DAVEY

Climate Change Projections for British Columbia

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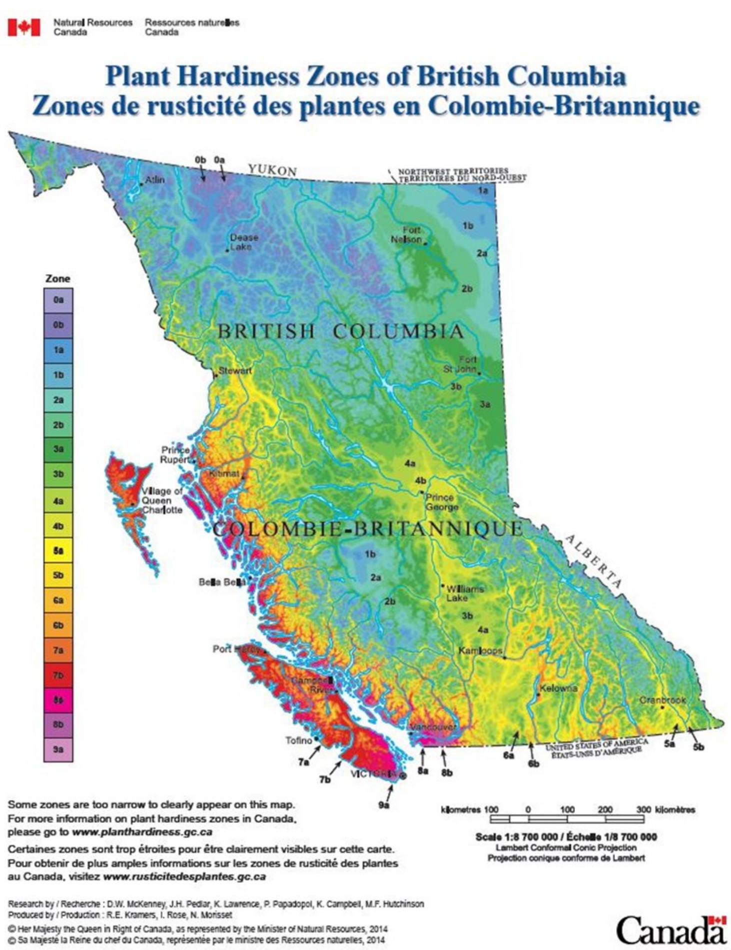
The Davey Climate Change Fact Sheet Series projects the future impacts of climate change on the tree care industry over the next 30-70 years, with emphasis on changes in temperature, precipitation, storm intensity, tree health, pest pressure, wildfire, and worker stress. Temperatures across Canada have risen 1.7°C since 1948, which is twice the global average. By the end of the century, temperatures are expected to increase between 1.8-6.0°C, with the future trajectory of greenhouse gas emissions providing the largest source of uncertainty. The Intergovernmental Panel on Climate Change (IPCC) projects future climates by modeling different emissions scenarios called "Representative Concentration Pathways (RCP)." This fact sheet focuses on changes expected to occur in British Columbia based on lower (RCP2.6), intermediate (4.5RCP), and higher (RCP8.5) emissions scenarios. Currently, global patterns of fossil fuel consumption correspond most closely with the high emissions scenario, while the lower and intermediate emission scenarios will require significant mitigation measures yet to be implemented.

The climate is warming, especially in winter

The mean temperature across British Columbia has increased by 1.9°C between 1948 and 2016. All seasons are warming but the most substantial warming (3.7°C) has occurred during winter, with annual minimum temperatures increasing at a faster rate (+1.7°C) than annual maximum temperatures (+0.6°C). Temperature increases are more pronounced in traditionally cooler areas, with the northern regions of British Columbia having warmed 1.6-2.0°C per century compared to 0.8°C in the southern coastal regions. In the Summer of 2021, British Columbia experienced a heat dome - a high-pressure weather system that traps heat – that set over 1,000 record temperatures across the province, including a record high of 49.6°C in the village of Lytton. While an extremely rare occurrence dependent on a convergence of factors, one study estimates that the climate warming already experienced has made the occurrence of a heat dome event of this magnitude 150 times more likely.

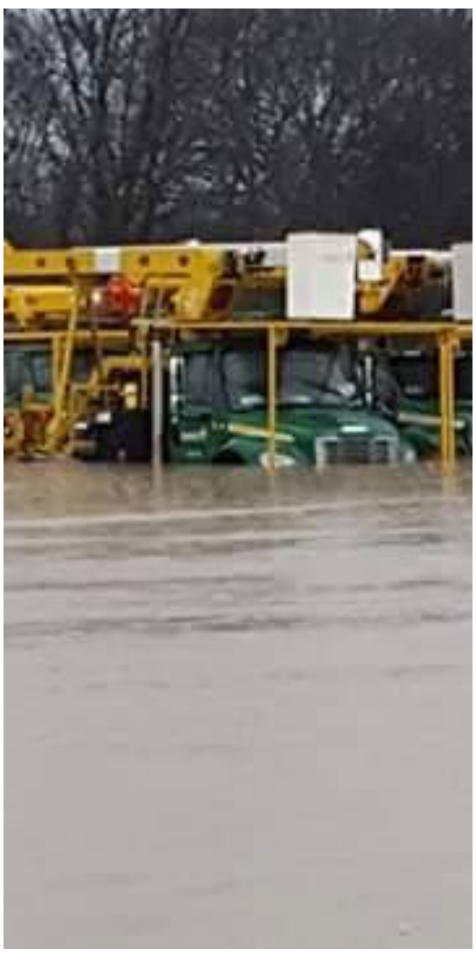


By late-century, British Columbia is expected to warm by an additional 1.7-4.5°C compared to the 1961-1990 historical average, with northern areas continuing to warm at a considerably faster pace than the global average. The province's interior will experience greater increases in temperature than the coast, given the moderating effect of ocean temperatures.

Hardiness zones in Canada differ slightly from USDA plant hardiness zones. While the USDA zones range from 0a to 13b and are based on the average lowest temperatures experienced in a region each year, Canadian hardiness zones range from 0a to 9b, integrating seven different climate conditions including rainfall, frost-free periods, maximum snow depth, average temperatures, and wind, among others.

The climate is warming cont. Canada's hardiness zones have increased significantly along the west coast over the past several decades. British Columbia's major population centers currently range from Zone 9b in Victoria in the southeast to Zone 7a in Kelowna in the province's interior. In northern British Columbia, hardiness zones shifted from 0a to 3a between the 1931-1960 and the 1981-2010 time periods, while Vancouver shifted from 7a to 8b. Hardiness zones are expected to continue their northward shift as the climate continues to warm.

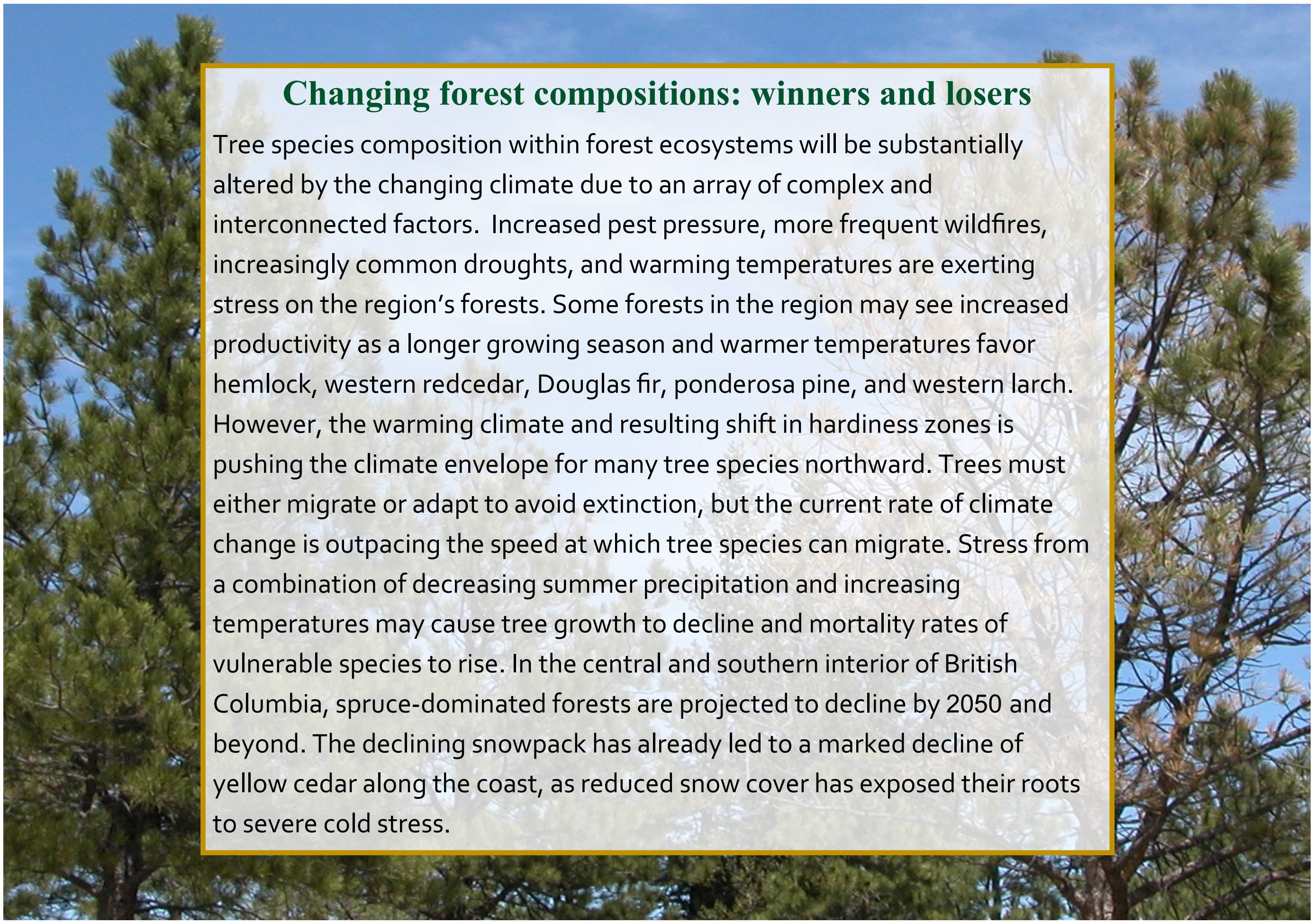
By 2050, Vancouver and the surrounding region is expected to experience twice as many days that exceed 25°C, from an average of 22 days per year currently to 55. By 2080, the city is expected to experience a 4.9°C increase in average annual daytime temperature under the high emissions scenario. Which will increase the length of the growing season by 20% and growing degree days by 45%, while decreasing the number of days with frost by 60%.



Increased variation in precipitation Although British Columbia receives more precipitation than any other Canadian province, annual precipitation in British Columbia increased by only 5% between 1948 and 2012, the lowest increase for any province. Precipitation is projected to increase by another 4-6% by 2050. By the late 21st century, annual mean precipitation in British Columbia is expected to increase by as much as 14% under the high emissions scenario.

Precipitation, however, is not distributed evenly across the seasons or by location. For example, Vancouver is experiencing wetter winters but dryer summers. Conversely, most other regions of British Columbia are projected to see decreased winter precipitation. As the climate warms, the amount of precipitation falling as snow will decrease, and snowpack is projected to shrink by about 60% by 2050 based on the high emission scenario. The melting snowpack will increase water runoff and decrease water availability during the summer months. Summer aridity in southern British Columbia is expected to intensify, with summer precipitation expected to decline in the Vancouver region by 19% percent by mid-century and 29% by late century. The dry summer period is projected to lengthen by about 20% by late-century.

The consequences of climate change on precipitation include greater year-to-year variability coupled with increased frequency of extreme precipitation events. In the Vancouver area under the high emission scenario, for example, 30% more precipitation is projected to fall on the 95th percentile wettest days by mid-century, while 60% more precipitation is expected on the 99th percentile wettest days .



Changing forest compositions: winners and losers

Tree species composition within forest ecosystems will be substantially altered by the changing climate due to an array of complex and interconnected factors. Increased pest pressure, more frequent wildfires, increasingly common droughts, and warming temperatures are exerting stress on the region's forests. Some forests in the region may see increased productivity as a longer growing season and warmer temperatures favor hemlock, western redcedar, Douglas fir, ponderosa pine, and western larch. However, the warming climate and resulting shift in hardiness zones is pushing the climate envelope for many tree species northward. Trees must either migrate or adapt to avoid extinction, but the current rate of climate change is outpacing the speed at which tree species can migrate. Stress from a combination of decreasing summer precipitation and increasing temperatures may cause tree growth to decline and mortality rates of vulnerable species to rise. In the central and southern interior of British Columbia, spruce-dominated forests are projected to decline by 2050 and beyond. The declining snowpack has already led to a marked decline of yellow cedar along the coast, as reduced snow cover has exposed their roots to severe cold stress.

Increased pest pressure Changes in climate conditions have supported the northward spread of insects and pathogens formerly limited by cold winters, including pine stem rusts, Dothistroma needle blight, aspen leafminer, and willow borer. Mountain pine beetle is the most economically and ecologically important forest insect in British Columbia. Periodic outbreaks of mountain pine beetle play a crucial role in native lodgepole pine ecosystems by killing over mature and stressed trees, contributing to forest renewal and succession. Outbreaks also contribute to periodic wildfires, which are critical for maintaining the fire dependent lodgepole pine ecosystem. Cold temperature is a primary source of mortality for overwintering mountain pine beetle, which is unable to establish at high elevations and northern latitudes where winter temperatures fall below -40°C. As the climate has warmed, mountain pine beetle has migrated into northern British Columbia where it never existed before because winters were too cold, and where the trees are less resistant than more southern populations that have coevolved with the insect. Consequently, unprecedented outbreaks in recent years have killed hundreds of millions of even healthy trees. Lodgepole pine ecosystems currently extend well beyond the climate limitations of the mountain pine beetle, but its distribution of the beetle is projected to extend another seven degrees latitude further north with a 2.5°C temperature increase.

Historically, the forests of British Columbia have been a carbon sink, removing far more CO_2 from the atmosphere than they emitted. However, as millions of beetle-killed trees decompose and burn, the forests of British Columbia have become a carbon source, emitting more CO_2 than they sequester. In the 1990s, the province's forests removed approximately 84 million tons of CO_2 ($MtCO_2$) per year. Between 2009 and 2018, however, British Columbia's forests emitted 39 $MtCO_2$. Instead of slowing the rate of climate change and mitigating its effects, these forests are contributing to accumulation of greenhouse gasses in the atmosphere as part of a vicious cycle.

Human health and well being

Climate change in British Columbia has major consequences for public health and worker safety. In the next several decades, the number of climate-related disasters is expected to increase, including major heat waves, poor air quality, flooding, wildfires, sea-level rise, and extreme-weather events, negatively impacting the physical and mental health of affected communities. By the end of the century, sea level under the high emission scenario could be 130 cm higher than it is today along Canada's southwestern pacific coast, potentially displacing more than 311,000 people in British Columbia.

Higher temperatures will also adversely affect worker stress. British Columbia experienced record breaking heat, out of control wildfires, and widespread smoke dispersion in the summer of 2021, with 619 deaths resulting from the unprecedented heat dome, and other health ailments attributed to a combination of heat exhaustion and smoke inhalation. Two states of emergency were declared in British Columbia that year due to extreme wildfires and flooding. Vector-borne diseases, including Lyme disease and West Nile virus, may increase in British Columbia as the climate warms. Climate change increases the odds that these events will occur more frequently in the future.

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