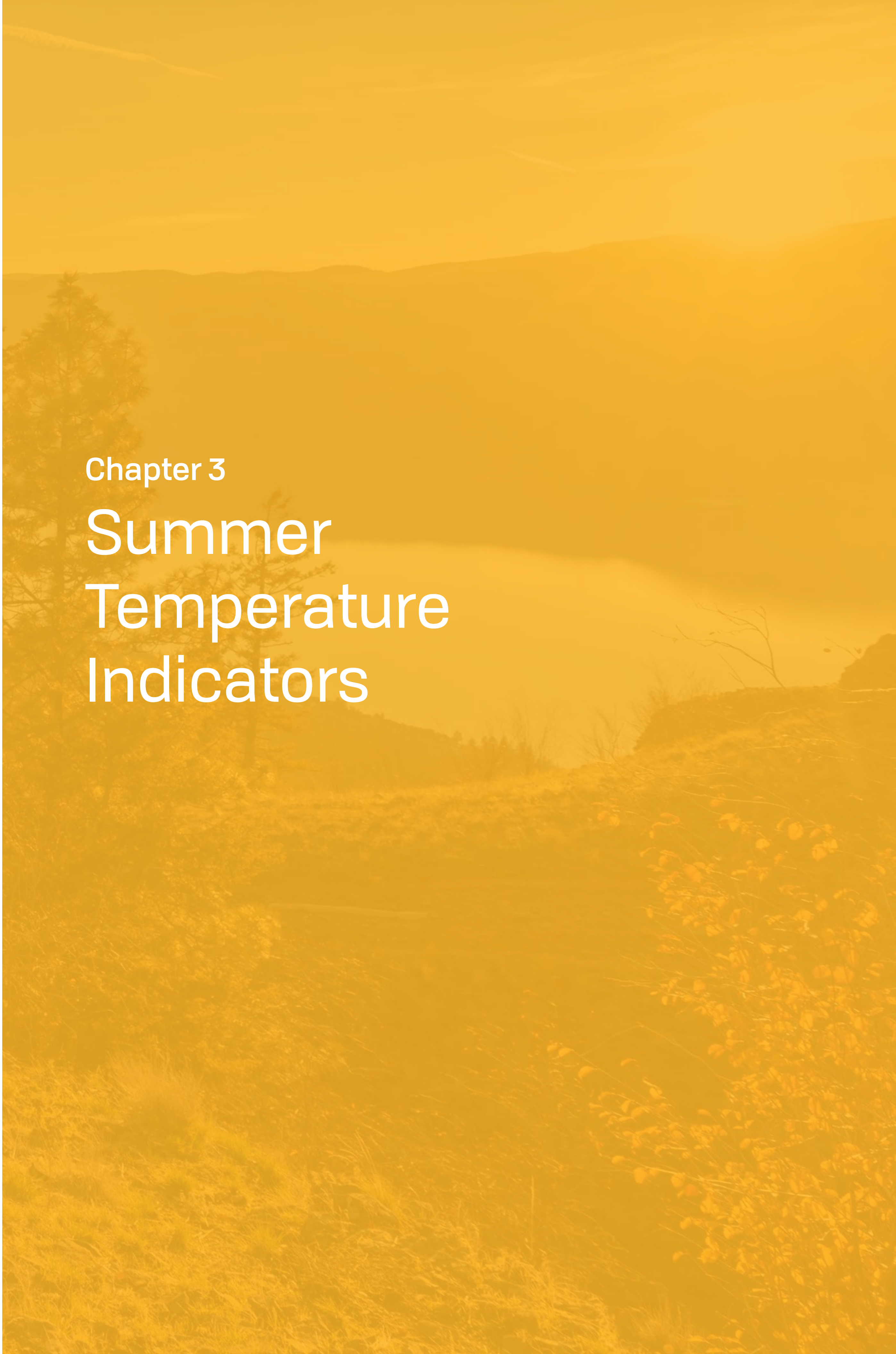
[10] https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/energy-efficiency/energy-step-code

[11] https://adaptationcanada2016.ca/wp-content/uploads/2016/04/W4A-Wilson.pdf

[12, 13] https://www.bchousing.org/publications/BC-Energy-Step-Code-Guide-Supplemental.pdf

Chapter 3

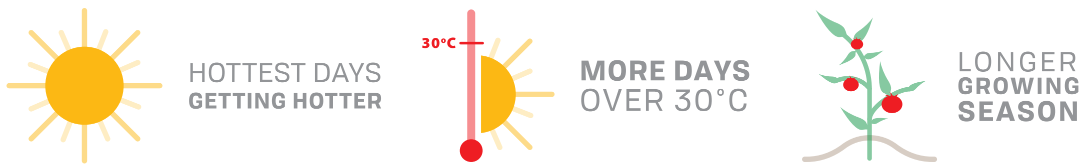
Summer Temperature Indicators



Chapter 3

Summer Temperature Indicators

Summer temperatures are expected to warm considerably over time, indicating that new climate conditions in summer will be unlike temperatures historically experienced in the Okanagan. This section further describes changes in summer temperature, and provides descriptions of the indicators and values relating to future average and extreme summer temperatures.



Days Above 30°C

About this Indicator

Days above 30°C indicates how many days reach temperatures over 30°C in any one year. This indicator of extreme heat is important t o public health as temperatures at or near 30°C can cause heat stress in vulnerable populations.[14]

Projections

- In the past, the Okanagan region (the total area inside all three Regional District boundaries) experienced just under a week per year, on average, of days above 30°C. By the 2050s, the region can expect an average of over three weeks above 30°C per year and over five weeks per year by the 2080s. **This marks a considerable change from the past.**
- The valley bottoms are projected to experience the greatest changes, with approximately 50 additional days above 30°C projected by the 2080s, compared to the past.
- In the valley bottoms, which experienced many more days above 30°C in the past than the region as a whole, will more than double by the 2050s, and almost triple by the 2080s.

TABLE 1: CHANGE IN SUMMER DAYS ABOVE 30°C

		Past Days	2050s Change (Days)		2080s Change (Days)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	6	16	(9 to 25)	31	(15 to 52)
	Valley Bottom Only	27	32	(17 to 47)	52	(31 to 75)
RDCO	Whole Regional District	7	18	(10 to 29)	35	(19 to 57)
	Valley Bottom Only	24	32	(19 to 48)	54	(32 to 78)
RDOS	Whole Regional District	5	14	(7 to 23)	29	(16 to 47)
	Valley Bottom Only	28	33	(19 to 47)	54	(33 to 76)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected increase in temperature (in °C) by the 2050s from the past baseline.
2080 Change refers to the projected increase in temperature (in °C) by the 2080s from the past baseline.

[14] Note that the Hot Design Temperature indicator (BCBC 97.5) can be found in the appendix.

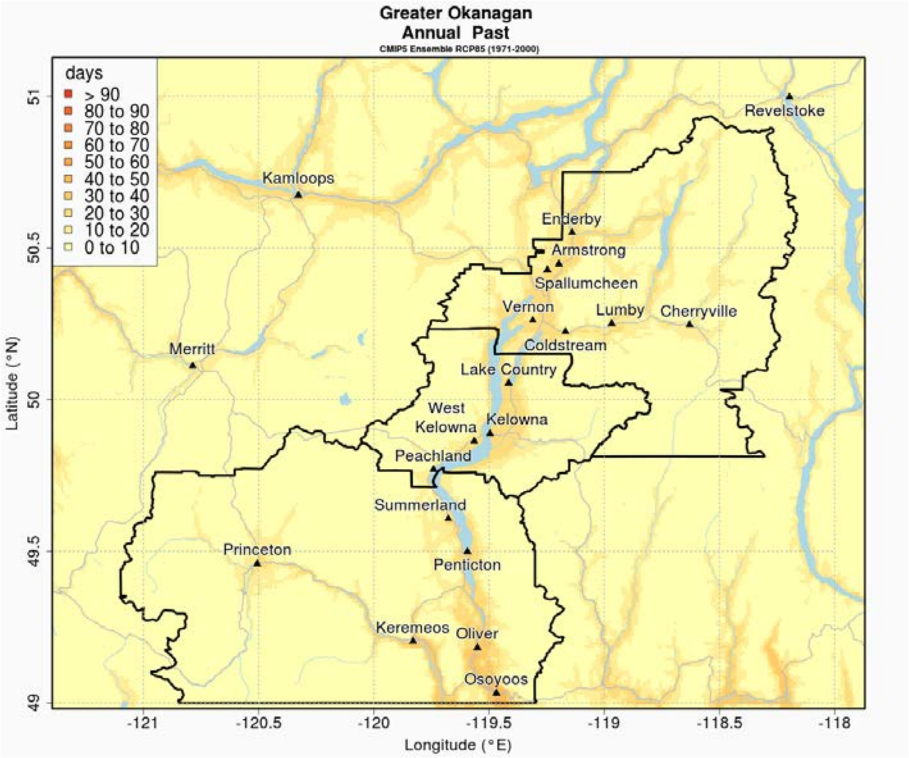


FIGURE 3: DAYS ABOVE 30°C – PAST

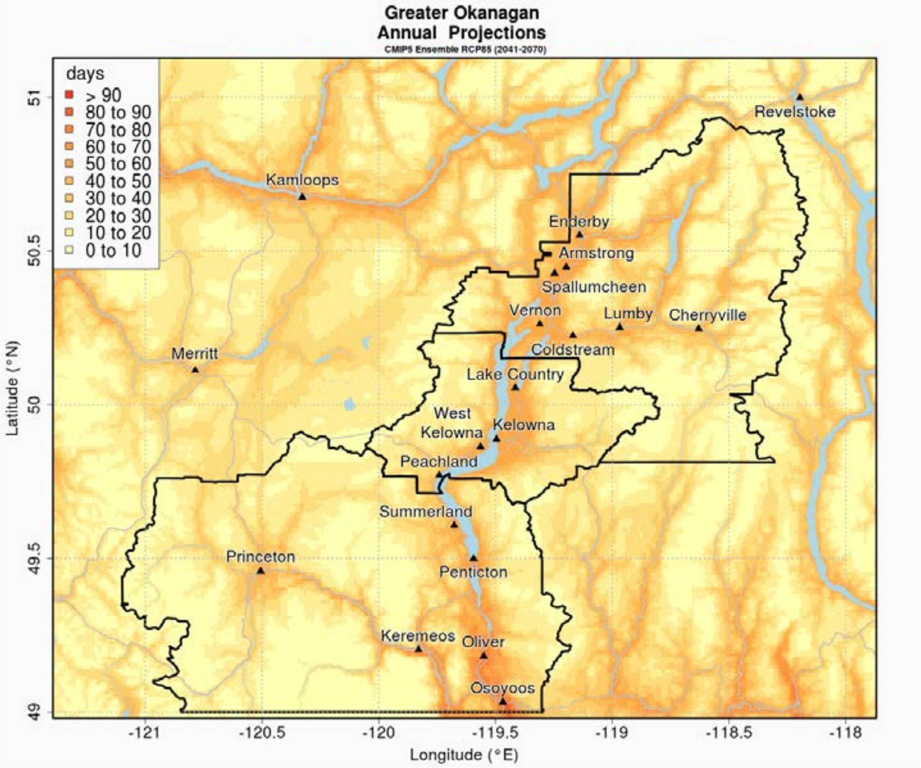


FIGURE 4: DAYS ABOVE 30°C – FUTURE (2050s)

Hottest Days

About this Indicator

Hottest days refers to the hottest daytime high temperature of the season (or year). This measure illustrates how extreme temperature changes are projected to unfold over time.

Projections

- In the past, the hottest summer day in the Okanagan region was about 30°C. By the 2050s, hottest day temperatures are expected to increase by 4.5°C, and by over 7°C by the 2080s.
- Valley bottoms have historically experienced hotter temperatures. In the past, the average hottest day temperatures in valley bottoms was 36°C. By the 2080s, this will result in annual hottest day temperatures over 43°C in the populated areas of the Okanagan region by the end of the century, on average.
- Spring temperatures across the Okanagan region are also projected to warm, though the magnitude of the change is smaller than Summer. By the 2050s, the hottest spring day is projected to increase by 3.0°C to 25.7°C, and by 4.7°C to 27.4°C by the 2080s.
- In the future, the annual hottest daytime highs will be as warm as extreme 1-in-20 hottest day temperatures of the past. **This is a remarkable change in that what was once a rare extreme heat event will become commonplace.**

TABLE 2: CHANGE IN HOTTEST DAY

			Past (°C)	2050s Change (°C)		2080s Change (°C)	
				Average	(Range)	Average	(Range)
RDNO	Spring	Whole Regional District	22.6	3.1	(2 to 4)	4.9	(3 to 7)
		Valley Bottom Only	28.5	3.0	(2 to 4)	4.8	(3 to 7)
	Summer	Whole Regional District	29.9	4.5	(3 to 6)	7.3	(5 to 9)
		Valley Bottom Only	35.9	4.5	(3 to 6)	7.2	(5 to 9)
RDCO	Spring	Whole Regional District	23.9	3.0	(3 to 4)	4.7	(3 to 6)
		Valley Bottom Only	28.3	2.9	(2 to 4)	4.6	(3 to 6)
	Summer	Whole Regional District	30.7	4.5	(2 to 6)	7.1	(5 to 9)
		Valley Bottom Only	35.3	4.4	(2 to 6)	7.1	(5 to 9)
RDOS	Spring	Whole Regional District	22.5	2.8	(2 to 4)	4.6	(3 to 6)
		Valley Bottom Only	29.1	2.8	(2 to 4)	4.5	(3 to 6)
	Summer	Whole Regional District	29.4	4.4	(3 to 6)	7.0	(5 to 9)
		Valley Bottom Only	35.8	4.4	(2 to 6)	7.0	(5 to 9)

TABLE NOTES

Past refers to the time period from 1971 to 2000.

2050 Change refers to the projected increase in temperature (in °C) by the 2050s from the past baseline.

2080 Change refers to the projected increase in temperature (in °C) by the 2080s from the past baseline.

1-in-20 Hottest Day

About this Indicator

1-in-20 hottest day refers to a day so hot that it has only a 1-in-20 chance of occurring in a given year. That is, there is a 5% chance in any year that a daytime high temperature could reach this threshold. This indicator illustrates what extreme heat events will feel like over time, and will be useful to understand impacts related to ecosystems, health, agriculture, and forestry.

Projections

- The past 1-in-20 hottest day in the Okanagan region was 32.8°C. By the 2050s, the region can expect this to increase to 37.8°C, and to 40.1°C by the 2080s.
- In the valley bottoms, the temperatures are projected to be even hotter. The past 1-in-20 hottest day in the north was 38.9°C. By the 2050s, this is expected to increase by 5.1°C to 44°C, and by 7.3°C to 46.2°C by the 2080s. This trend is similar across all Regional Districts.
  These changes mark a significant departure from historical temperatures in the Okanagan region.

TABLE 3: 1-IN-20 HOTTEST DAY

		Past (°C)	2050s Change (°C)		2080s Change (°C)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	33.1	5.2	(2 to 6)	7.5	(5 to 9)
	Valley Bottom Only	38.9	5.1	(2 to 7)	7.3	(4 to 9)
RDCO	Whole Regional District	33.7	5.0	(3 to 7)	7.3	(4 to 9)
	Valley Bottom Only	38.2	4.9	(3 to 7)	7.2	(4 to 9)
RDOS	Whole Regional District	32.4	4.8	(3 to 6)	7.2	(5 to 9)
	Valley Bottom Only	38.4	4.9	(3 to 7)	7.2	(4 to 9)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected increase in temperature (in °C) by the 2050s from the past baseline.
2080 Change refers to the projected increase in temperature (in °C) by the 2080s from the past baseline.

Note: Climate projections for two additional hot temperature indicators (Days Above 25°C and Hot Design Temperature—TX 97.5/BCBC97.5) can be found in the Additional Indicators Appendix.

Growing Season Length

About this Indicator

Growing season length is an annual measure that counts the number of days between the first span of at least 6 days with a daily average temperature greater than 5°C and the first span after July 1 of 6 days with temperature less than 5°C. It indicates the length of the growing season for typical plants or crops. This measure helps to inform an understanding of agricultural opportunities and challenges made available by warmer temperatures.[15]

Projections

- In the past, the Okanagan region experienced an average of about 170 days in the growing season.
- Across the Okanagan region, growing season length is projected to increase by over a month by the 2050s and over two months by the 2080s.
- Valley bottoms are projected to experience a longer growing season than the region as a whole. Central and south valley bottoms can expect a growing season of over ten months by the 2080s.

[15] Change in Growing Degree Days is available in the Additional Indicators Appendix.

TABLE 4: CHANGE IN GROWING SEASON LENGTH

		Past (Days)	2050s Change (Days)		2080s Change (Days)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	167	36	(23 to 49)	62	(47 to 76)
	Valley Bottom Only	227	39	(28 to 54)	72	(54 to 85)
RDCO	Whole Regional District	180	39	(26 to 54)	67	(50 to 80)
	Valley Bottom Only	237	44	(31 to 61)	78	(60 to 93)
RDOS	Whole Regional District	163	41	(28 to 54)	69	(50 to 86)
	Valley Bottom Only	243	44	(29 to 55)	73	(56 to 91)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected increase in the days of growing season by the 2050s from the past baseline.
2080 Change refers to the projected increase in the days of growing season by the 2080s from the past baseline.

Cooling Degree Days

About this Indicator

Cooling degree days refers to the number of degrees that a day's average temperature is above 18°C. To determine the number of cooling degree days in a month, the number of degrees that the daily temperature is over 18°C for each day would be added to give a total value. This measure is used to estimate the use of air conditioning to cool buildings and homes.

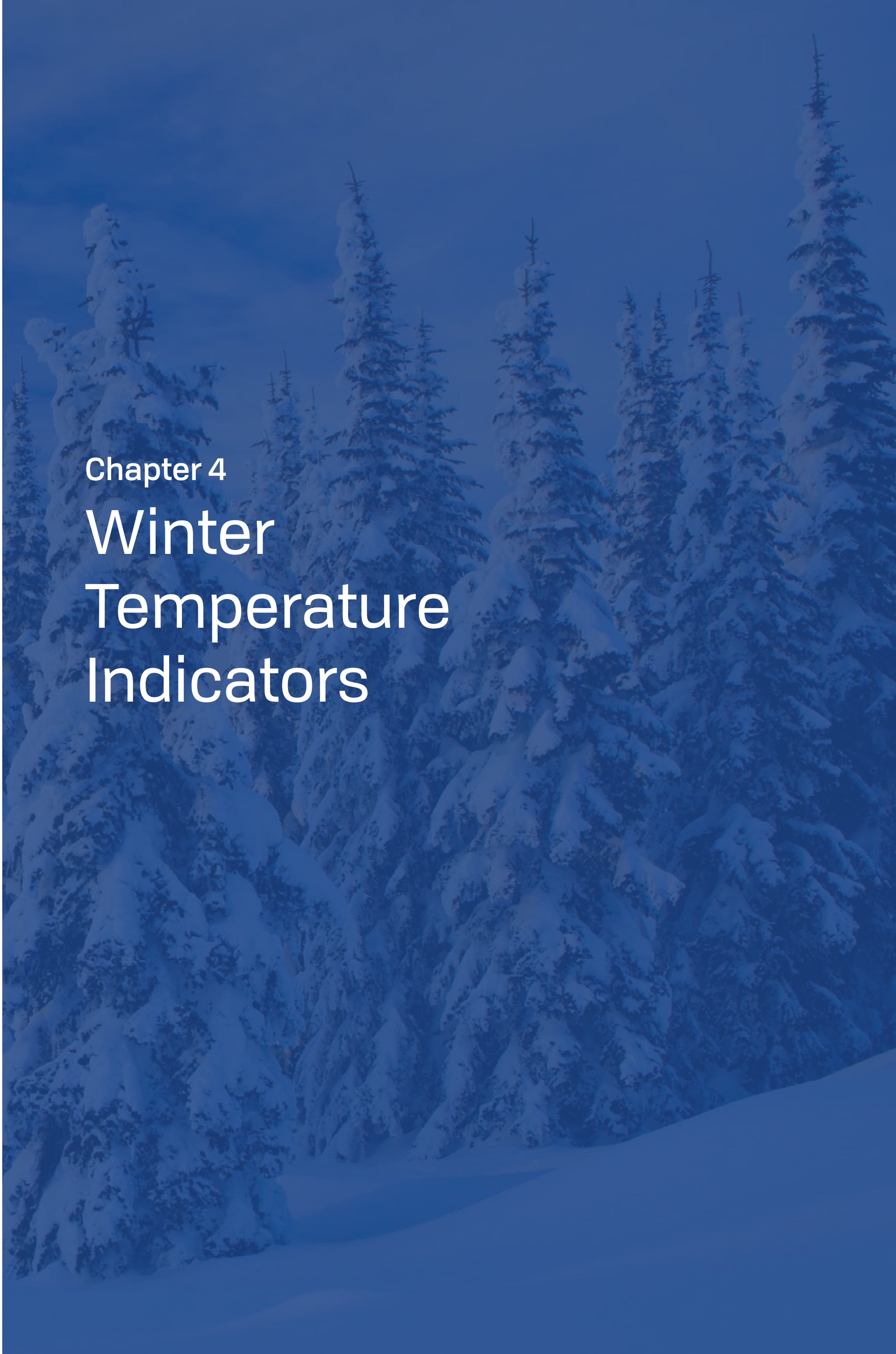
Projections

- Historically, there has been moderate demand for cooling in this region by this measure (an average of about 50 cooling degree days). Valley bottoms in all Regional Districts have experienced significantly more cooling degree days than in the past, over three times the regional average.
- The Okanagan can expect an increase of 144 more cooling degree days by the 2050s, and 312 more by the 2080s.
- Valley bottoms are projected to experience nearly double the regional average cooling degree days in the future. As this is a measure of cooling demand, these increases indicate that **significantly more energy will be required to cool homes and buildings in the future.**

TABLE 5: CHANGE IN COOLING DEGREE DAYS

		Past (Degree Days)	2050s Change (Degree Days)		2080s Change (Degree Days)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	48	150	(60 to 265)	325	(136 to 538)
	Valley Bottom Only	216	342	(168 to 547)	635	(339 to 951)
RDCO	Whole Regional District	67	176	(72 to 298)	368	(163 to 592)
	Valley Bottom Only	230	354	(173 to 565)	655	(354 to 977)
RDOS	Whole Regional District	42	130	(55 to 224)	285	(118 to 468)
	Valley Bottom Only	243	360	(174 to 573)	664	(363 to 984)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected increase in cooling degree days by the 2050s from the past baseline.
2080 Change refers to the projected increase in cooling degree days by the 2080s from the past baseline.
Actual change is recorded (not percent change) due to low baseline values.



Chapter 4

Winter Temperature Indicators

Chapter 4

Winter Temperature Indicators

Future climate projections indicate that the Okanagan can expect to see warmer winter months. **By the 2080s, January temperatures will feel more like mid to late autumn temperatures of the past,** with warmer nights, and fewer frost days. These indicators are useful when trying to determine how ecological systems, and associated economic and cultural activities, can be expected to change over time.

Average Spring Nighttime Low Temperatures

About this Indicator

Average spring nighttime low temperatures are averaged over the season and illustrated in the tables and plots below.

Projections

- Average past spring nighttime lows were -1.6°C in the Okanagan. Spring nighttime lows are projected to increase by 3°C by the 2050s, and by 5°C by the 2080s. This is similar across all Regional Districts and valley bottoms.

TABLE 6: CHANGE IN AVERAGE SPRING NIGHTTIME LOW

		Past (°C)	2050s Change (°C)		2080s Change (°C)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	-1.6	3.1	(2 to 4)	5.1	(4 to 6)
	Valley Bottom Only	3.0	3.1	(2 to 4)	5.1	(4 to 6)
RDCO	Whole Regional District	-0.7	3.1	(2 to 4)	5.0	(4 to 6)
	Valley Bottom Only	3.6	3.1	(2 to 4)	5.0	(4 to 6)
RDOS	Whole Regional District	-1.9	3.0	(2 to 4)	4.9	(4 to 6)
	Valley Bottom Only	3.5	3.0	(2 to 4)	4.9	(4 to 6)

TABLE NOTES

Past refers to the time period from 1971 to 2000.

2050 Change refers to the projected increase in temperature (°C) by the 2050s from the past baseline.

2080 Change refers to the projected increase in temperature (°C) by the 2080s from the past baseline.

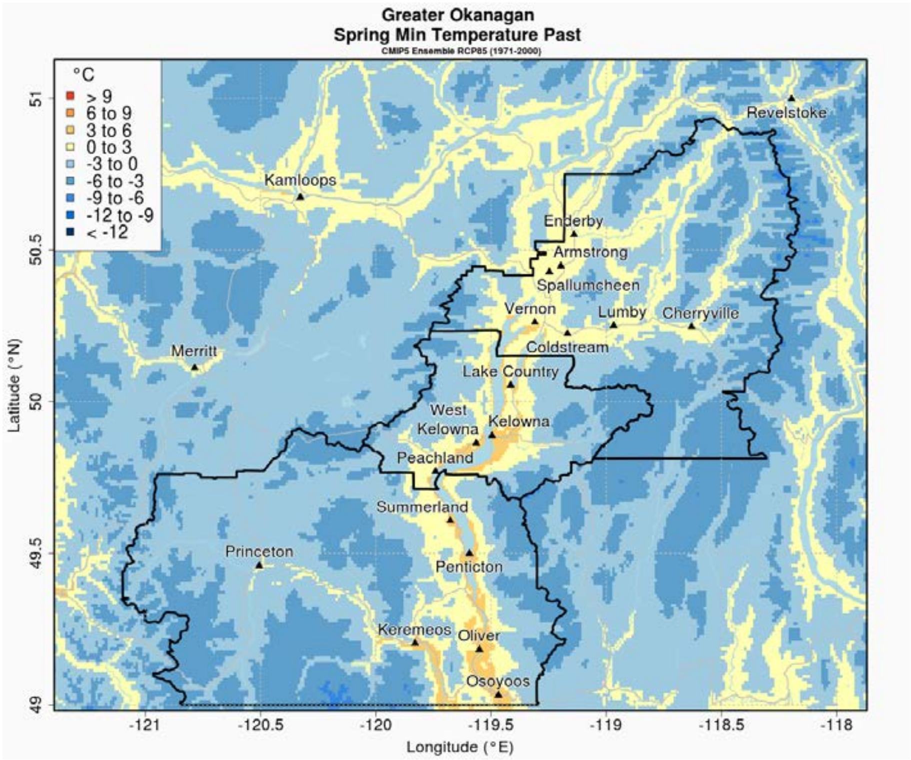


FIGURE 5: SPRING NIGHTTIME LOWS – PAST

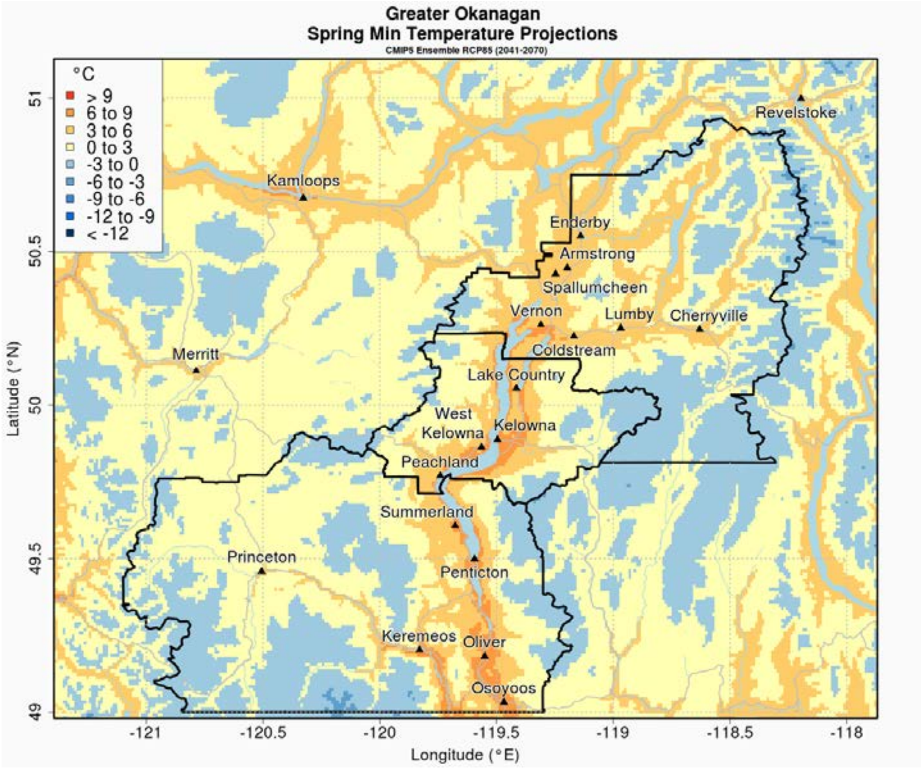


FIGURE 6: SPRING NIGHTTIME LOWS – FUTURE (2050s)

Coldest Night

About this Indicator

Coldest night refers to the coldest nighttime low temperature of the year (or in a particular season), on average. This measure illustrates how extreme temperature changes are projected to unfold over time.

Projections:

- In the past, the coldest winter night for the Okanagan region was about -25°C. By the 2050s, the coldest night is expected to warm by 6°C to -19°C, and by the 2080s, temperatures are projected to warm by 10°C to -15°C. While the coldest night is projected to warm in all seasons, the coldest night in winter is projected to warm more rapidly than other seasons.
- Valley bottoms follow a similar trend, though historically coldest winter nights have been approximately 3°C to 5°C warmer than the Regional District average.

TABLE 7: CHANGE IN COLDEST NIGHTS

			Past (°C)	2050s Change (°C)		2080s Change (°C)	
				Average	(Range)	Average	(Range)
RDNO	Winter	Whole Regional District	-25.4	5.9	(3 to 9)	10.1	(8 to 14)
		Valley Bottom Only	-21.9	6.0	(4 to 9)	10.3	(8 to 14)
	Autumn	Whole Regional District	-16.0	5.5	(4 to 7)	8.1	(6 to 10)
		Valley Bottom Only	-11.7	5.5	(4 to 7)	8.1	(6 to 10)
RDCO	Winter	Whole Regional District	-24.6	6.1	(4 to 10)	10.3	(8 to 15)
		Valley Bottom Only	-18.8	6.1	(4 to 10)	10.3	(8 to 15)
	Autumn	Whole Regional District	-15.8	5.4	(4 to 7)	8.0	(6 to 10)
		Valley Bottom Only	-10.1	5.2	(4 to 6)	7.8	(6 to 9)
RDOS	Winter	Whole Regional District	-24.5	6.1	(4 to 10)	10.3	(8 to 14)
		Valley Bottom Only	-18.9	6.1	(4 to 10)	10.3	(9 to 15)
	Autumn	Whole Regional District	-16.5	5.0	(3 to 6)	7.4	(5 to 9)
		Valley Bottom Only	-10.6	5.1	(4 to 7)	7.6	(5 to 9)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected increase in temperature (°C) by the 2050s from the past baseline.
2080 Change refers to the projected increase in temperature (°C) by the 2080s from the past baseline.

Frost Days

About this Indicator

Frost days is an annual count of days when the daily minimum temperature is less than 0°C, which may result in frost on the ground. This indicator is helpful to understand changes and impacts on agriculture and ecosystems, as it indicates how often temperatures below freezing occur.[16]

Projections

- In the past, the region experienced on average about six months of frost days, annually. The region is expected to experience 28% fewer frost days by the 2050s, and about half as many as in the past by the 2080s. This trend is similar across all three Regional Districts.
- Valley bottoms have historically experienced fewer frost days. In the past, the South Okanagan's valley bottom has experienced 96 frost days, annually. This is less than the other Regional Districts. By the 2050s, frost days in the South Okanagan are expected to decline by 49%, and by 71% by the 2080s.
- Fewer frost days have implications for invasive species, agriculture, and streamflow.

[16] Freezing degree days is available in the Additional Indicators Appendix.

TABLE 8: PERCENT CHANGE IN FROST DAYS, ANNUALLY

		Past (Days)	2050s Change (Days)		2080s Change (Days)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	189	-27%	(-34 to -19)	-46%	(-56 to -37)
	Valley Bottom Only	113	-47%	(-56 to -38)	-69%	(-83 to -60)
RDCO	Whole Regional District	173	-31%	(-39 to -23)	-50%	(-59 to -40)
	Valley Bottom Only	102	-53%	(-63 to -41)	-76%	(-89 to -65)
RDOS	Whole Regional District	195	-27%	(-36 to -19)	-46%	(-55 to -32)
	Valley Bottom Only	96	-49%	(-60 to -38)	-71%	(-85 to -62)

TABLE NOTES:
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected percent change by the 2050s from the past baseline.
2080 Change refers to the projected percent change by the 2080s from the past baseline.

Ice Days

About this Indicator

Ice days are days when daytime high temperature is less than 0°C. This measure offers insight into changes in the number of days when the temperature does not rise above freezing, which could affect ecosystems, species, and transportation in the region.

Projections

- In the past, the region had about two and a half months of ice days. The region is expected to experience a month fewer ice days by the 2050s, and a month and a half fewer by the 2080s. This trend is similar across the Regional Districts.
- Valley bottoms experience less than half as many ice days as the Regional District areas.
- Depending on annual variability, a decrease in ice days could result in additional freeze-thaw cycles in some years, possibly leading to an increase in rain-on-snow events and associated flooding.[17]

TABLE 9: CHANGE IN ICE DAYS

		Past (Days)	2050s Change (Days)		2080s Change (Days)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	80	-30	(-37 to -26)	-47	(-52 to -42)
	Valley Bottom Only	36	-17	(-22 to -11)	-24	(-27 to -21)
RDCO	Whole Regional District	65	-27	(-33 to -23)	-40	(-45 to -37)
	Valley Bottom Only	28	-14	(-17 to -11)	-20	(-22 to -17)
RDOS	Whole Regional District	75	-30	(-38 to -23)	-46	(-54 to -41)
	Valley Bottom Only	28	-14	(-17 to -10)	-20	(-22 to -16)

TABLE NOTES:
Past refers to the time period from 1971 to 2000.
2050 Change refers to the projected change in days by the 2050s from the past baseline.
2080 Change refers to the projected change in days by the 2080s from the past baseline.

[17] https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/2017_flood_response_report_final.pdf

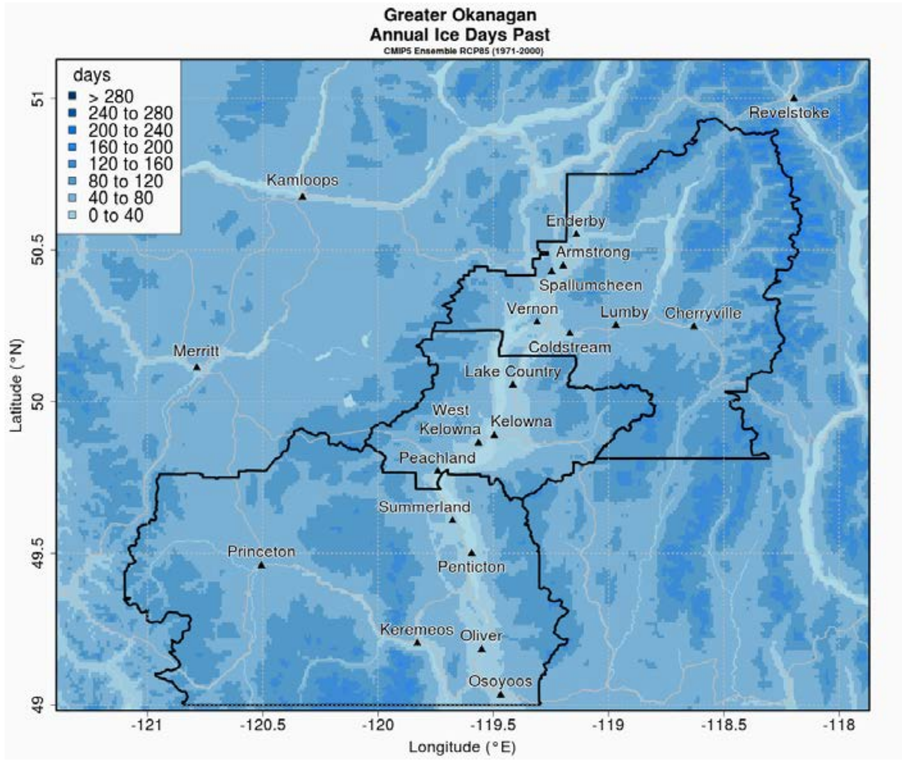


FIGURE 7: ICE DAYS – PAST

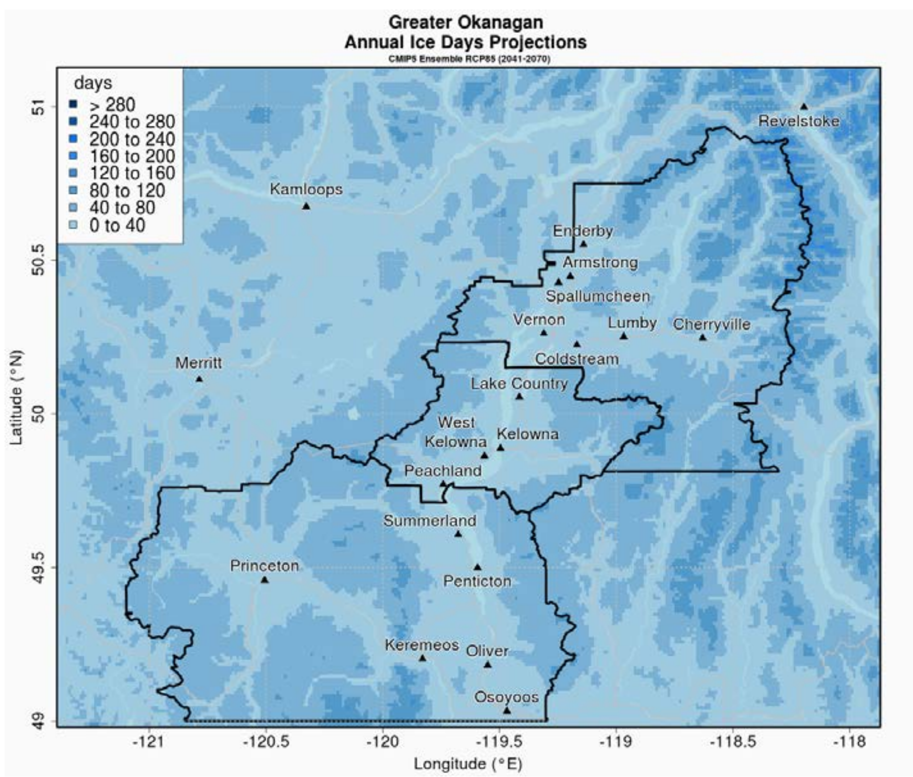


FIGURE 8: ICE DAYS – FUTURE (2050s)

Heating Degree Days

About this Indicator

Heating degree days is an indicator of the amount of energy that it takes to heat buildings to comfortable temperatures.[18]

Projections

- The Okanagan region currently experiences more heating degree days than cooling degree days.
- Heating degree days are projected to decrease by about 20% by the 2050s, and by almost one third by the 2080s. This relative change in heating degree days is similar across the region and marks a considerable difference in heating load from the past.
- Valley bottoms experience considerably fewer heating degree days than the Regional District areas.
- The Okanagan will require less energy for heating in the future, and more energy for cooling, particularly in the valley bottoms, where temperatures are higher, and the majority of the population lives.

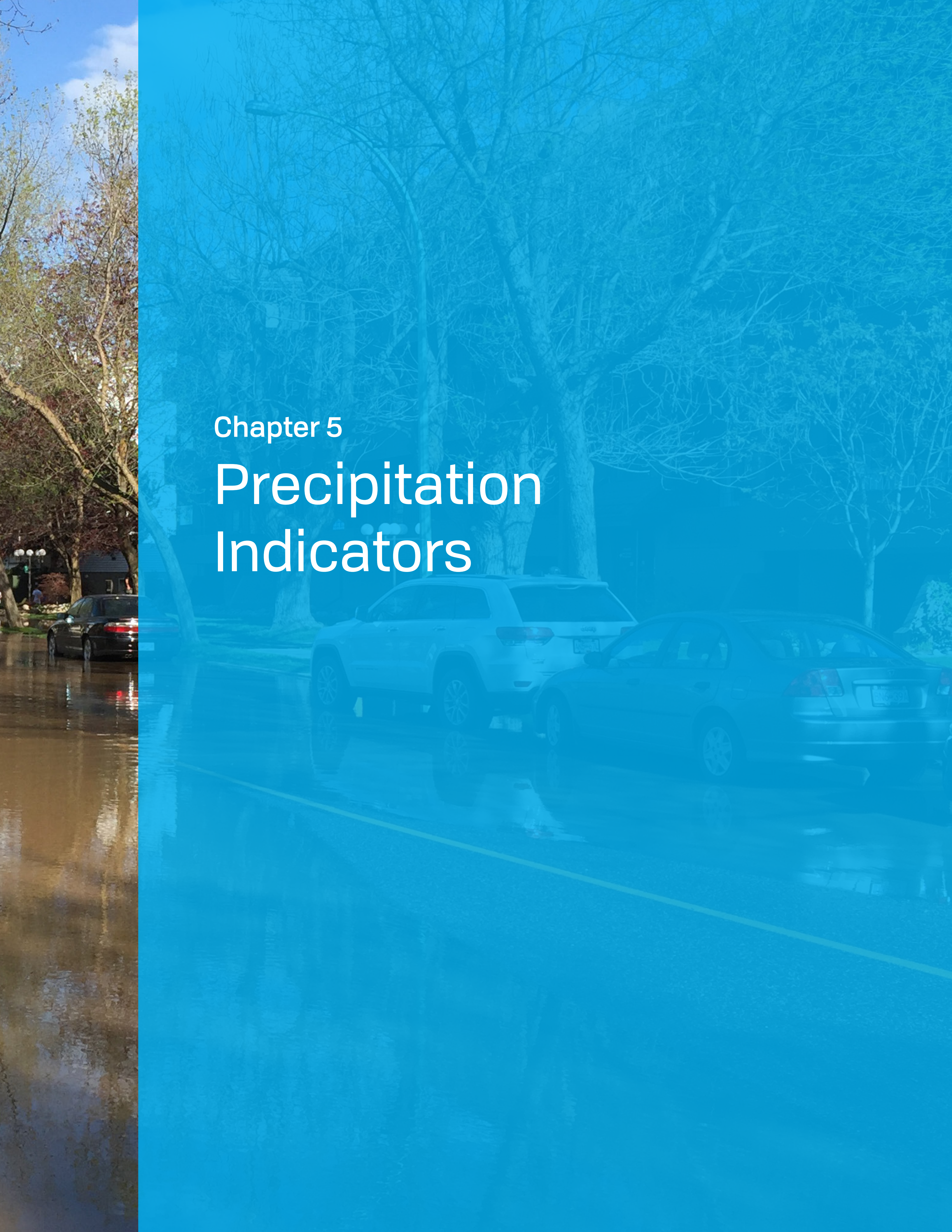
TABLE 10: PERCENT CHANGE IN HEATING DEGREE DAYS

		Past (Degree Days)	2050s Change (Degree Days)		2080s Change (Degree Days)	
			Average	(Range)	Average	(Range)
RDNO	Whole Regional District	5130	-20%	(-25 to -13)	-31%	(-37 to -23)
	Valley Bottom Only	3640	-22%	(-27% to -15)	-35%	(-41 to -27)
RDCO	Whole Regional District	4810	-20%	(-26 to -13)	-32%	(-39 to -24)
	Valley Bottom Only	3430	-23%	(-29 to -16)	-36%	(-43 to -28)
RDOS	Whole Regional District	5180	-19%	(-26 to -12)	-31%	(-38 to -23)
	Valley Bottom Only	3370	-23%	(-29 to -16)	-37%	(-44 to -27)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Percent Change refers to the projected percent change by the 2050s from the past baseline.
2080 Percent Change refers to the projected percent change by the 2080s from the past baseline.

[18] Heating Degree Days (HDD) is a derived variable calculated by multiplying the number of days that the average daily temperature is below 18°C by the number of degrees below that threshold. For example, if a given day saw an average temperature of 14°C (4°C below the 18°C threshold), that day contributed 4 heating degree days to the total. If a month had 15 such days, and the rest of the days had average temperatures above the 18°C threshold, that month would result in 60 heating degree days.


APARTMENTS
For Inquiries
NO VACANCY



Chapter 5

Precipitation Indicators

Chapter 5

Precipitation Indicators

Precipitation increases can be expected across all seasons, except summer. The largest increases in precipitation will take place during the spring and autumn months. This can lead to more frequent flooding and stress to ecosystems. Conversely, summer is expected to remain the driest season, and become drier on average. Decreases in summer precipitation plus hotter temperatures (and thus increased evaporation) could pose increased risks of wildfires, drought, and associated health impacts. The indicators below offer additional insight into future precipitation trends for the Okanagan and Similkameen watersheds.


LESS SUMMER RAIN


MORE RAIN IN THE SPRING

Total Precipitation

About this Indicator

Total precipitation is all precipitation summed over a month, season, or year, including rain and snow water equivalent. This is a high-level indicator of how precipitation amounts are expected to change.

Projections

- Precipitation increases can be expected year-round, except in summer.
- The largest increases are expected to occur during the spring and autumn months. On average, the region can expect between 10% and 20% more precipitation during these seasons by the 2080s.
- Summer will remain the driest season, and become drier. By the 2080s, the region can expect about one quarter less precipitation than in the past.
- These relative trends are similar across all Regional Districts, as well as in valley bottoms.
- While projections indicate an increase in precipitation year-round for all seasons except summer, the range in models and natural year-to-year variation **could result in some years experiencing extended periods without (or with low) precipitation.**

TABLE 11: SEASONAL PRECIPITATION

			Past (mm)	2050s Percent Change		2080s Percent Change	
				Average	(Range)	Average	(Range)
RDNO	Spring	Whole Regional District	215	12%	(3 to 21)	18%	(13 to 30)
		Valley Bottom Only	98	13%	(2 to 19)	20%	(14 to 30)
	Summer	Whole Regional District	220	-12%	(-32 to 1)	-20%	(-45 to -1)
		Valley Bottom Only	120	-11%	(-29 to 4)	-19%	(-43 to 1)
	Autumn	Whole Regional District	265	10%	(2 to 17)	18%	(8 to 26)
		Valley Bottom Only	116	11%	(3 to 18)	20%	(9 to 28)
	Winter	Whole Regional District	251	7%	(0 to 14)	14%	(1 to 27)
		Valley Bottom Only	109	8%	(-2 to 17)	15%	(3 to 29)
RDCO	Spring	Whole Regional District	148	11%	(1 to 18)	17%	(12 to 25)
		Valley Bottom Only	74	13%	(2 to 21)	19%	(13 to 24)
	Summer	Whole Regional District	156	-14%	(-36 to 2)	-22%	(-48 to -1)
		Valley Bottom Only	95	-12%	(-31 to 4)	-20%	(-46 to 0)
	Autumn	Whole Regional District	181	10%	(2 to 20)	19%	(9 to 29)
		Valley Bottom Only	87	10%	(2 to 20)	19%	(9 to 30)
	Winter	Whole Regional District	188	7%	(-1 to 14)	14%	(3 to 27)
		Valley Bottom Only	89	8%	(-2 to 18)	15%	(3 to 25)
RDOS	Spring	Whole Regional District	156	10%	(0 to 18)	15%	(9 to 21)
		Valley Bottom Only	82	12%	(2 to 21)	17%	(12 to 24)
	Summer	Whole Regional District	142	-17%	(-41 to 2)	-26%	(-56 to -2)
		Valley Bottom Only	96	-14%	(-37 to 3)	-22%	(-50 to 0)
	Autumn	Whole Regional District	192	9%	(0 to 23)	17%	(7 to 27)
		Valley Bottom Only	74	9%	(1 to 18)	16%	(6 to 28)
	Winter	Whole Regional District	220	5%	(-2 to 12)	12%	(3 to 26)
		Valley Bottom Only	76	7%	(-1 to 17)	14%	(4 to 25)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Percent Change refers to the projected percent change by the 2050s from the past baseline.
2080 Percent Change refers to the projected percent change by the 2080s from the past baseline.

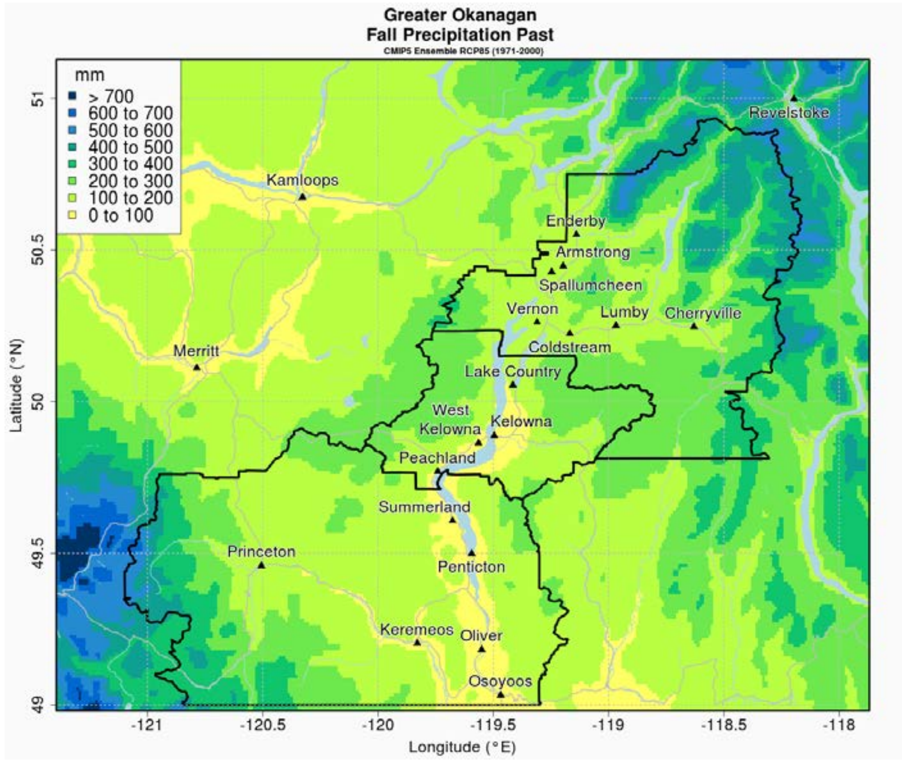


FIGURE 9: AUTUMN PRECIPITATION – PAST

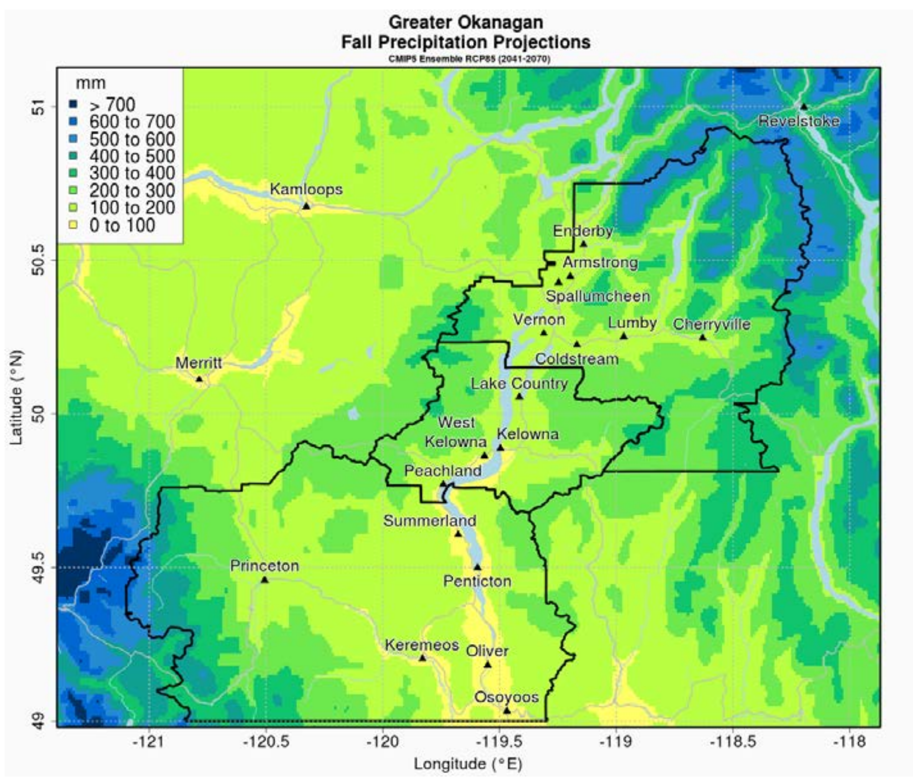


FIGURE 10: AUTUMN PRECIPITATION – FUTURE (2050s)

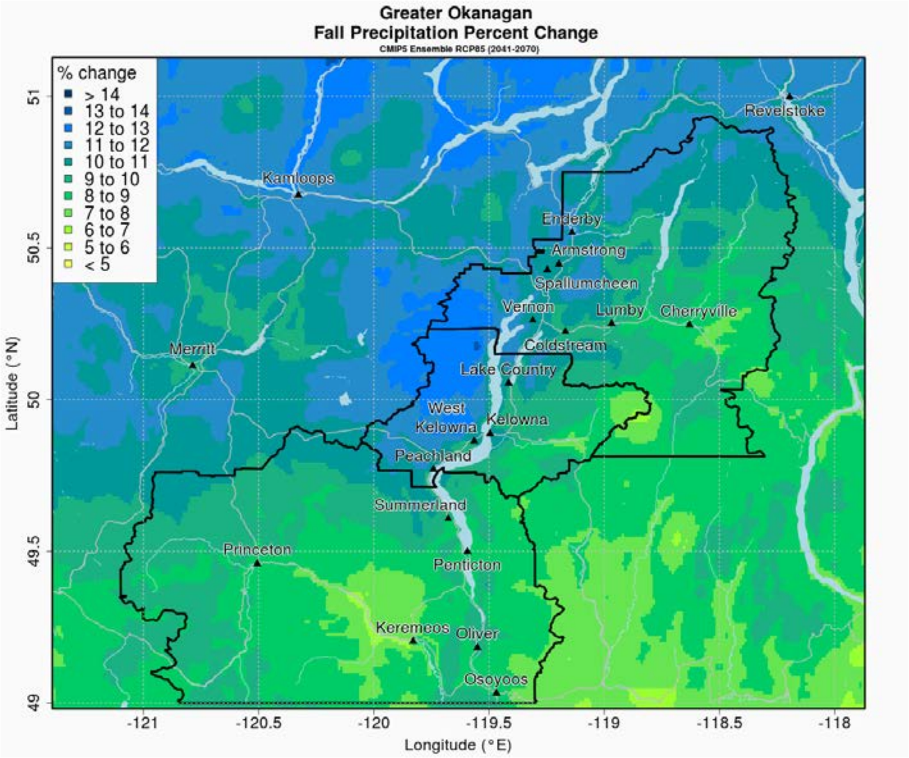


FIGURE 11: AUTUMN PRECIPITATION – PERCENT CHANGE (2050s)

Wettest Day

About this Indicator

Wettest day is the largest amount of rain that falls on any single day of the year, on average.

Projections

- Precipitation volume on wet days will increase.
- In the past, the wettest day of the year (averaged over the region) was 25 mm of precipitation. This will increase by over 10% by the 2050s, and over 20% by the 2080s. This relative change is similar across the region.
- Valley bottoms receive less precipitation than the Regional District average.

Wettest 5 Days

About this Indicator

Wettest 5 days describes the largest amount of precipitation that falls over a period of 5 consecutive days in the year, on average.

Projections

- In the past, the Okanagan's wettest 5 days was about 60 mm of precipitation, on average. This will increase by almost 10% by the 2050s, and by almost 20% by the 2080s. This trend is similar across the Regional Districts.
- Valley bottoms receive less precipitation than the Regional District average.

1-in-20 Wettest Day

About this Indicator

The 1-in-20 wettest day is an indicator of extreme weather. It is a day so wet that it has only a 1-in-20 chance of occurring in a given year. That is, there is a 5% chance in any year that a 1-day rainfall event of this magnitude will occur.

Projections

- In the past, the 1-in-20 wettest day was a day with about 40 mm of precipitation, on average. This is expected to increase by almost 20% by the 2050s, and by over 30% by the 2080s. Similar relative increases are expected quite consistently across the region.
- Similar to the wettest day indicator, valley bottoms receive less precipitation than Regional District averages.

TABLE 12: WETTEST DAYS INDICATORS

			Past (mm)	2050s (%) Change		2080s (%) Change	
				Average	(Range)	Average	(Range)
RDNO	Wettest day of the year precipitation (RX1DAY)	Whole Regional District	26	13%	(3 to 19)	25%	(16 to 34)
		Valley Bottom Only	18	12%	(3 to 21)	21%	(15 to 27)
	Wettest 5-day period of the year precipitation (RX5DAY)	Whole Regional District	62	9%	(1 to 15)	19%	(12 to 23)
		Valley Bottom Only	37	8%	(-4 to 22)	16%	(7 to 26)
	1-in-20 wettest day precipitation	Whole Regional District	36	18%	(2 to 31)	36%	(17 to 51)
		Valley Bottom Only	28	20%	(4 to 44)	29%	(11 to 53)
RDCO	Wettest day of the year precipitation (RX1DAY)	Whole Regional District	22	12%	(2 to 20)	23%	(14 to 29)
		Valley Bottom Only	17	10%	(-3 to 19)	18%	(11 to 24)
	Wettest 5-day period of the year precipitation (RX5DAY)	Whole Regional District	51	8%	(0 to 16)	18%	(13 to 25)
		Valley Bottom Only	32	6%	(-5 to 18)	15%	(7 to 23)
	1-in-20 wettest day precipitation	Whole Regional District	33	18%	(0 to 37)	35%	(10 to 52)
		Valley Bottom Only	26	15%	(-6 to 36)	27%	(3 to 46)
RDOS	Wettest day of the year precipitation (RX1DAY)	Whole Regional District	25	10%	(-1 to 21)	21%	(12 to 30)
		Valley Bottom Only	15	5%	(-11 to 15)	12%	(6 to 23)
	Wettest 5-day period of the year precipitation (RX5DAY)	Whole Regional District	56	6%	(-1 to 15)	17%	(11 to 24)
		Valley Bottom Only	29	2%	(-10 to 11)	10%	(1 to 17)
	1-in-20 wettest day precipitation	Whole Regional District	40	14%	(-7 to 33)	32%	(10 to 50)
		Valley Bottom Only	23	10%	(-4 to 31)	16%	(0 to 32)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Percent Change refers to the projected percent change by the 2050s from the past baseline.
2080 Percent Change refers to the projected percent change by the 2080s from the past baseline.

Precipitation on Wet Days and Very Wet Days

About this Indicator

Precipitation on wet days is an indicator of extreme precipitation. It is the total amount of rain that falls on the wettest days of the year. Precipitation on very wet days is the total amount of rain that falls on the (even more strictly defined) wettest days of the year. Both of these indicators measure total annual precipitation during heavy precipitation events, which is a combination of both how often these events occur (frequency) and the size of these events (magnitude).

Projections

- Precipitation on wet days in the Okanagan is expected to increase by over one quarter of past amounts by the 2050s, and by over one half by the 2080s.
- Precipitation on very wet days in the Okanagan is expected to increase by almost one half by the 2050s, and to almost double by the 2080s.
- Precipitation on wet and very wet days in the North Okanagan is greater than the other Regional Districts.
- These projections indicate a remarkable change in the volume of precipitation that will fall on wet days, especially by the latter half of the century. **In the future, some parts of the Okanagan will get the same volume of precipitation in a single day as was received over the entire autumn season in the past.**
- The region can expect both more frequent and more intense downpours.

TABLE 13: CHANGE IN WET DAYS AND VERY WET DAYS

			Past (mm)	2050s (%) Change		2080s (%) Change	
				Average	(Range)	Average	(Range)
RDNO	Wet Days (R95p)	Whole Regional District	155	33%	(22 to 52)	60%	(32 to 76)
		Valley Bottom Only	77	25%	(13 to 43)	44%	(28 to 61)
	Very Wet Days (R99p)	Whole Regional District	43	63%	(27 to 109)	116%	(61 to 138)
		Valley Bottom Only	22	45%	(12 to 74)	89%	(46 to 122)
RDCO	Wet Days (R95p)	Whole Regional District	113	28%	(15 to 43)	51%	(28 to 64)
		Valley Bottom Only	58	23%	(6 to 38)	39%	(18 to 62)
	Very Wet Days (R99p)	Whole Regional District	32	46%	(16 to 82)	96%	(54 to 123)
		Valley Bottom Only	17	39%	(7 to 80)	74%	(53 to 100)
RDOS	Wet Days (R95p)	Whole Regional District	125	22%	(8 to 39)	29%	(29 to 64)
		Valley Bottom Only	54	12%	(-8 to 25)	27%	(12 to 47)
	Very Wet Days (R99p)	Whole Regional District	37	34%	(5 to 78)	79%	(41 to 107)
		Valley Bottom Only	16	19%	(-32 to 55)	52%	(33 to 90)

TABLE NOTES
Past refers to the time period from 1971 to 2000.
2050 Percent Change refers to the projected percent change by the 2050s from the past baseline.
2080 Percent Change refers to the projected percent change by the 2080s from the past baseline.

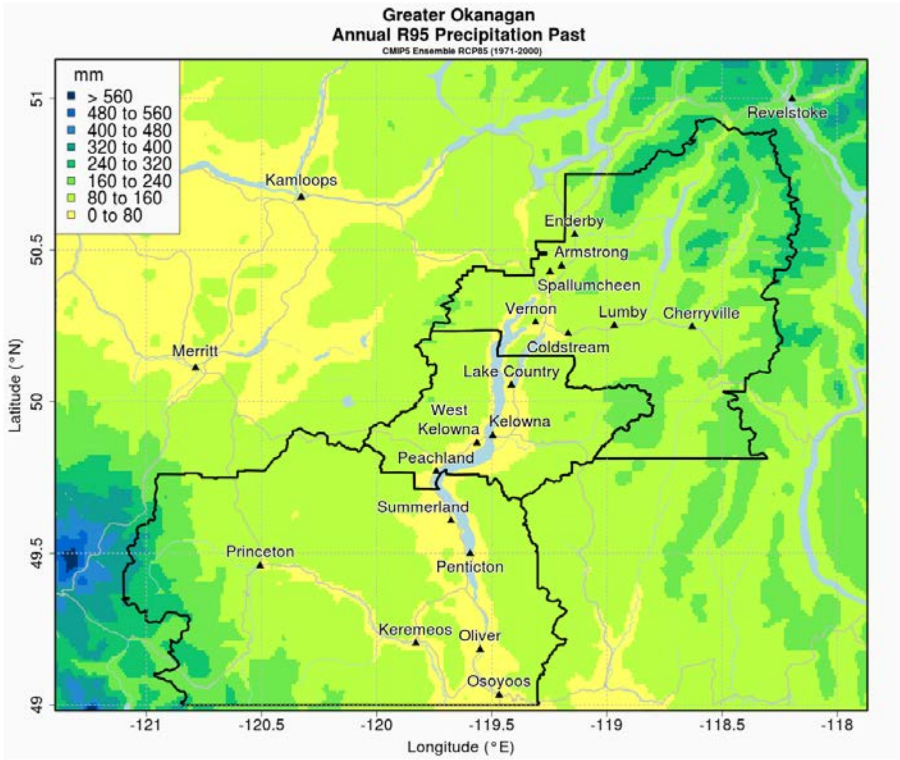


FIGURE 12: WET DAYS – PAST

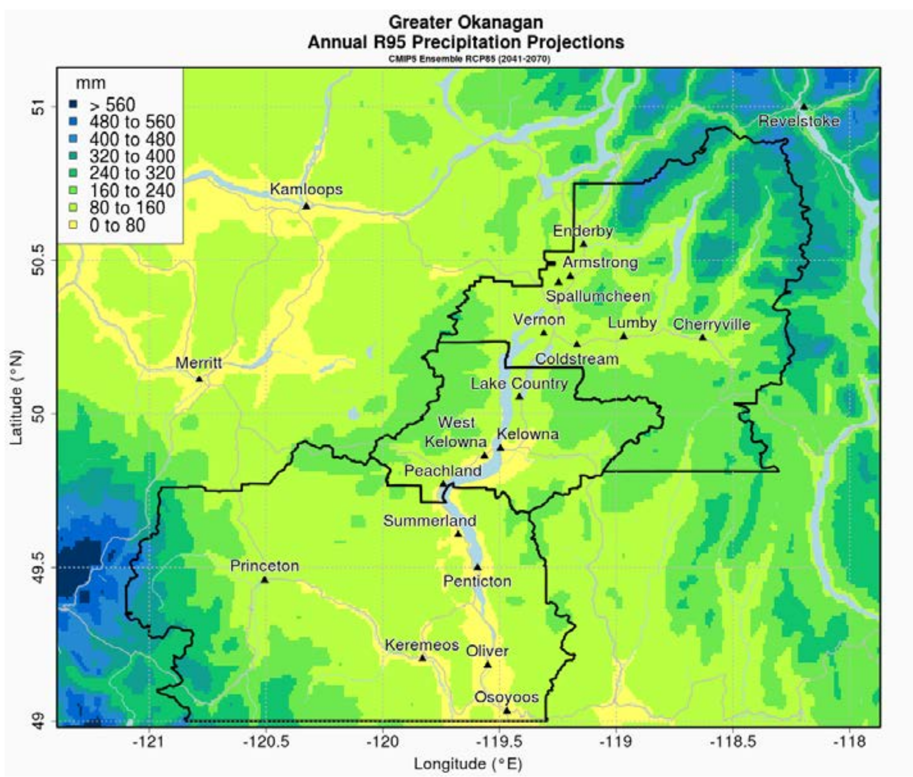
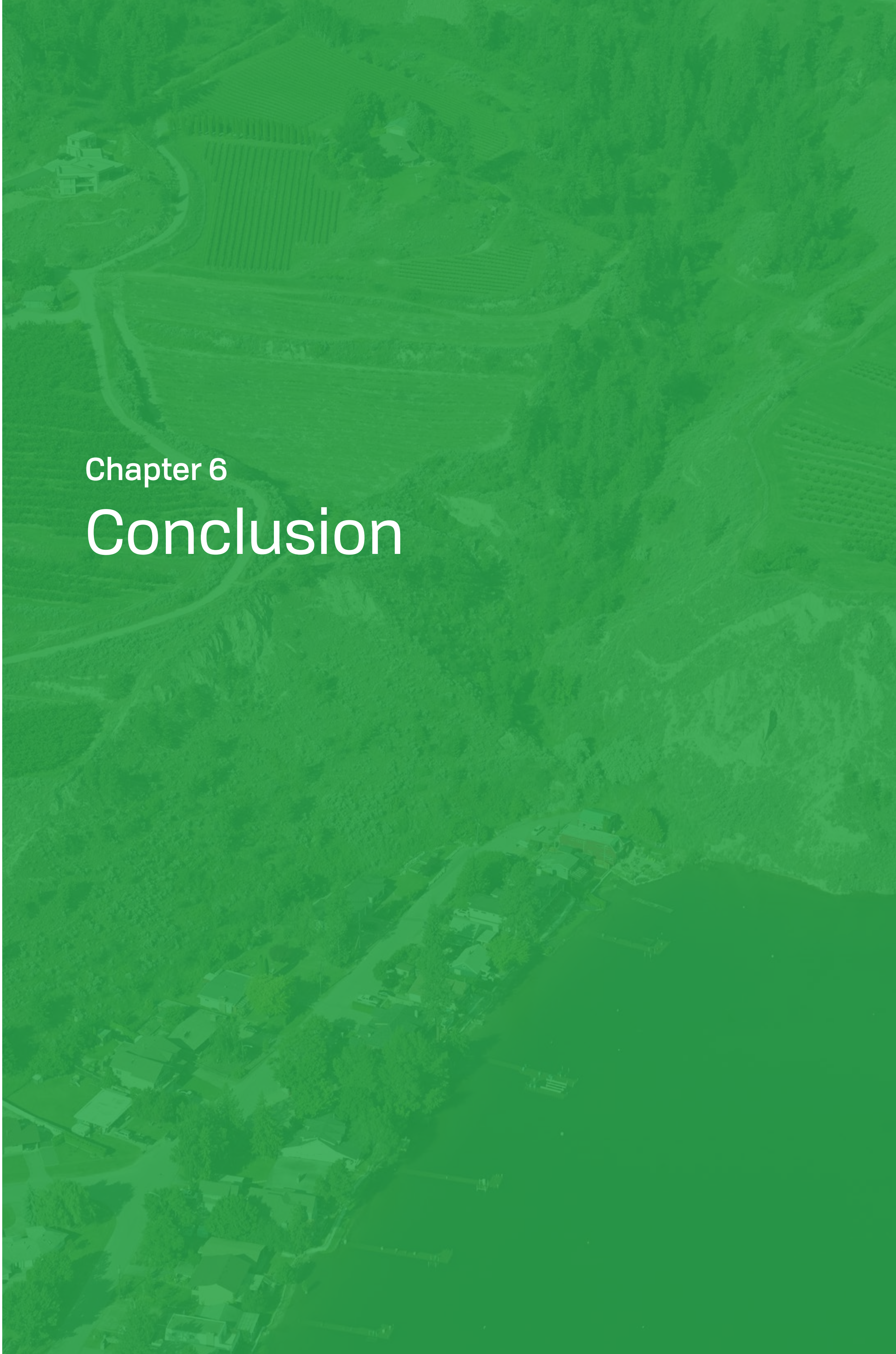


FIGURE 13: WET DAYS – FUTURE (2050s)



Chapter 6

Conclusion

Chapter 6

Conclusion

The climate is changing, and warmer temperatures, stronger storms, and less summer rain will be a growing reality across the region. With these changes, the impacts, including flooding, drought, and more intense wildfires, are expected to become more severe over time.

The time for climate action is now. Sharing this information with a wide range of audiences, including the public, stakeholders, and decision makers will set the foundation for action. As a region, preparing for change involves considering the impacts that the future climate will have on the region when making infrastructure, business, and ecosystem management decisions. Preparing now can ensure that the investments made today will be durable, and able to provide essential services over time.

Aggressive reductions of greenhouse gas (GHG) emissions is a key adaptation strategy, as reductions in global GHG emissions will curb the intensity of change experienced locally. The ability to limit GHG emissions is strongly linked to development patterns—how far apart buildings and communities are placed, and how people and goods move between them. As the region collaborates to prepare to adapt to climate change, communities will need to reduce GH emissions and be designed for the future climate.

Many players in the region are already working towards solutions, including developing climate action plans and land use policy to protect natural ecosystems and assets. This report provides local climate projections to inform the work going forward and help to prepare communities and citizens for the changes ahead.

Appendix 1

Methodology

This appendix offers additional notes on the methods used by climate scientists to produce the projections offered in this report.

Appendix 1

Methodology

Representative Concentration Pathways (RCP)

RCP describe potential 21st century scenarios of greenhouse gas (GHG) emissions, atmospheric GHG concentrations, aerosols, and land use. These RCPs are used for making projections and are based on the factors that drive human-caused GHG emissions: population size, economic activity, lifestyle, energy use, land use patterns, technology adoption, and climate policy. Each of the RCPs directly depends on the choices made by global society.

Climate Model Selection

Many different, highly sophisticated models are used to simulate how Earth's climate will respond to increasing GHGs, each with different strengths and weaknesses. To manage the uncertainty associated with modelling, it is best practice to apply an ensemble approach that uses several models to describe the bounds of projected climate change. The results in this report are based on a subset of climate models selected by PCIC from the Coupled Model Intercomparison Project 5 (CMIP5). The CMIP5 climate models were first screened to remove those that least accurately represented historical data. From the remainder, an ensemble of 12 models was chosen to provide the widest range of projected change for a set of climate parameters. Information from the large-scale global climate models was translated into projections at local scales using a procedure called downscaling. The model projections were downscaled to a ~10-km grid using a historical daily time series of temperature and precipitation (ANUSPLIN) in conjunction with the climate model projections. BCCAQ statistical downscaling was used, which is a hybrid climate analogue/quantile mapping method, for each of three RCPs (8.5, 4.5, and 2.6). These simulations at ~10-km resolution were then draped over an 800-m grid (PRISM) of 1971–2000 average temperature or precipitation to generate high-resolution maps of projected changes in the region.

Indicator Derivation

The historical baseline period used for all indicators in the report is 1971–2000. Values are averaged over this 30-year period to smooth out annual variability. The future projections are for the 2050s (which is an average of modelled values over the 2041–2070 period) and 2080s (2071–2100). The three RCP scenarios described above have somewhat similar GHG concentrations in the 2050s, but diverge considerably by the 2080s. Indicators of climate change take a similar divergent pattern by the 2080s. Many of the indicators of extreme events used in this report are derived using the definitions recommended by the Expert Team on Climate Change Detection and Indices (ETCCDI), known as the CLIMDEX indices. The indicator names in this report have been translated into plain language. In some cases, seasonal and annual versions of CLIMDEX indices were generated by taking the corresponding maximum (or minimum) from the highest (or lowest) monthly values in that season or year.

Interpretation

This report tells the story of how the region can expect temperature, precipitation, and related indices of extremes, to change. When reviewing the data provided in the tables and figures, it is important to note that the 10th to 90th percentile values projected by the ensemble are important for adaptation planning, as they take into account the range of uncertainty when projecting future climate change. Risk managers may find it appropriate to consider 90th percentile values when planning critical infrastructure investments. For some indicators, values for specific geographic areas may be more appropriate than the regional averages presented in the tables.

Appendix 2

Maps by Regional District

This appendix contains maps for each Regional District that correspond to the maps in the main body of the report. They are presented in three sections, each corresponding to one of the three Regional Districts.

Section A: Regional District of North Okanagan (RDNO)

Section B: Regional District of Central Okanagan (RDCO)

Section C: Regional District of Okanagan-Similkameen (RDOS)

Figures are numbered similarly to the main report. For example, the map for RDNO past days above 30°C is labelled Figure A2-3 (RDNO): Days Above 30°C – Past. This relates to Figure 3: Days Above 30°C - Past, which is the map for the entire Okanagan region.

- "A2" denotes that the map is a Figure in Appendix 2.
- "3" denotes that it relates to Figure 3 in the main body of the report.
- "(RDXX)" refers to the specific regional district.

Section A: Maps for Regional District of North Okanagan (RDNO)

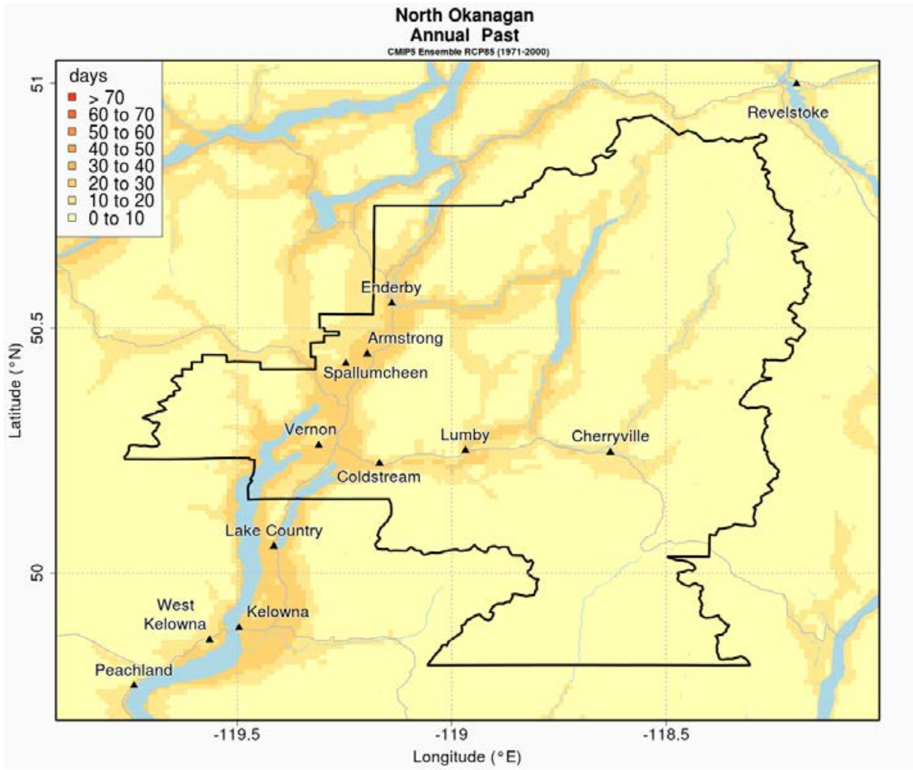


FIGURE A2-3 (RDNO): DAYS ABOVE 30°C – PAST

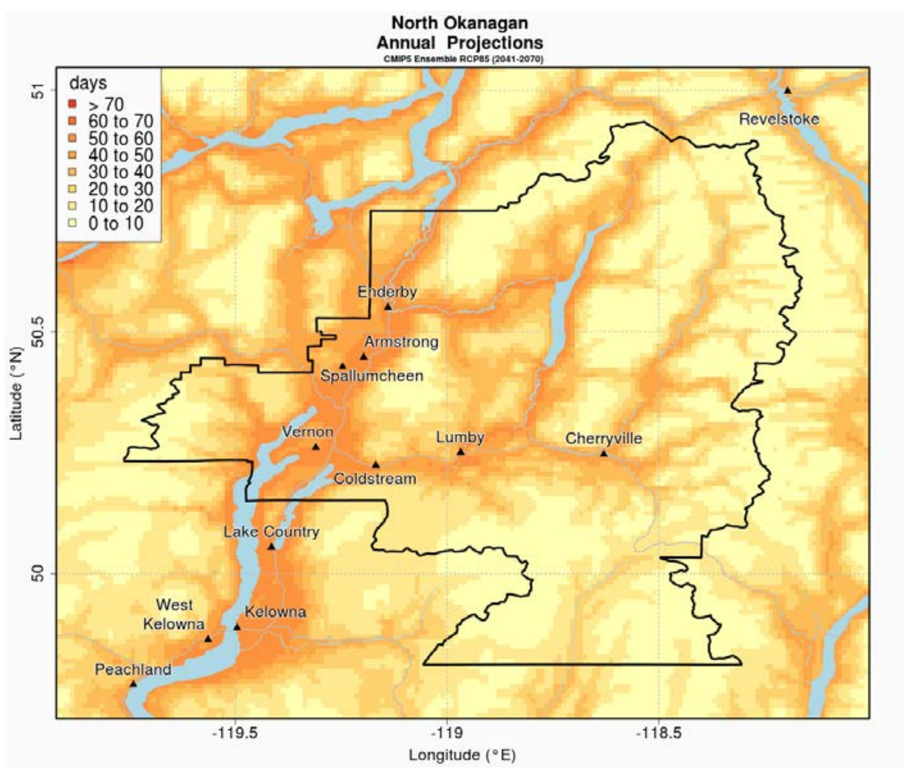


FIGURE A2-4 (RDNO): DAYS ABOVE 30°C – FUTURE (2050s)

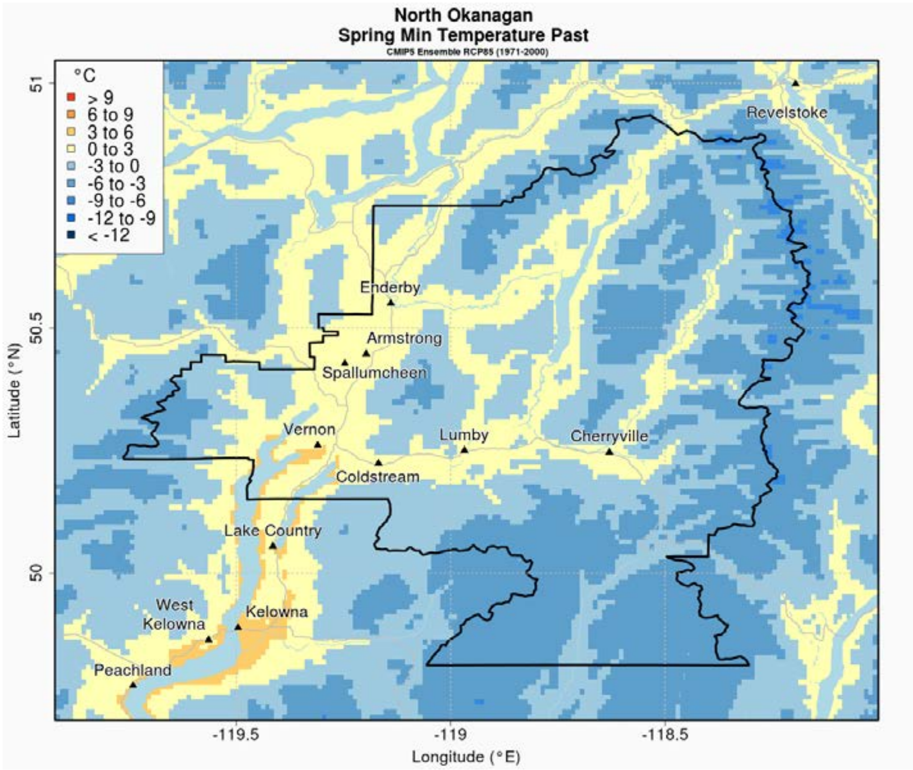


FIGURE A2-5 (RDNO): SPRING NIGHTTIME LOWS – PAST

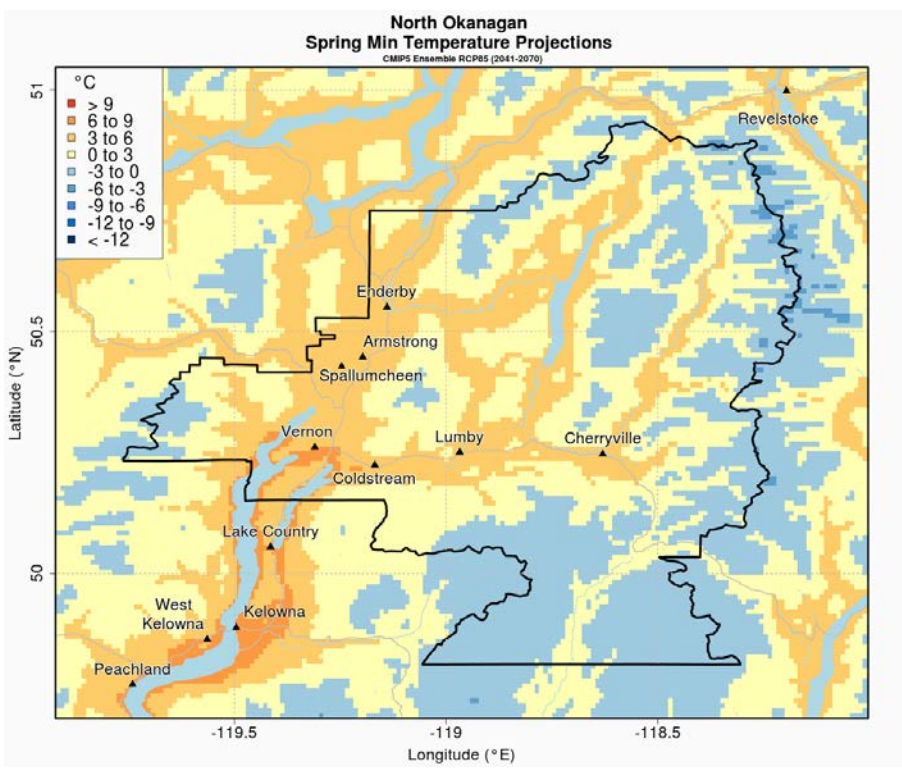


FIGURE A2-6 (RDOS): SPRING NIGHTTIME LOWS – FUTURE (2050s)

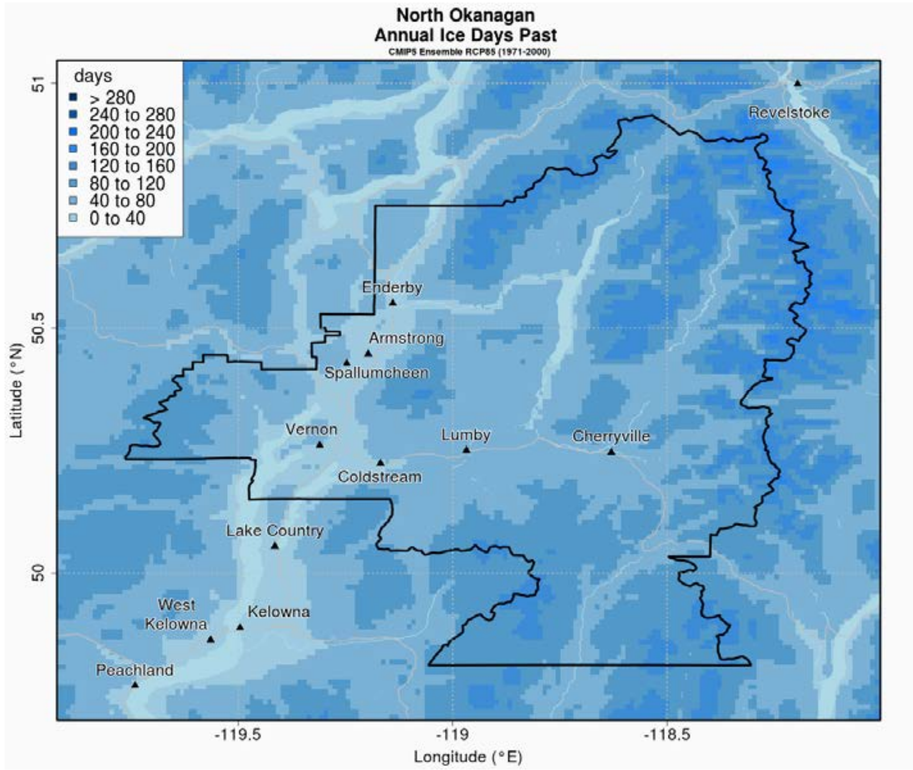


FIGURE A2-7 (RDOS): ICE DAYS – PAST

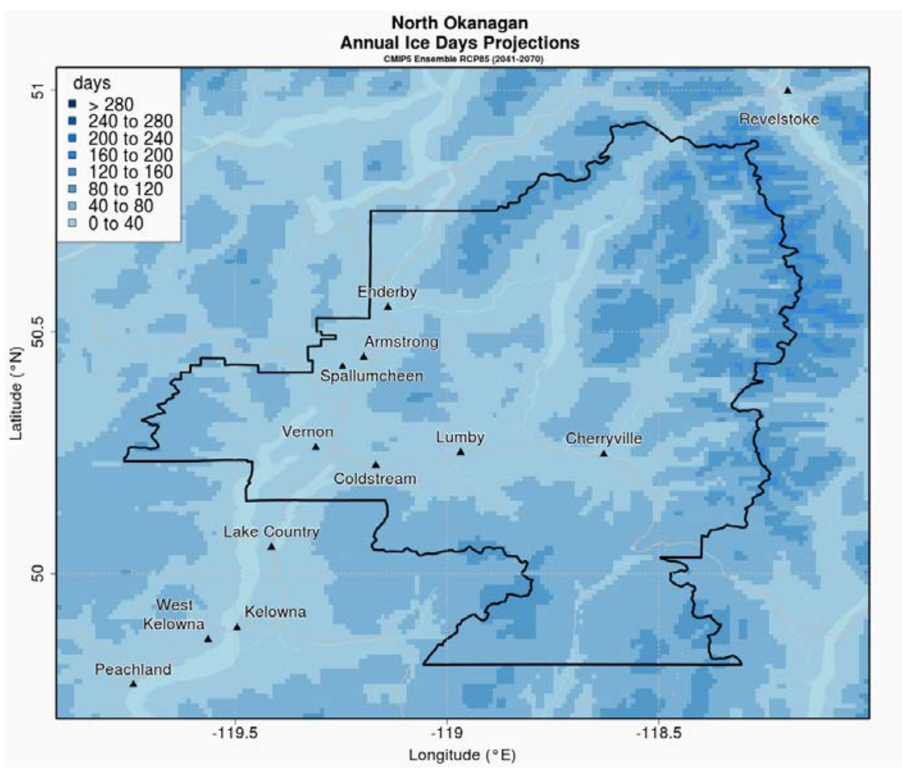


FIGURE A2-8 (RDOS): ICE DAYS – FUTURE (2050s)

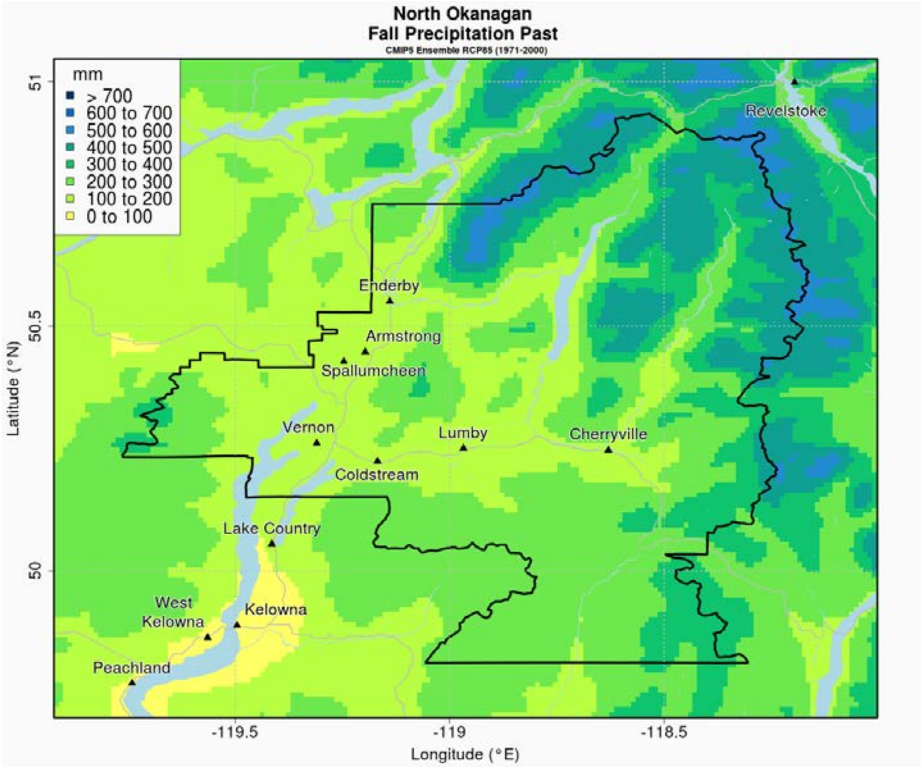


FIGURE A2-9 (RDOS): AUTUMN PRECIPITATION – PAST

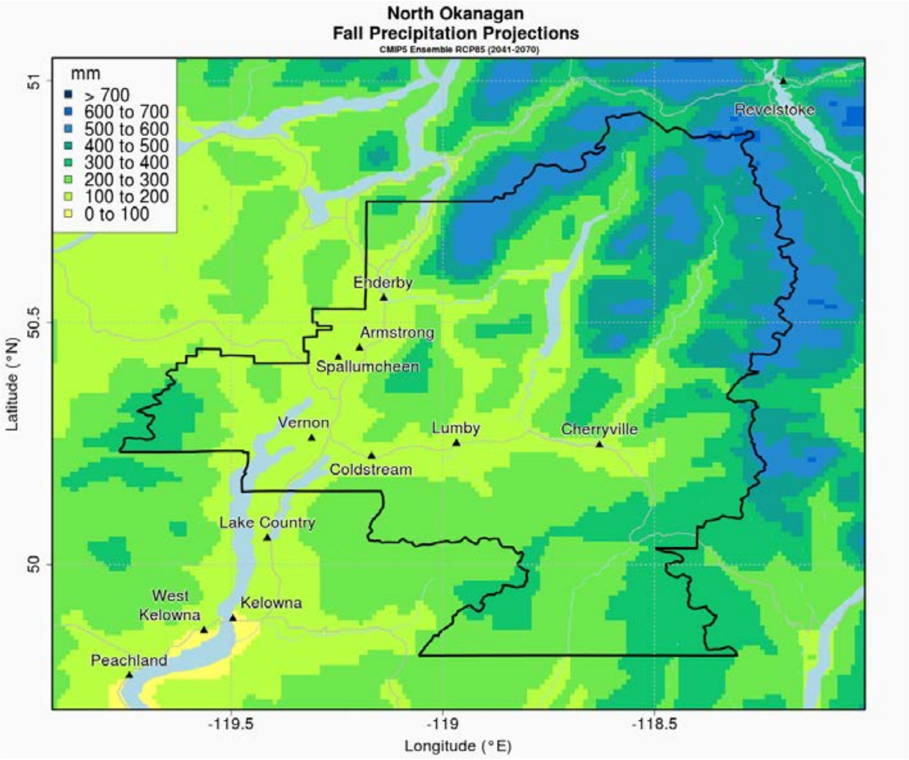


FIGURE A2-10 (RDNO): AUTUMN PRECIPITATION – FUTURE (2050s)

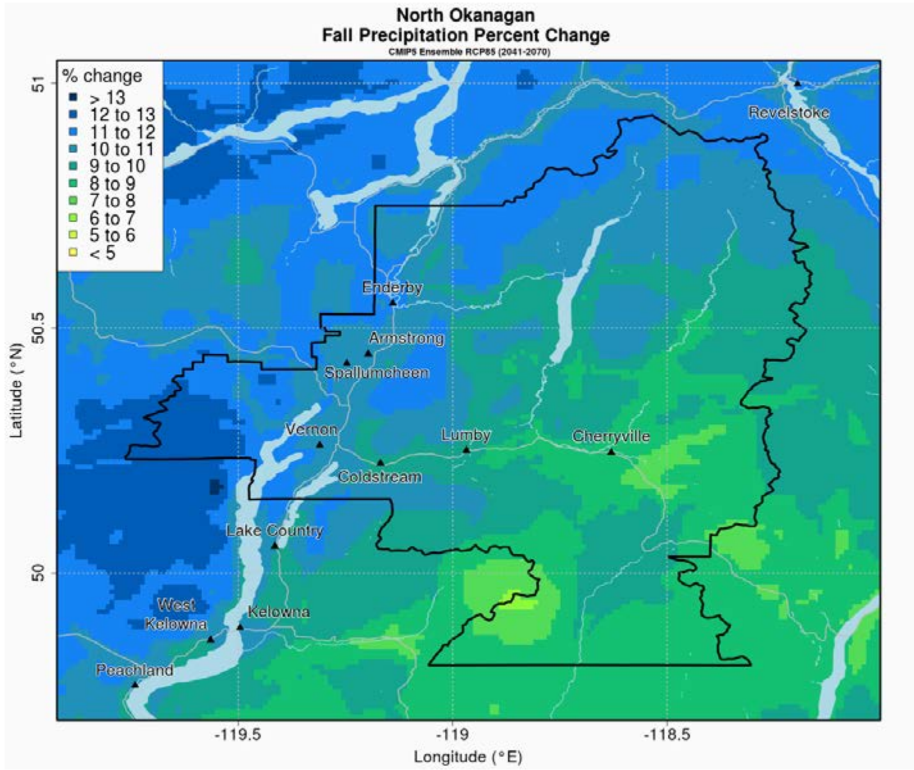


FIGURE A2-11 (RDNO): AUTUMN PRECIPITATION – PERCENT CHANGE (2050s)

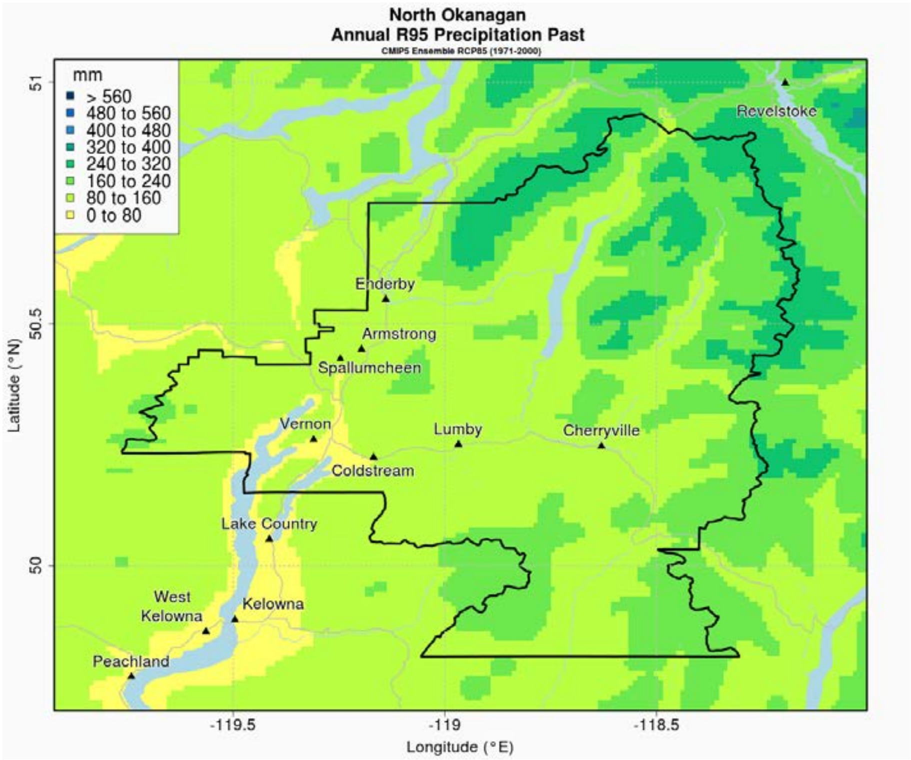


FIGURE A2-12 (RDNO): WET DAYS – PAST

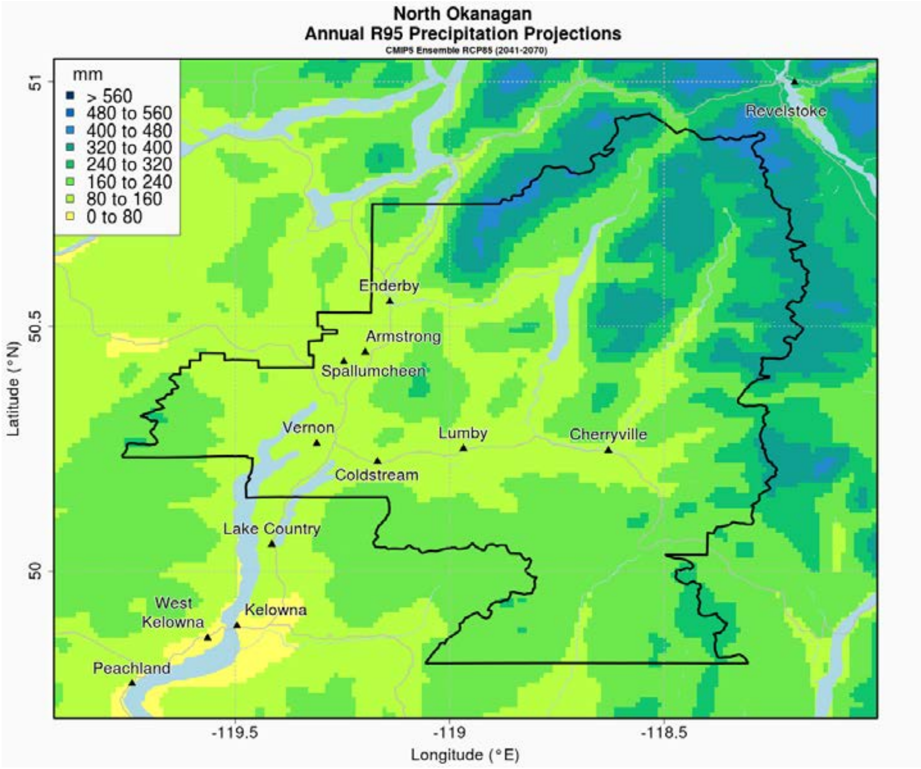


FIGURE A2-13 (RDNO): WET DAYS – FUTURE (2050s)

Section B: Maps for Regional District of Central Okanagan (RDCO)

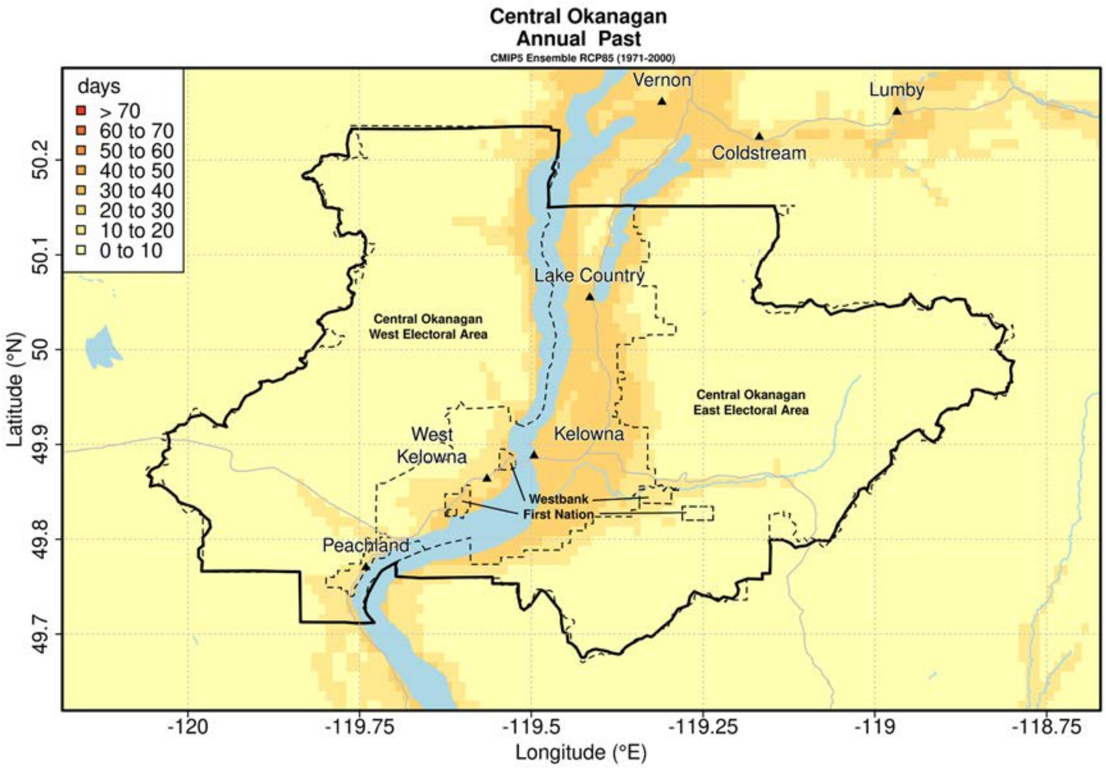


FIGURE A2-3 (RDCO): DAYS ABOVE 30°C – PAST

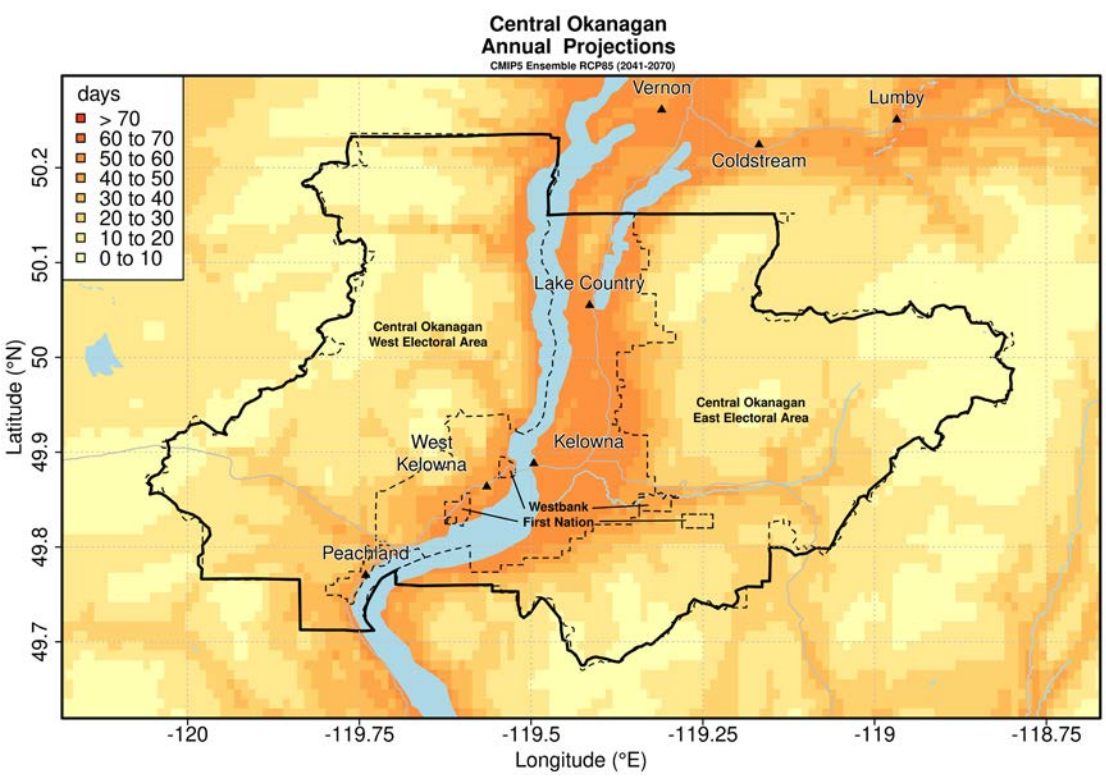


FIGURE A2-4 (RDCO): DAYS ABOVE 30°C – FUTURE (2050s)

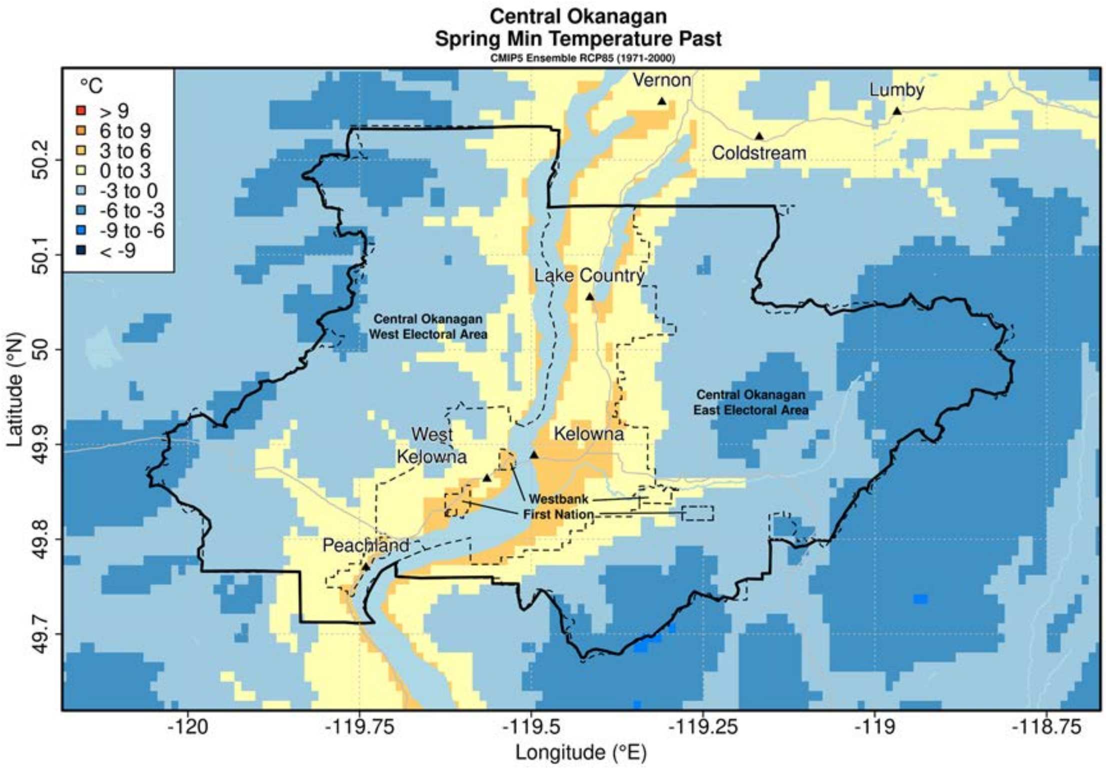


FIGURE A2-5 (RDCO): SPRING NIGHTTIME LOWS – PAST

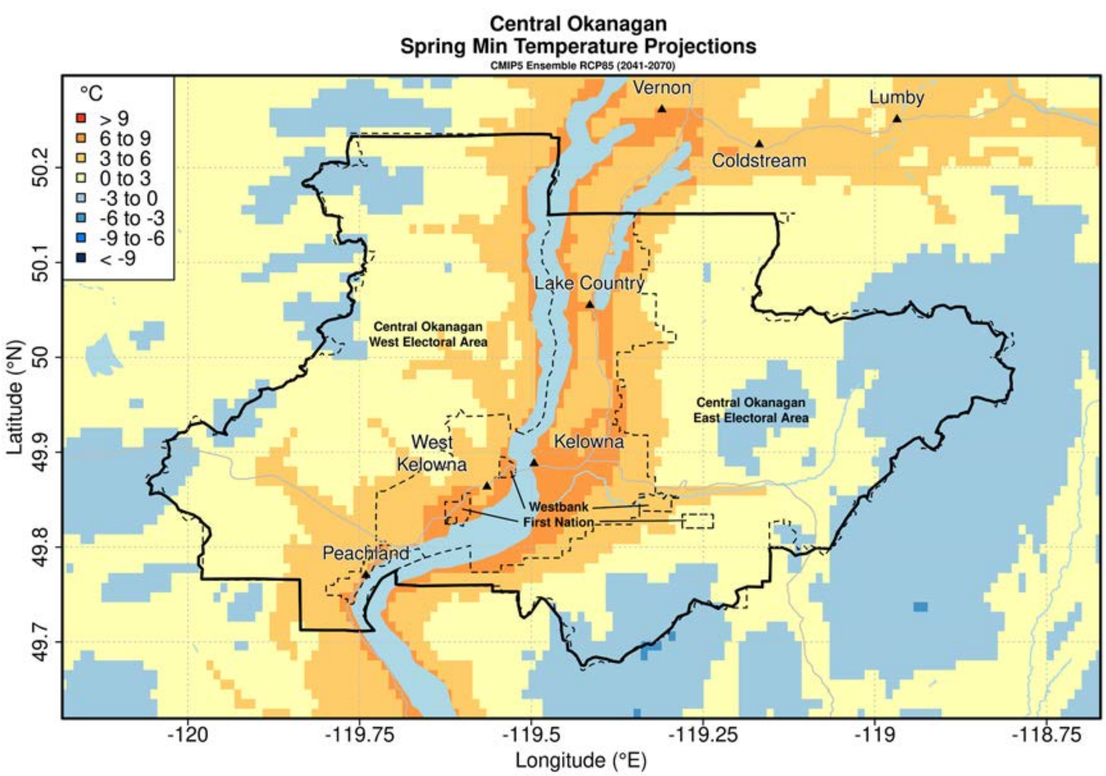


FIGURE A2-6 (RDCO): SPRING NIGHTTIME LOWS – FUTURE (2050s)

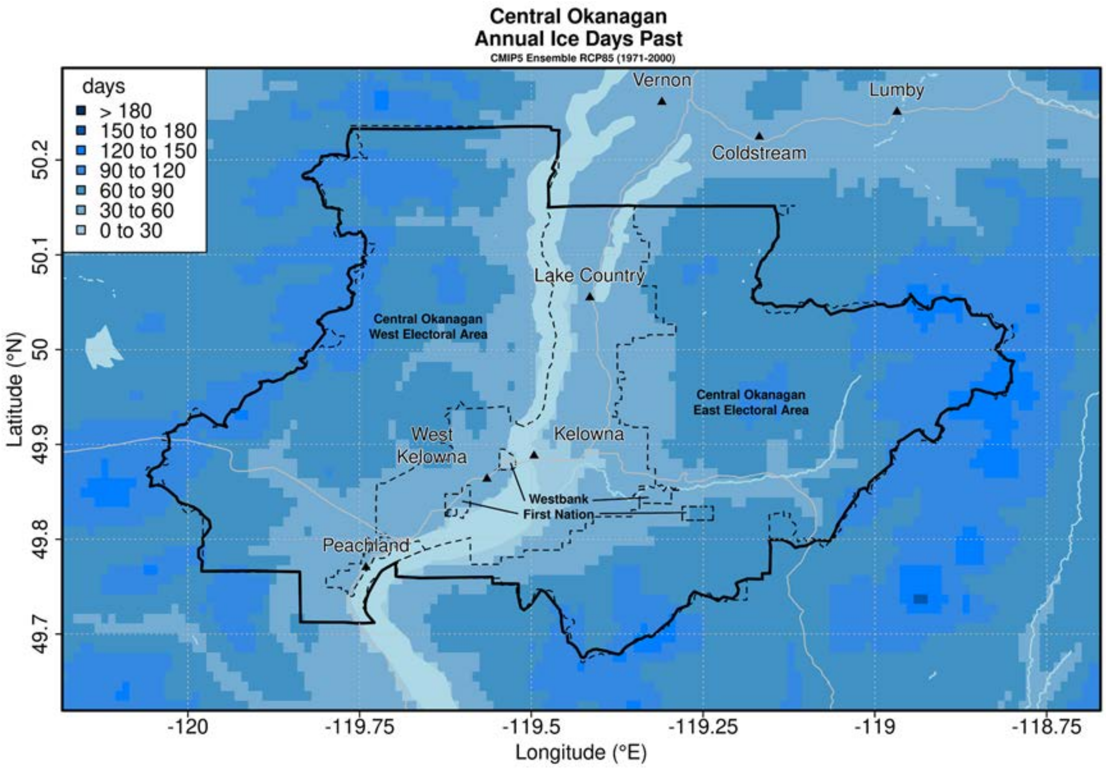


FIGURE A2-7 (RDCO): ICE DAYS – PAST

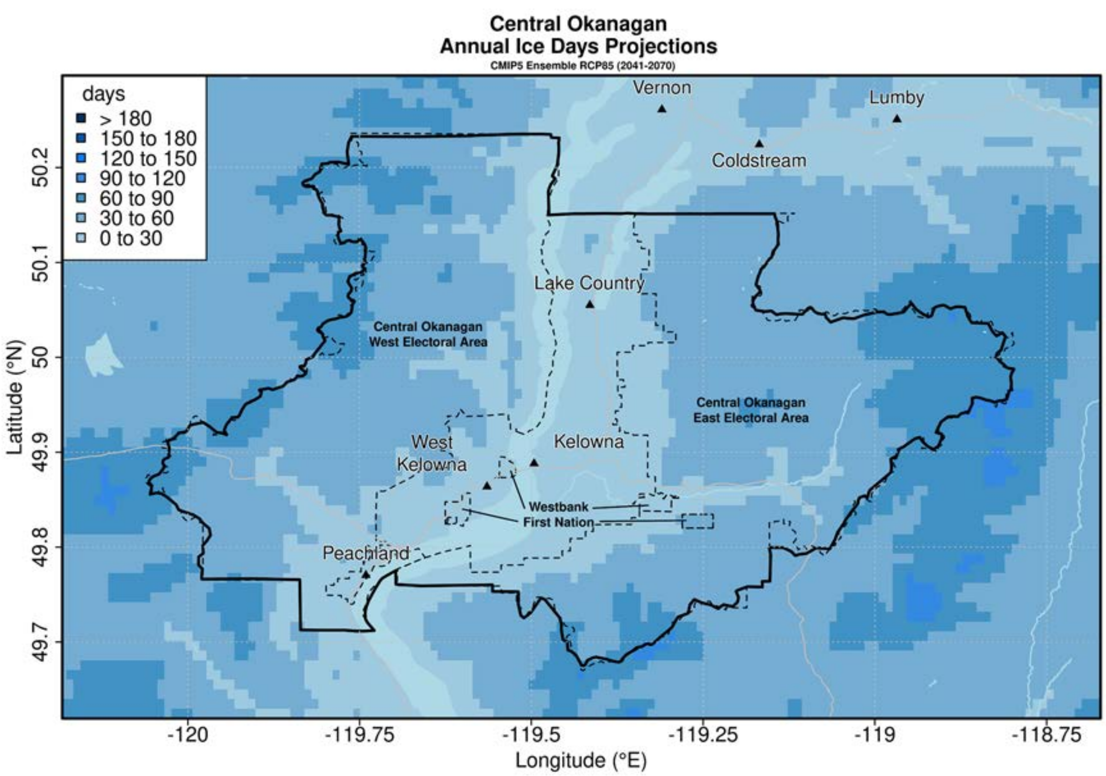


FIGURE A2-8 (RDCO): ICE DAYS – FUTURE (2050s)

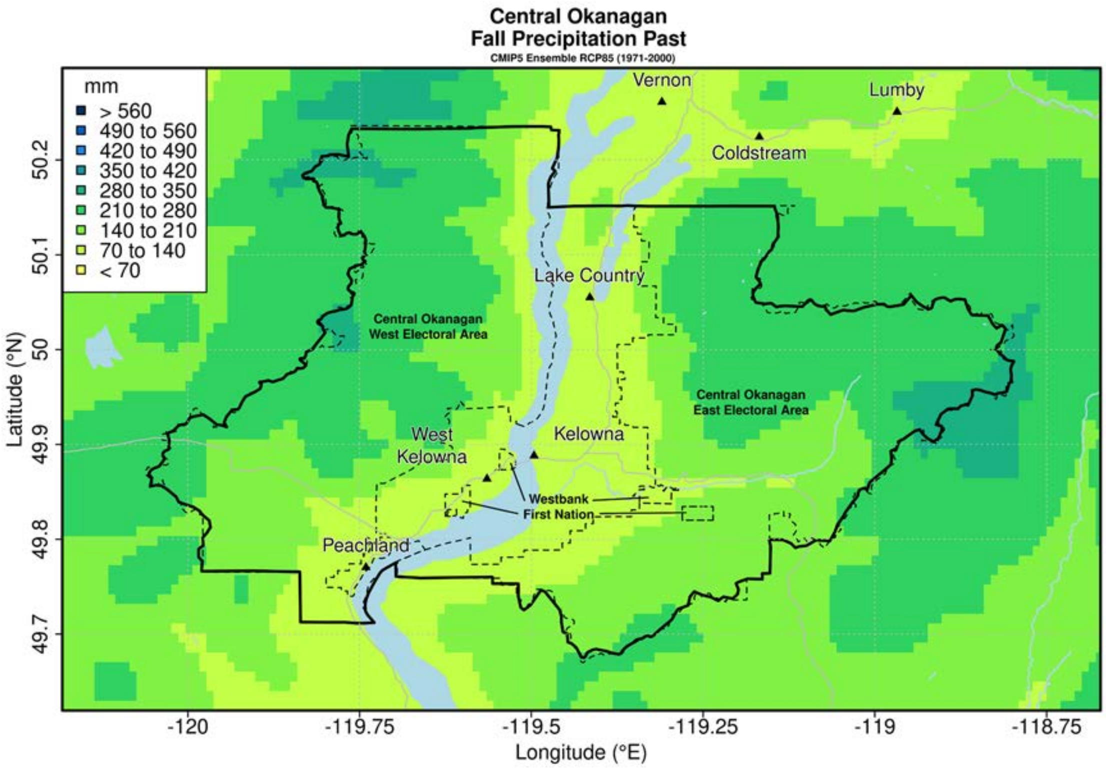


FIGURE A2-9 (RDCO): AUTUMN PRECIPITATION – PAST

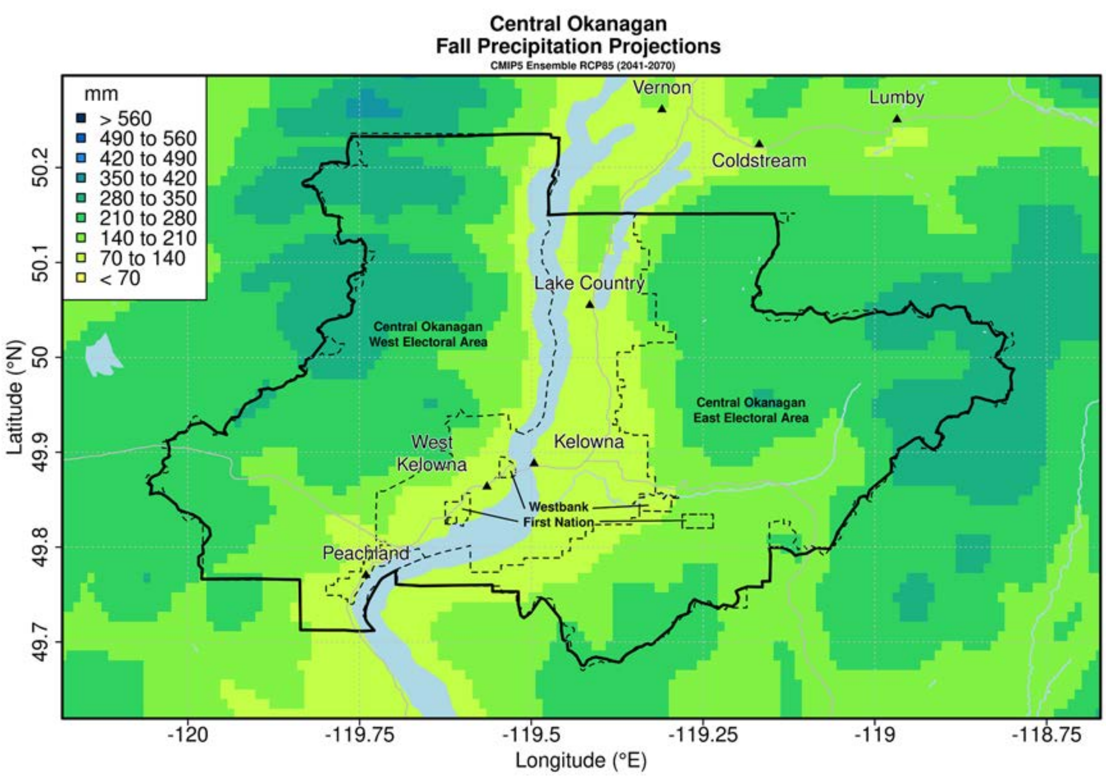


FIGURE A2-10 (RDCO): AUTUMN PRECIPITATION – FUTURE (2050s)

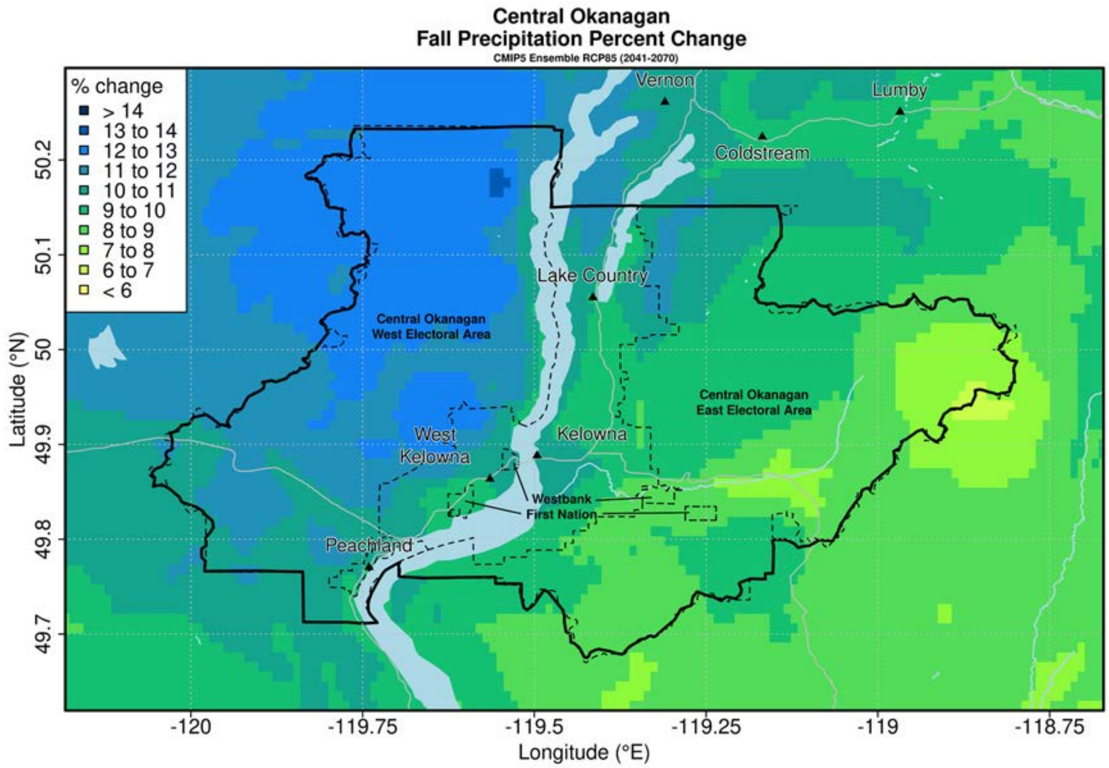


FIGURE A2-11 (RDCO): AUTUMN PRECIPITATION – PERCENT CHANGE (2050s)

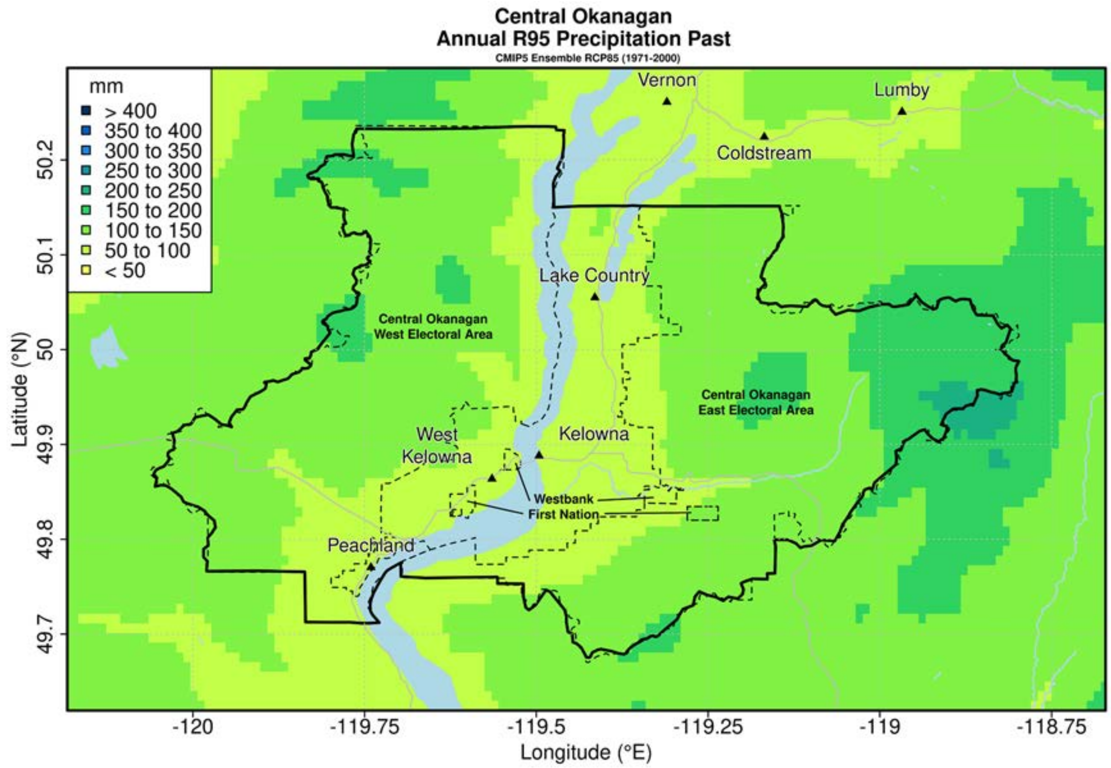


FIGURE A2-12 (RDCO): WET DAYS – PAST

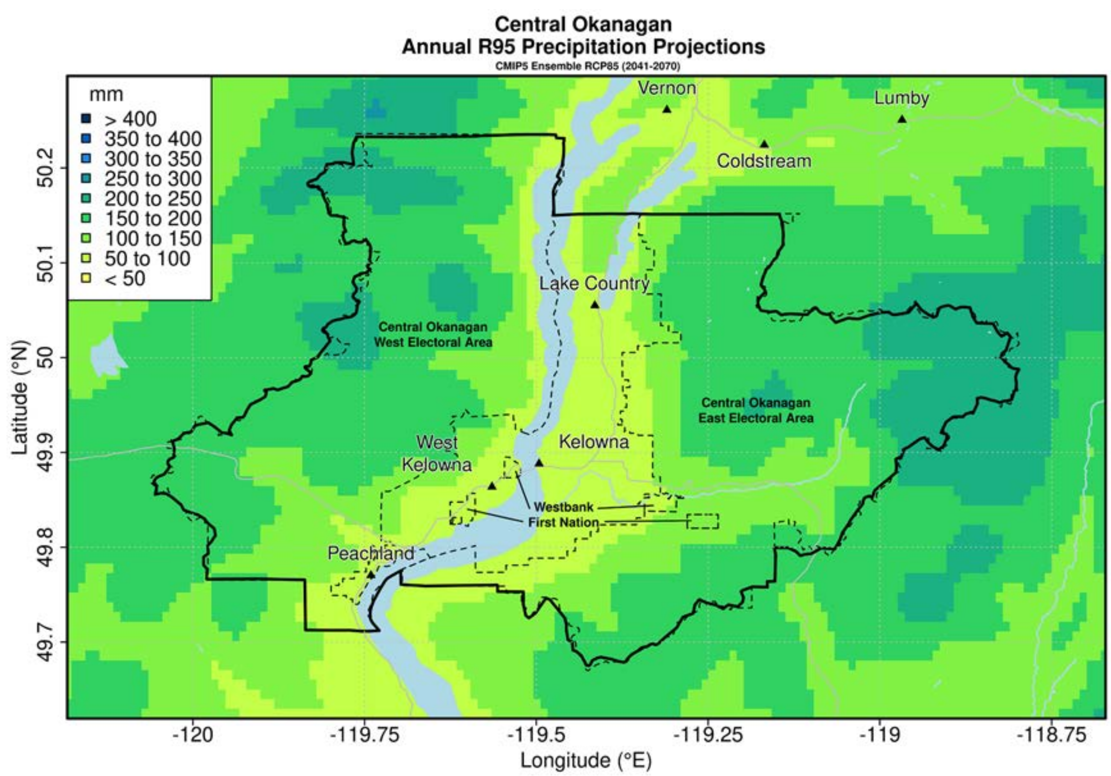


FIGURE A2-13 (RDCO): WET DAYS – FUTURE (2050s)

Section C: Maps for Regional District of Okanagan–Similkameen (RDOS)

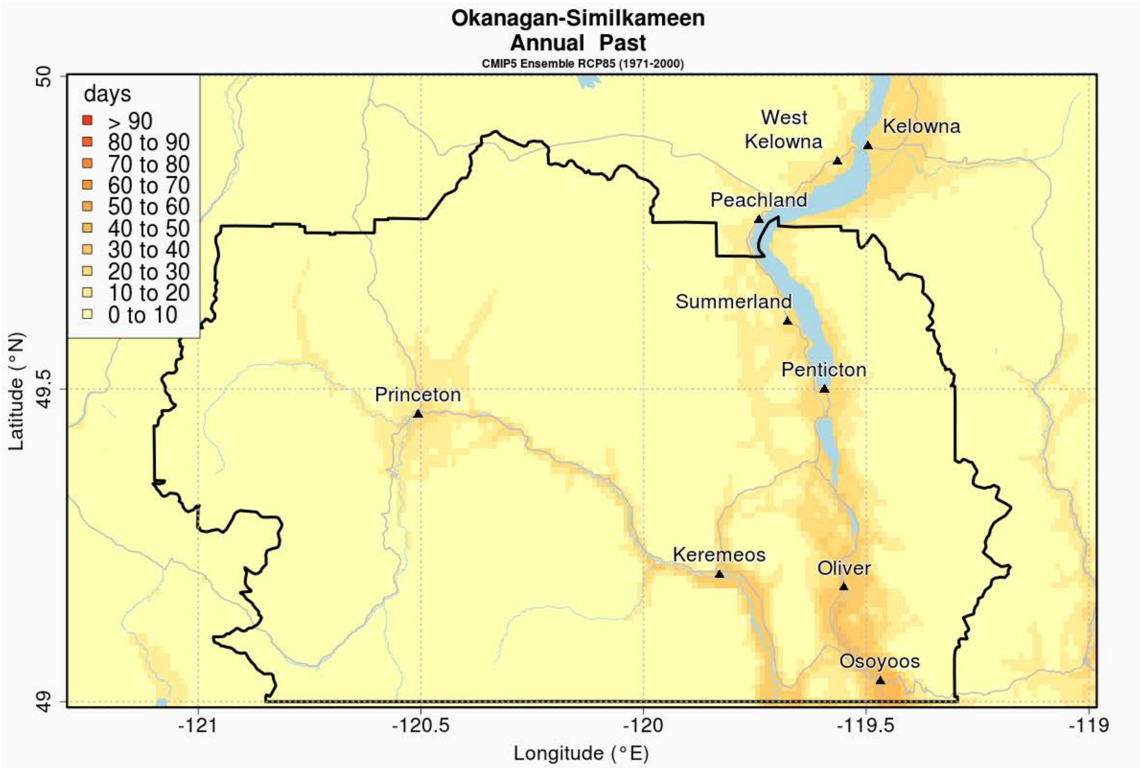


FIGURE A2-3 (RDOS): DAYS ABOVE 30°C – PAST

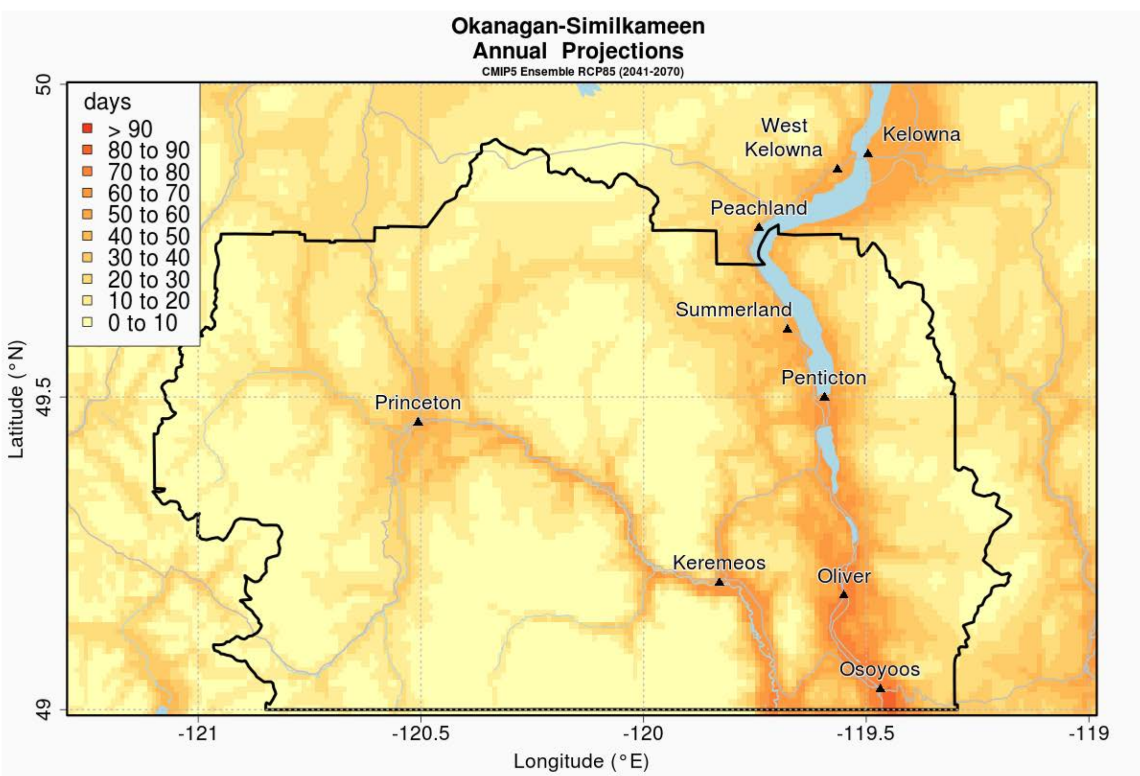


FIGURE A2-4 (RDOS): DAYS ABOVE 30°C – FUTURE (2050s)

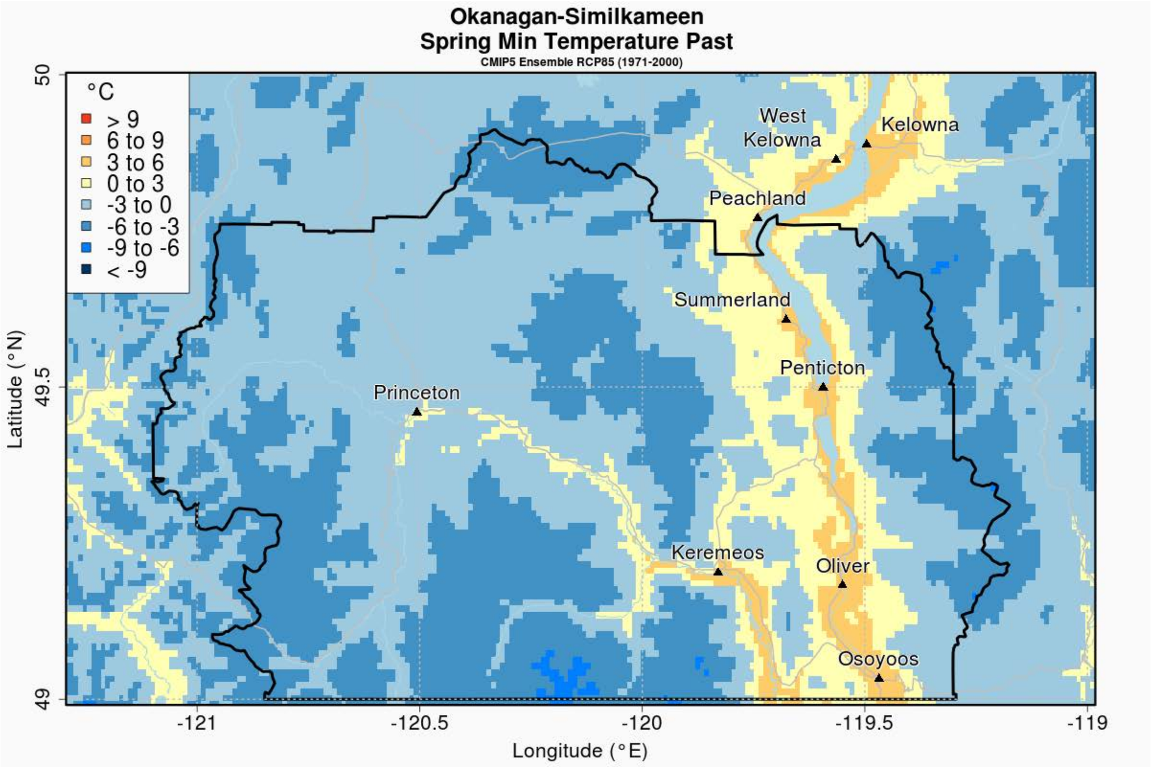


FIGURE A2-5 (RDOS): SPRING NIGHTTIME LOWS – PAST

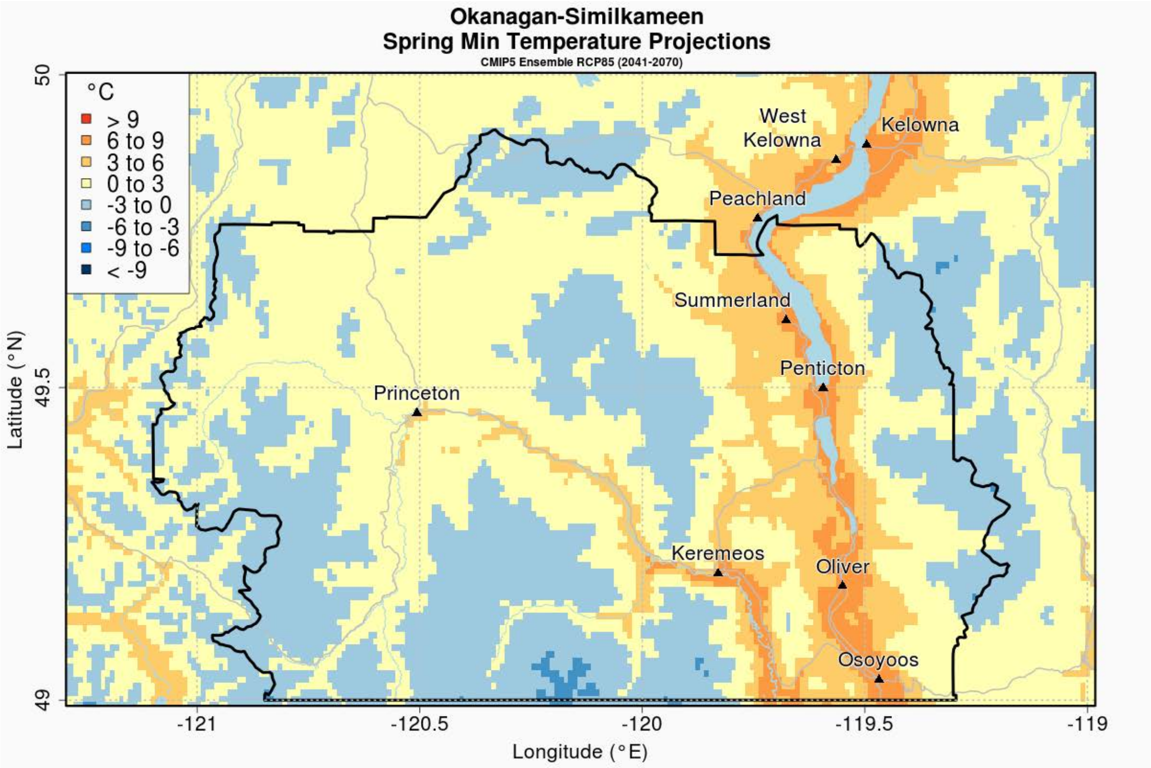


FIGURE A2-6 (RDOS): SPRING NIGHTTIME LOWS – FUTURE (2050s)

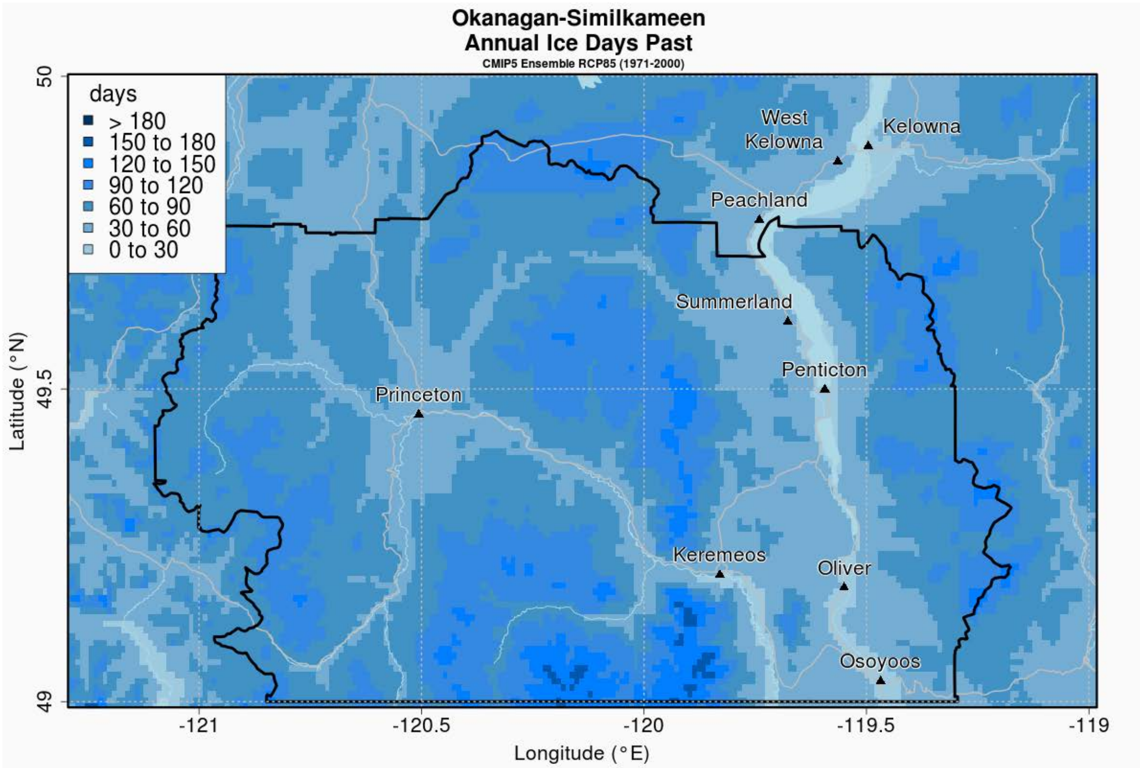


FIGURE A2-7 (RDOS): ICE DAYS – PAST

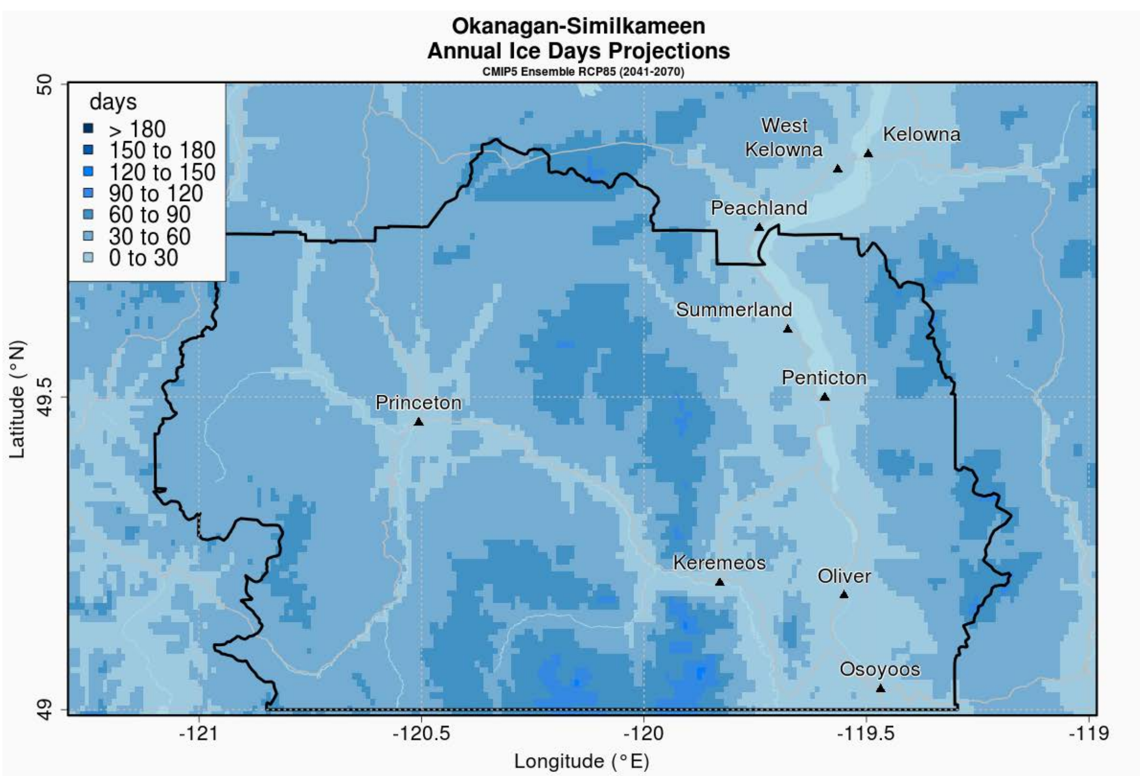


FIGURE A2-8 (RDOS): ICE DAYS – FUTURE (2050s)

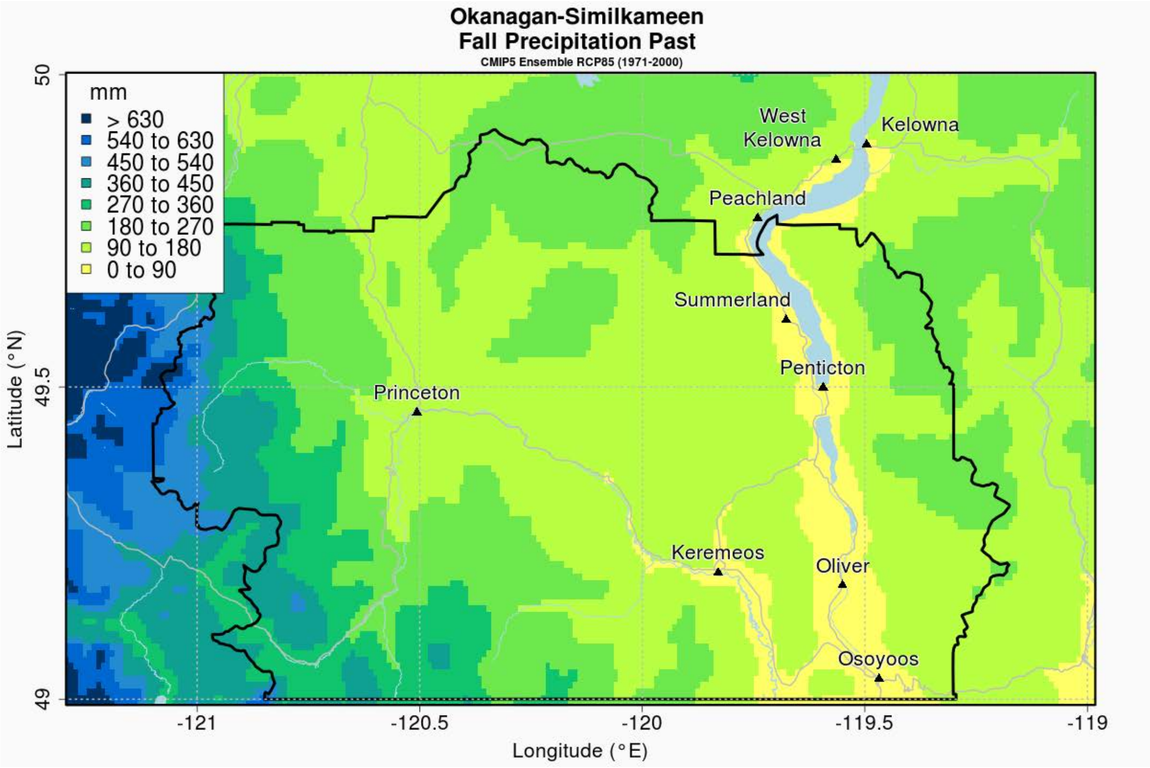


FIGURE A2-9 (RDOS): AUTUMN PRECIPITATION – PAST

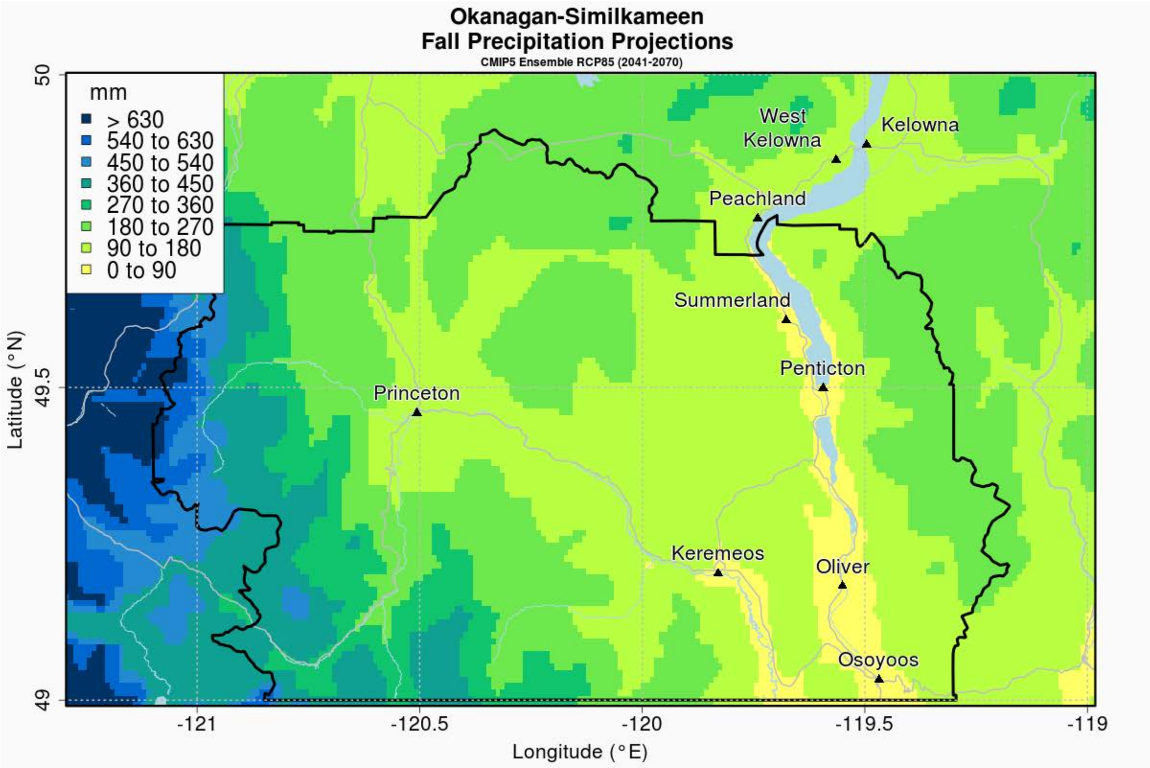


FIGURE A2-10 (RDOS): AUTUMN PRECIPITATION – FUTURE (2050s)

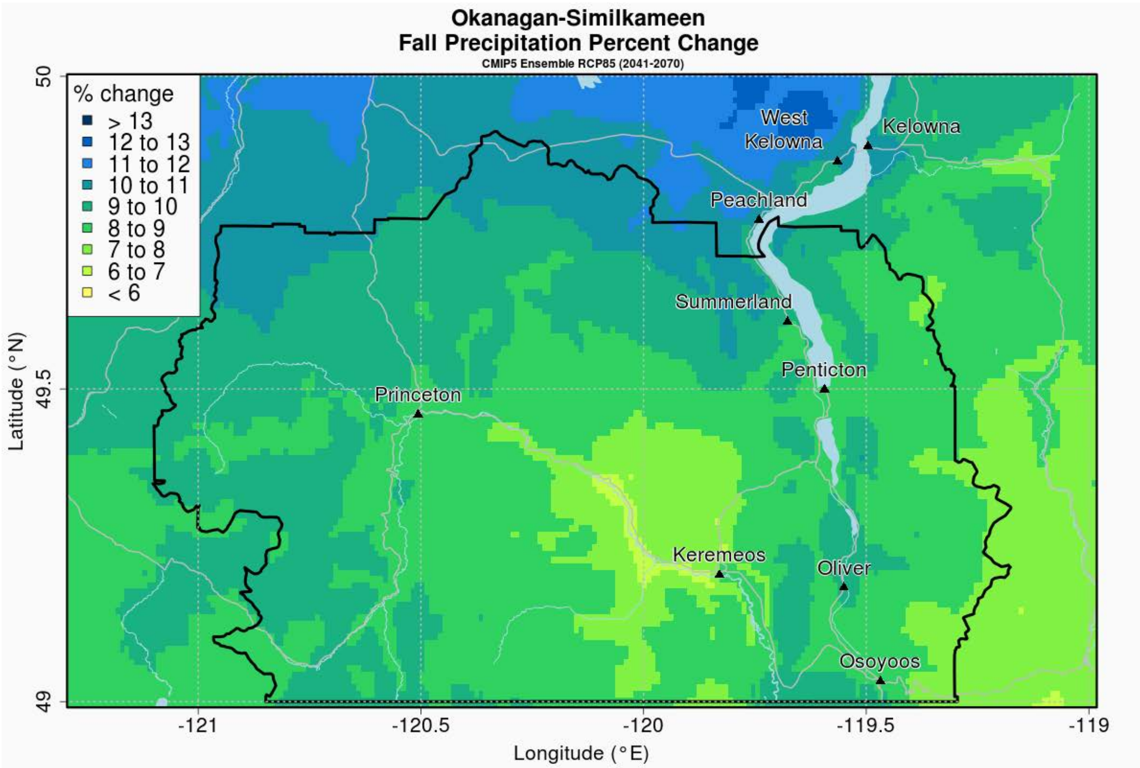


FIGURE A2-11 (RDOS): AUTUMN PRECIPITATION – PERCENT CHANGE (2050s)

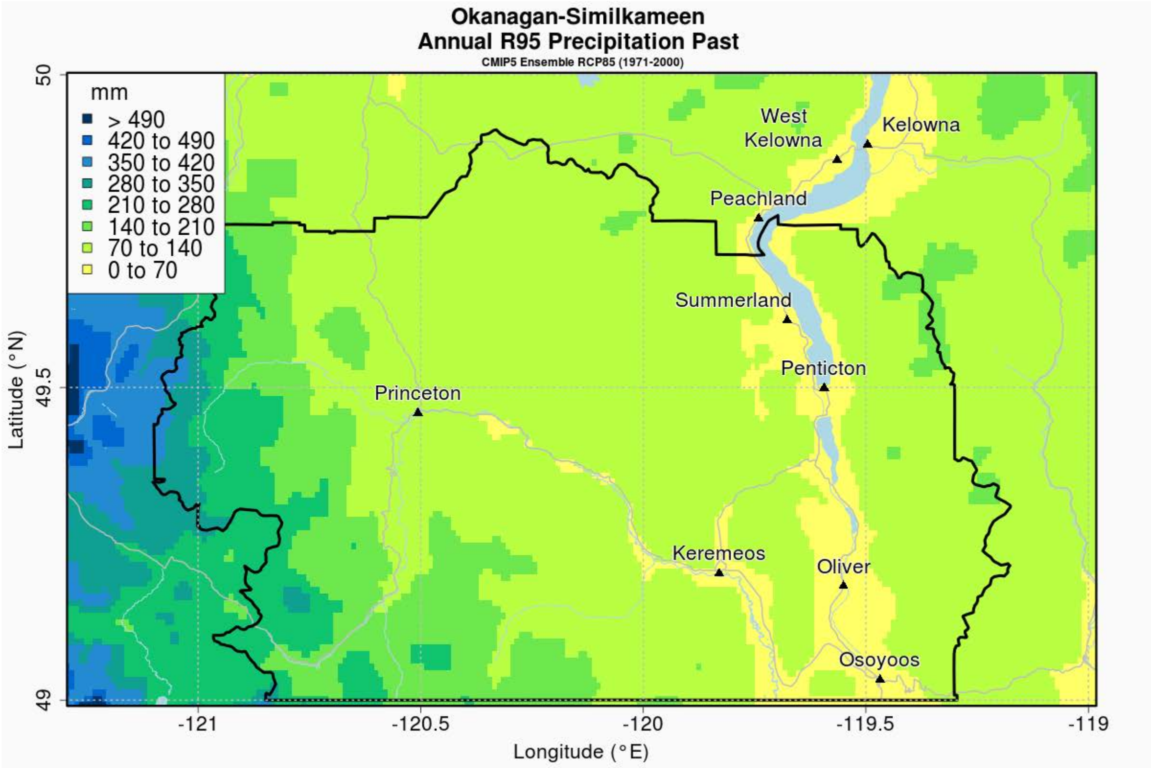


FIGURE A2-12 (RDOS): WET DAYS – PAST

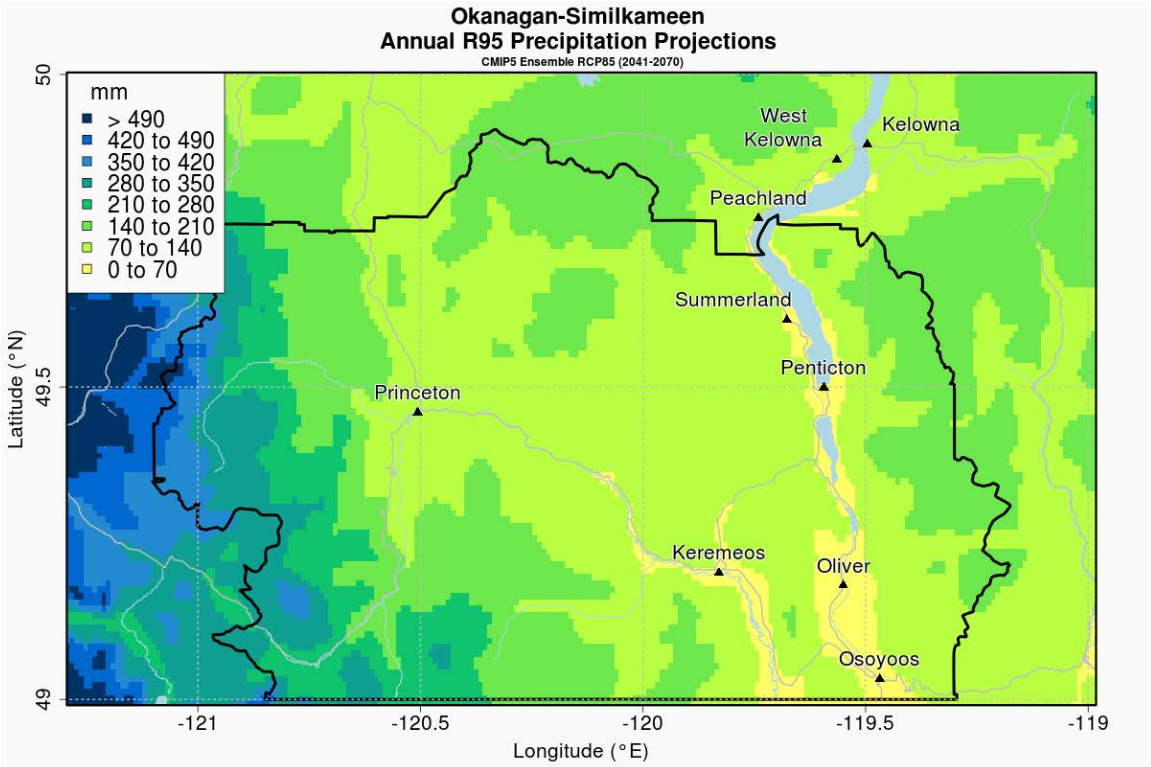
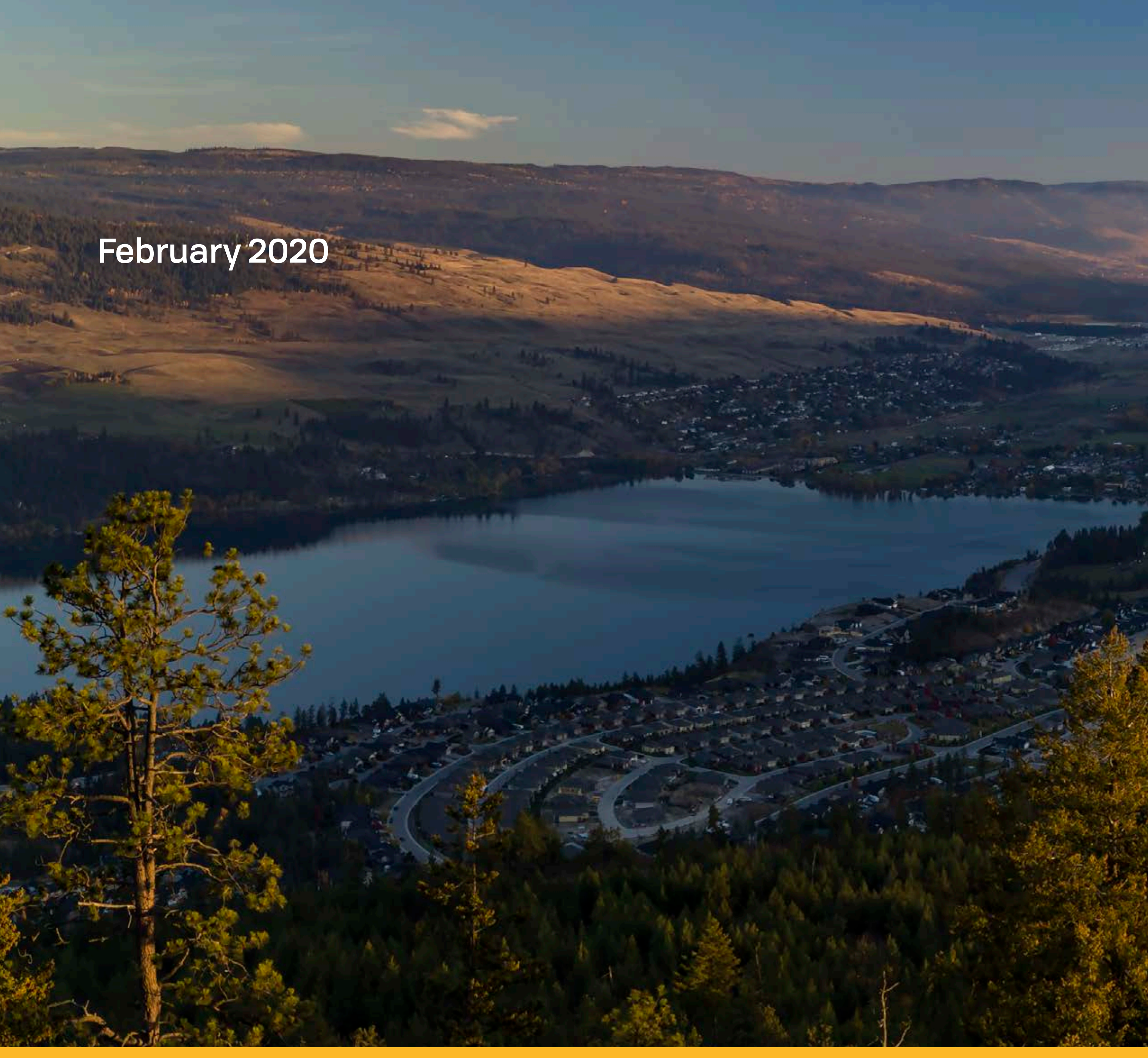


FIGURE A2-13 (RDOS): WET DAYS – FUTURE (2050s)



February 2020

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Regional District of Central Okanagan

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