

Confronting Our Changing Winters

a Science Links synthesis report

Regional trends and projections for Acadia

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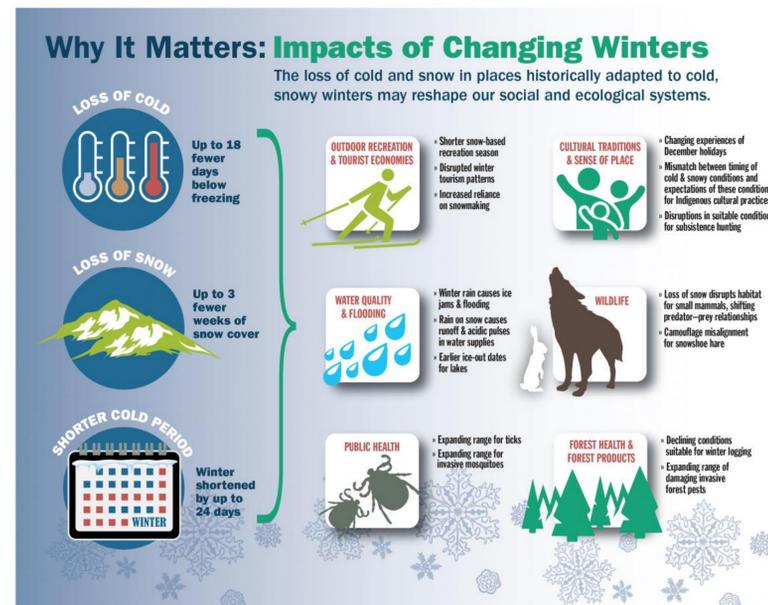


Report: <https://hubbardbrook.org/confronting-our-changing-winters>

Related work: changingwinters.com

Winter Conditions are Changing Across the Northern Forest

Winter is warming faster than any other season in eastern North America. We examined 100 years of winter temperature and precipitation data from weather stations across the northern forest region. We developed and calculated specific indicators of how winter conditions have changed across the northern forest over the past century. We developed these indicators in dialogue with community leaders and stakeholders from various networks, including outdoor recreation and tourism, land management and conservation, and the forest products industry (Figure 1). The results show a clear picture of declining snowpack and fewer days with cold temperatures over the last century (Figure 2), which are projected to continue (Figure 3). This loss of cold and snow, in a region historically adapted to cold, snowy winters, has profound implications for water, wildlife, forests, and people.



Winter climate change may fundamentally reshape the ecological and social fabric of the northern forest.

Figure 1.

In the last 100 years:

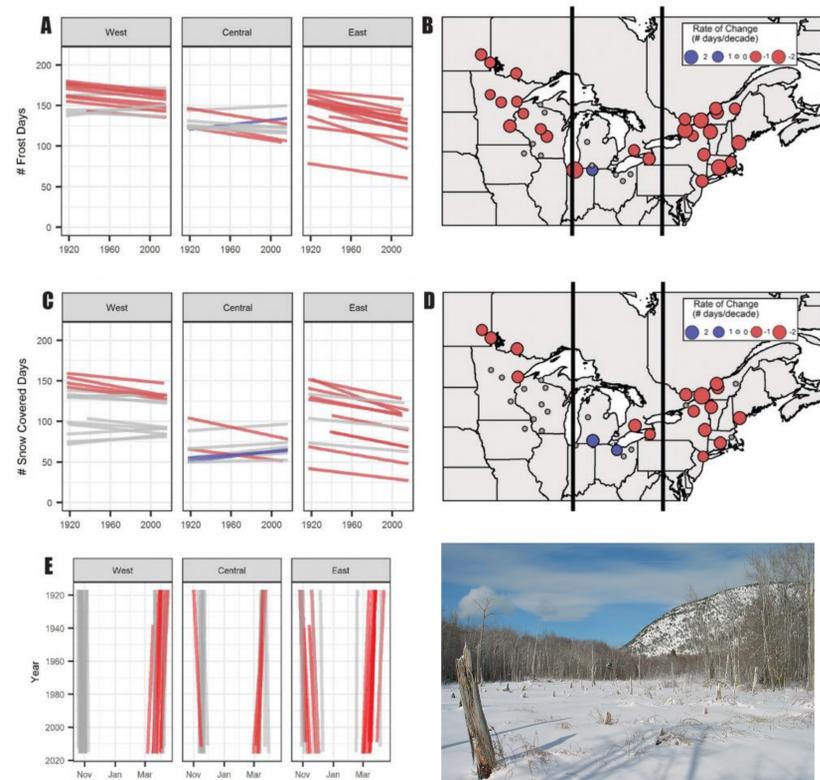


Figure 2: Change over a 100-year period from 1917 to 2016 in the number of frost days (panels A and B), the number of snow-covered days (panels C and D), and length of the cold period (panel E). Red lines show decreasing trends over the time series. Blue lines indicate increasing trends, while gray lines indicate a lack of significant change over time. Sites are grouped into three geographic subregions, west, central, and east. Maps display rates of change over the entire study area, with red dots showing negative trends, blue dots showing positive trends, and gray dots showing no significant change. The size of the dot illustrates the magnitude of change. The strength of the trend toward fewer cold days, fewer snow-covered days, and shorter winters varies across the region, with the Northeast showing some of the largest losses in these winter indicators.

Key Findings:

1) We are losing the cold.

We found overall declining trends in the indicators of “coldness.” For example, there are now fewer ice days (when daytime temperatures never go above freezing), frost days, and extreme cold days than in the past 100 years.

Indicators for the East Subregion: **18 fewer frost days** (when minimum daily temperatures dip below freezing); **15 fewer extreme cold days** (when minimum daily temperatures reach below 0°F (-18°C)); **20 more ‘mud days’** (bare ground plus max. daily temperature above freezing).

2) We are losing the snow.

Winters in the eastern areas of the northern forest have lost 21 days of snow cover over the past century. Winters in the western areas have lost 17 days of snow cover over the past century. In both of these regions, we found increases in the number of “mud days” in winter. Weather stations in the central northern forest show mixed trends, with some sites near the Great Lakes gaining snow-covered days.

Indicators for the East Subregion: **21 fewer snow-covered days** (snow depth greater than 0 mm.); **16 fewer snowmaking days** before Christmas (minimum daily temperatures reach below 23°F).

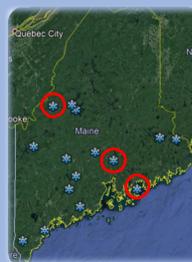
3) Winters are getting shorter.

The cold period of the year has shortened by about three weeks across the northern forest. During the 1910s, the sustained cold period lasted about 146 days (range of 85–190 days across individual sites). During the 2010s, the sustained cold period was down to about 126 days (range of 9–194 days across individual sites), largely due to earlier onset of spring. During this cold period, cold and snowy conditions have become more intermittent.

Indicator for the East Subregion: **Length of Winter – 21 days shorter**

Looking to the future:

Maine’s winters will continue to warm... and lose snow.



Projections courtesy E. Burakowski, UNH; See also: Grogan et al. 2020, Pierce et al. 2014

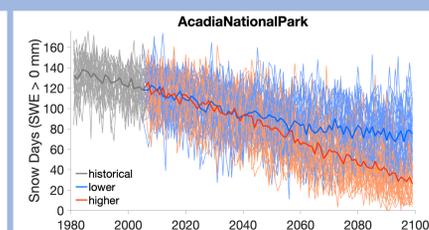
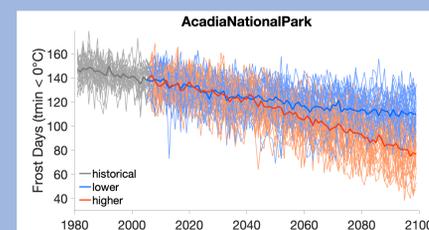
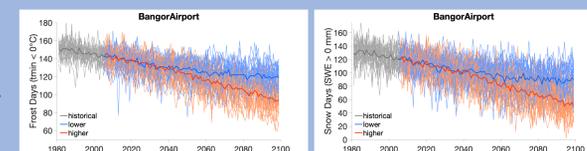
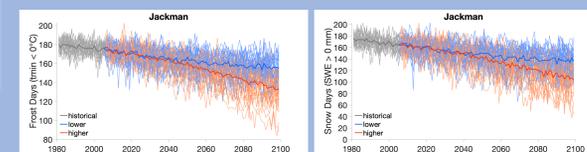


Figure 3. Projected change in number of frost days (minimum temp. below freezing, left) and snow cover days (right) under high (RCP 8.5) and low (RCP 4.5) emissions scenarios.

The *Confronting Our Changing Winters* Science Links synthesis report is based on the following two studies:

- Contosta, A.R., Casson, N.J., Nelson, S.J., Ayres, M.P., Burakowski, E.A., Campbell, J., Creed, I., Eimers, C., Evans, C., Fernandez, I., Fuss, C., Son, K., Templer, P., Thornbrugh, C. (2019), Northern forest winters have lost cold, snowy conditions that are important for ecosystems and human communities. *Ecological Applications*, 29(7), <https://doi.org/10.1002/eap.1974>.
- Contosta, A.R., Casson, N.J., Nelson, S.J., Garlick, S., (2019), Defining frigid winter illuminates its loss across seasonally snow-covered areas of eastern North America. *Environmental Research Letters*, <https://doi.org/10.1088/1748-9326/ab54f3>.

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