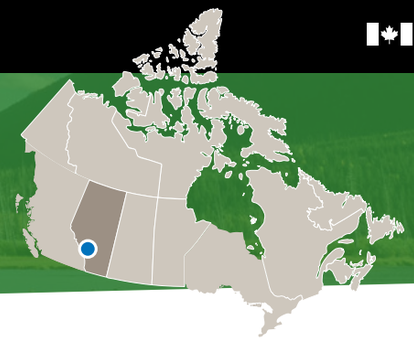
Parks Canada Parcs Canada

Canada

Banff National Park

Climate summary



Elev. range: 1325 to 3612 m
Area: 6641 km²
Latitude: 51.541658°N
Longitude: -116.117195°W

About Banff National Park

Banff National Park protects 6,641 km² of rugged peaks, icefields and glaciers, alpine meadows, lakes, rivers, and thermal springs within the main and front ranges of the Rocky Mountains. The Park's land and waters are places of immense ecological, cultural, and historical significance and lie within Treaty 6, 7, and 8 territories and the Métis homeland. Banff contains the headwaters of the Bow, Red Deer, and North Saskatchewan rivers, which are the water sources for millions of people living downstream, and provides important habitat for 56 species of mammals, 300 species of birds, and more than 800 species of plants. Banff National Park encompasses two communities, contains major transportation corridors, is part of the UNESCO Canadian Rocky Mountain Parks World Heritage Site, and is Canada's most popular national park, welcoming over 4 million visitors each year. Visitors and residents alike enjoy the many activities Banff offers, such as hiking, mountaineering, backcountry camping, cycling, paddling, and skiing.

Changes in temperature

Banff National Park, much like the rest of Canada, is warming faster than the global average. If emissions continue to increase at the current rate, then by 2051-2080, the average annual temperature in the park is projected to increase by about 3 to 6 degrees relative to the recent past. The effects of a warming climate include hotter maximum temperatures, warmer minimum temperatures, fewer days below zero per year, fewer very cold days per year, and longer frost free seasons. Warmer temperatures will result in increased glacial melt, alpine permafrost thaw, and reduced duration of the winter snowpack in Banff National Park. Additionally, a warmer climate will likely intensify some weather extremes, increasing the frequency and severity of heatwaves, droughts and wildfires.

Changes in precipitation and water availability

Within Banff, total annual precipitation is projected to increase by 2051-2080. However, climate models suggest the potential for a decrease in precipitation during the summer months. Models also project an increase in precipitation extremes (e.g. heavy precipitation events) over that same time period. For example, the maximum amount of rainfall over a 5-day period is expected to increase by 14% under a high emissions scenario, relative to the recent past. Seasonal changes in temperature and precipitation (see the *Climograph*, p.2) will likely combine to influence the hydrology of Banff National Park. For instance, rising temperatures can cause more precipitation to fall as rain rather than snow, and alter the timing and magnitude of peak stream flows in spring.

Variable	Recent past[1] 1961-1990	Moderate emissions future[2] 2051-2080	High emissions future[2] 2051-2080
Average annual temperature	-1.8 °C (-1.9 to -1.6)	1.1 °C (0.7 to 2.7)	2.3 °C (1.7 to 4.4)
Hottest day of the year	23.0 °C (22.2 to 23.5)	26.7 °C (25.5 to 29.4)	28.8 °C (27.4 to 31.9)
Days per year above 25°C	1 (0 to 1)	8 (4 to 21)	16 (11 to 37)
Days per year below -15°C	67 (65 to 70)	44 (37 to 49)	37 (26 to 45)
Frost free season (days)[3]	46 (41 to 52)	98 (82 to 120)	115 (95 to 135)
Total annual precipitation (mm)	1185 mm (1156 to 1208)	1262 mm (1181 to 1357)	1284 mm (1187 to 1368)
Maximum 5-day precipitation	77 mm (74 to 83)	85 mm (78 to 93)	88 mm (79 to 95)
Wet days (> 10 mm)	31 (29 to 33)	35 (31 to 41)	37 (32 to 42)

Projected climate values for Banff National Park

Larger values denote the median of an ensemble of 26 climate models; values in brackets denote the 10th and 90th percentile values.

[1] The recent past was computed using historical model simulations.

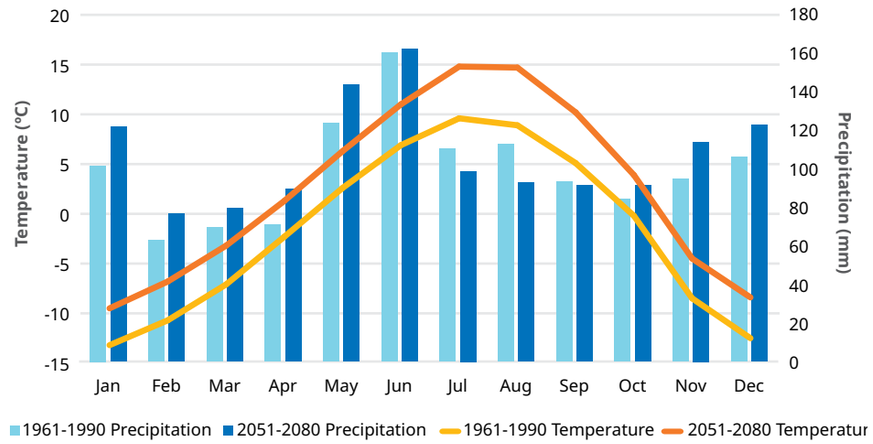
[2] The 'moderate emissions future' refers to Shared Socioeconomic Pathway 2 (SSP2-4.5) and 'high emissions future' refers to SSP5-8.5.

[3] The number of days between the last spring frost (last day with a mean temperature below 0 °C) and the first fall frost (first day with a mean temperature below 0 °C).

Spotlight on impacts: alpine meadows

The alpine ecoregion covers approximately 44% of Banff National Park, of which only about 6% is alpine meadows. These ecologically important meadows are highly sensitive to climate change. Increasing temperatures and changes to total precipitation, snowfall-to-rainfall ratios, snowpack depth, and timing and magnitude of snowmelt will have profound impacts on the structure and function of these high-elevation ecosystems. The upward migration of the treeline, shrub encroachment into the alpine, changes in the timing of life cycle events, and shifts in plant and animal distributions are among the anticipated impacts of a changing climate that are expected to reduce the extent of alpine meadows in the park. Parks Canada is currently working to better understand the ongoing impacts of climate change in these special places through research, ecological monitoring, and modelling. Additionally, Parks Canada utilizes visitor management strategies to minimize stress in these regions, such as implementing restricted activity periods and seasonal closures of particularly sensitive areas, including Sunshine Meadows, Healy Pass, and Citadel Pass.

Healy Pass
Photo: © N. Bonsteel.



Climograph showing projected monthly average temperature and total precipitation values for the past (1961-1990) and future high emissions scenario (SSP5-8.5; 2051-2080). Values represent the median of a 26 climate model ensemble averaged across Banff National Park. Note: This graph only shows the median value of the ensemble and does not display the range of individual model projections.

Looking toward the future

The amount of future warming we experience depends on the concentration of greenhouse gases in the atmosphere. To account for future emissions uncertainty, climate models are run using different scenarios, called Shared Socioeconomic Pathways (SSPs). SSP1-2.6 (not shown in table on p.1) is a low emissions scenario characterized by rapid emissions reductions and policy focused on sustainable development. In this scenario, emissions peak around 2020 and decline to zero near mid-century. In the moderate SSP2-4.5 scenario, socioeconomic development continues to follow current patterns and emissions peak around 2050 then decline. SSP5-8.5 represents a very high emissions scenario characterized by further fossil-fuel driven economic development. In this scenario, emissions rise throughout the century.

About the data

As per standard practice, the data in this report comes from an ensemble of 26 Coupled Model Intercomparison Project Phase 6 (CMIP6) global climate models that have been downscaled to 6 km by 10 km using the MBCn method. Values have been spatially averaged across the park and temporally averaged over two 30-year time periods (1961-1990 and 2051-2080). The summary table on the reverse page displays the median, 10th and 90th percentile values of the climate model ensemble, which helps demonstrate the range in model projections. For a full description of the data and modeling methodology, and to download additional data, visit ClimateData.ca.

Potential climate change impacts and adaptation responses

Climate change will affect all programs under Parks Canada's mandate. There are many likely impacts associated with projected future climate conditions at Banff National Park. The table below outlines some examples of these projected conditions and impacts, as well as potential options for adaptation responses. Parks Canada will work with Indigenous partners to develop and implement climate change adaptation responses where interest and capacity allow. Parks Canada uses information like this, along with Indigenous knowledge, to better manage operations in national historic sites, national parks, and national marine conservation areas, as well as the services offered to visitors.

Parks Canada program area	Future climate condition	Example of likely impact	Example of potential adaptation response
Natural heritage	Warmer annual temperatures	Glacier loss and changes to downstream aquatic ecosystems	Identify and protect and/or restore cold-water westslope cutthroat trout and bull trout habitats that are likely to persist as glacial inputs decline over time
Cultural heritage	Decreased summer precipitation	Risk of wildfire damaging or destroying cultural resources	As feasible, document newly exposed archaeological or other cultural resources and take appropriate measures to protect them. Ensure national historic sites and federal heritage buildings have, or are integrated within, emergency response plans, have fire suppression systems and are practicing FireSmart principles
Visitor experience	Hotter summers	Increase in water-based activities	Develop educational materials that inform visitors of the hazards and safety precautions that should be considered when using park waterbodies
Health, safety & wellness	Increase in extreme weather events	Increased risk of flooding and wildfires	Ensure visitors and staff are aware of information systems used to communicate current risks, emergency alert systems, and provide guidelines and safety tips
Built assets	Warmer winters	Increased frequency and severity of insect outbreaks, such as mountain pine beetle	Monitor forest health around campgrounds and utilize forest management activities such as removal of colonized and dead trees, pheromone baiting and trapping, forest thinning, and prescribed fires to protect infrastructure and people

Acknowledgment

We thank ClimateData.ca and PAVICS for providing the climate data used in this document. For further details on climate projections, please visit **ClimateData.ca**.

For information about this Climate Summary contact us at:
changementclimatique-climatechange@pc.gc.ca