TECHNICAL BULLETIN *Prepared by the Davey Institute*

Climate Change Projections for the Atlantic Maritime Provinces

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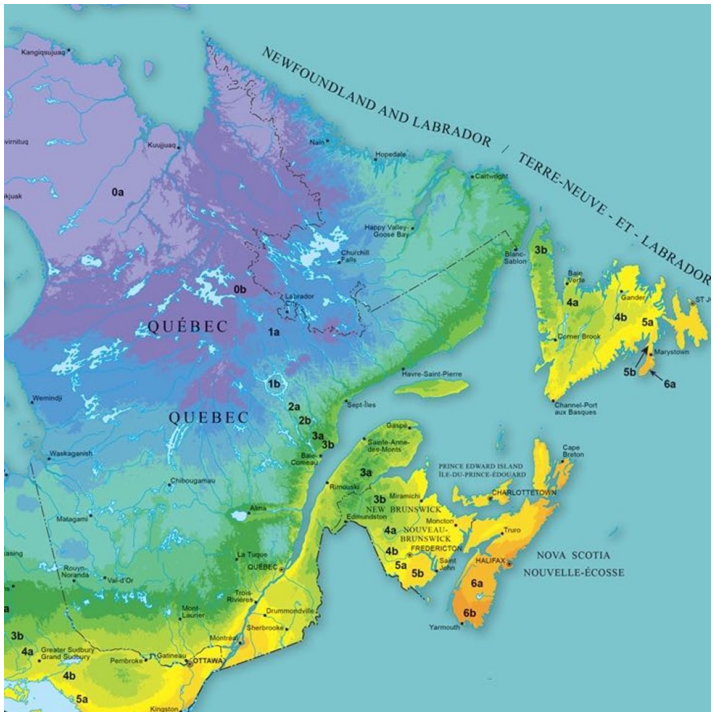
The Davey Climate Change Fact Sheet Series projects the future impacts of climate change on the tree care industry over the next 30-70 years, with emphasis on changes in temperature, precipitation, storm intensity, tree health, pest pressure, wildfire, and worker stress. Temperatures across Canada have 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 Canada's Atlantic Region, including the maritime provinces of New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island, 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: Surging summer temperatures but smaller changes in winter

The Atlantic provinces have warmed 0.7°C since 1948, which is lower than the average for the entirety of Canada. However, in contrast to general trends in Canada of greater warming in winter relative to summer, the Atlantic region has warmed faster in summer than winter. On the east coast, the climate has warmed by 1.3°C in summer compared with only 0.5° C during winter.

Projected temperature increases for the rest of the century vary among the provinces. New Brunswick and Newfoundland and Labrador face the highest projected warming over the next several decades. By 2050, as compared to the 1976-2005 baseline, New Brunswick and Newfoundland and Labrador are expected to warm under the high emissions scenario by 3.4 and 3.5°C, respectively, and by 5.8 and 6.1°C, respectively by the end of the century. Nova Scotia and Prince Edward Island will experience significant increases as well, with the climate projected to warm by 2.4 and 1.4°C, respectively, by 2080, even under the intermediate emissions scenario.



Gardenia. (2023). Hardiness zones in Canada. https://www.gardenia.net/guide/canadian-hardiness-zones

Similarly, the number of extreme heat days (greater than 30°C) will increase throughout the region. Under the high emissions scenario, the number of very hot days are projected to increase in Prince Edward Island, Nova Scotia, and New Brunswick by 24, 31, and 44 days, respectively. Conversely, the number of very cold days (less than -30°C) are projected to decrease in New Brunswick and Newfoundland and Labrador by two and nine days, respectively.

The climate is warming cont. 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.

Newfoundland and Labrador experiences hardiness zones as low as 0a, while hardiness zones for the major population centers in New Brunswick and Nova Scotia range from 3a to 6b. Changes in hardiness zones over the past century have been far less pronounced in eastern provinces than throughout much of the rest of the country and especially the west coast. Indeed, Halifax, Nova Scotia experienced no change in its hardiness zone between the mid-20th century and early 21st century, and hardiness zones in some parts of the island of Newfoundland even decreased by as much as half a zone. However, dramatic warming is anticipated by the end of the century during the growing season, especially under the higher emissions scenario, which will have marked effects on plant and insect phenology and communities throughout the region.

Highly variable precipitation and extreme weather events Climate change has led to increased precipitation and more extreme weather events. Between 1948 and 2016, annual precipitation across Atlantic Canada increased by 11%. Under the high emissions scenario, precipitation is projected to increase by an additional 12% by 2100, with a higher percentage of winter precipitation expected to fall as rain rather than snow, contributing to increased flooding. Precipitation is also predicted to become more erratic, with high precipitation events punctuated by increased frequency of dry weather.

Higher precipitation will be accompanied by more frequent storms and other extreme weather events. Under the high emissions scenario, the median annual maximum precipitation event for a given 20-year period is projected to increase by 30% by the end of the century. Heightened ocean temperatures at higher latitudes are projected to increase the strength of storms that reach the Canadian coast. In September 2022, Hurricane Fiona pounded Nova Scotia, Prince Edward Island, and Newfoundland and Labrador with damaging winds, heavy rainfall and storm surge flooding. Under all emission scenarios, extreme weather events are projected to become more frequent as the climate continues to warm.

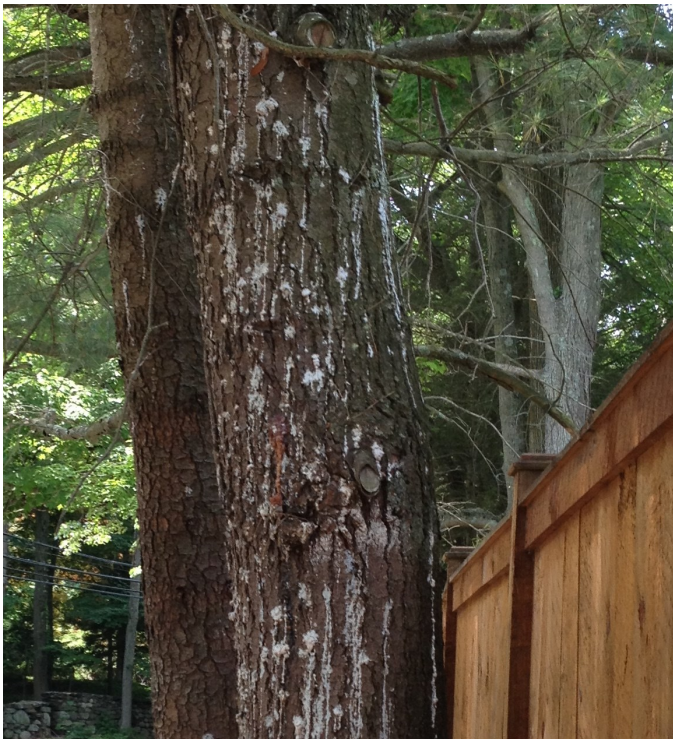
Short and long-term impacts on forest health

By 2050, climate change is anticipated to have considerable impacts on the forests of Atlantic Canada. In the short-term, disturbances including severe storm events, pest outbreaks, invasions by non-native species, and increased wildfire will alter forest communities and ecosystem processes. In the long-term, climate warming conditions will lead to northward shifts in tree species distribution. By 2100, climate zones suitable for certain hardwood species are projected to shift northward by 250-600 km. Red and black spruce are expected to decline in growth and abundance, while the climate zone suitable for yellow birch is projected to shift to the northeast. A similar shift is projected for balsam fir as it disappears from Nova Scotia and most of New Brunswick. Some species that currently reside exclusively south of the border with the United State are projected to migrate into Canada. The shift in species composition in response to the changing climate could impose significant impacts on the forest-dependent enterprises and communities.

As the climate warms it can become more suitable for invading species. The European spruce sawfly is one example of an invasive species particularly damaging to a variety of spruce trees in Atlantic Canada that is projected to migrate northward. As winters warm, hemlock woolly adelgid is also expected to become increasingly problematic in New Brunswick and Nova Scotia, as are native insects such as spruce budworm.

Southern pine beetle, which periodically causes widespread mortality of pines in the southeastern United States, has migrated north as winters have warmed and is projected to invade forests of Maritime Canada before the end of the century. The minimum temperature threshold for overwintering survival of southern pine beetle is between -14 and -20°C, which constrains its northern distribution. In response to rising winter temperatures in eastern North America, the southern pine beetle has spread to New Jersey, New York, and Massachusetts. By 2080, this beetle is projected to spread to southeastern Canada, where it will impact white and red pine forests.

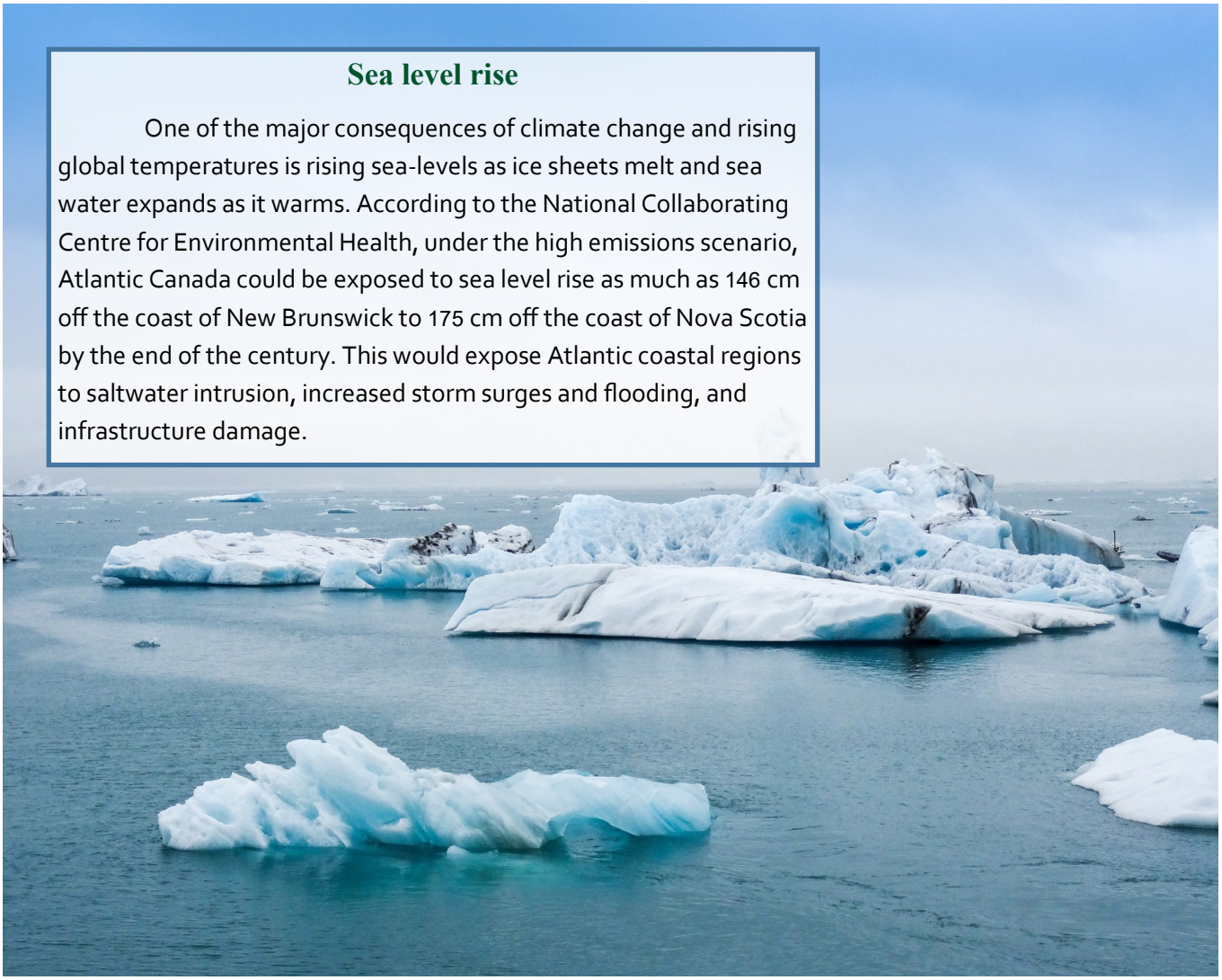
Hemlock woolly adelgid



Southern pine beetle damage

Sea level rise

One of the major consequences of climate change and rising global temperatures is rising sea-levels as ice sheets melt and sea water expands as it warms. According to the National Collaborating Centre for Environmental Health, under the high emissions scenario, Atlantic Canada could be exposed to sea level rise as much as 146 cm off the coast of New Brunswick to 175 cm off the coast of Nova Scotia by the end of the century. This would expose Atlantic coastal regions to saltwater intrusion, increased storm surges and flooding, and infrastructure damage.



Health risks and worker safety

Increased frequency and intensity of extreme weather events risk leaving many without power and adequate access to heat and water. Inland areas are more likely to experience heat waves, with the number of days exceeding 30°C in Nova Scotia and New Brunswick projected to increase by between 12 and 22 by 2050, respectively, relative to the 1980s. Outdoor workers and the elderly are particularly vulnerable to extreme heat exposure, as well as respiratory illnesses from air pollution. The proliferation of zoonotic diseases in Atlantic Canada has been linked with climate change. The well-documented increase in cases of Lyme disease in Atlantic Canada is the result of range expansion of ticks that are active longer in the season in response to warmer temperatures. Such impacts will continue to intensify as the climate continues to warm.

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