

Lilacs grow green earlier ... and winter shrinks

ALAN K. BETTS (akbetts@aol.com)

In the past 40 years, the growing season for frost-sensitive plants in Vermont has increased by almost two weeks; and for frost-hardy plants the growing season may have increased by as much as three to four weeks. The winter cold season has been getting shorter and less severe.

We hear a lot about climate change on the global scale: melting polar ice, receding glaciers and rising sea levels. But what is happening here in Vermont? To get the picture closer to home, we can look at certain local indicators of climate change: freeze dates, the length of the growing season, the frozen duration of small lakes and the onset of spring. All these climate indicators show a consistent pattern of a warming climate in Vermont during the past few decades.

The burning of fossil fuels (coal, oil, gas) has increased the concentration of greenhouse gases — especially carbon dioxide — in the atmosphere. The greenhouse gases are causing the surface temperature of the Earth to warm because they trap thermal radiation from the planet's surface and send some of it back. We are now witnessing unprecedented climate change as a result.

As Vermont's climate warms and the temperature shifts upward relative to freezing, the amount of snow cover diminishes. Snow cover reflects solar radiation back into the atmosphere. With less snow, the surface of the Earth absorbs more heat. The warmer surface temperature of the Earth causes more evaporation. More water vapor in the Earth's atmosphere increases the greenhouse heating of the Earth's surface.

Freeze period, grow season

There is a long record of climate station data in Vermont going back to 1893. During this time, the Vermont landscape has changed dramatically as forests have grown back. Regional and global climates have also changed substantially.

Between 1951 and 2008, data from four Vermont climate stations (Burlington, Cavendish, Enosburg Falls and St. Johnsbury) shows that the freeze period has become shorter and the growing season longer in Vermont:

Last spring freeze has come earlier by 1.4 days per decade, first autumn freeze has come later by 1.8 days per decade; and freeze-period has decreased and growing season has increased by 3.2 days per decade.

The actual first and last freeze dates, which are critical to the growing season for frost-sensitive plants, are sensitive to the local topography as well as to specific daily weather events, which vary a lot from year to year.

Freeze, ice-out, freeze length

The freeze and ice-out dates for small lakes are good "integrated" climate indicators for the length and severity of the cold season in Vermont. The date of freeze-up depends on lake and air temperatures

over several weeks in the fall. Ice thickness depends on the severity of the winter and the date of spring melt depends on ice thickness and air temperatures in spring. These dates are important for the ecology of the lakes and the frozen period (and ice thickness) matter to the public for winter recreation, including ice fishing.

Each year there is a contest to guess the ice-out date on Joe's Pond in West Danville, and these dates and the trend have been recorded since 1988. The ice-out date and time are defined as when an electric clock tethered to a block on the ice stops as a result of the ice break-up. The freeze-up and ice-out dates for Stile's Pond in Waterford at a lower elevation have been recorded since 1971 by the Fairbanks Museum in St. Johnsbury. Of course there is a lot of variability from year to year, but data shows that on average over the 40 winters *freeze-up has occurred later by four days per decade, ice-out has gotten earlier by three days per decade, and winter frozen duration has decreased by seven days per decade.*

Stile's Pond, for instance, is frozen for four weeks less on average than 40 years ago, a trend that is likely to continue as the global climate warms.

Lilac first leaf, first bloom

The first leaf and first bloom dates have been recorded for lilacs since 1965. Data are now available from six sites over the past 45 years — Swanton, Cavendish, Essex Junction, Newport, Union Village Dam and West Burke. Results show that the date of lilac first leaf in spring has advanced nearly three days per decade, while the later date of lilac first bloom has advanced more slowly by 1.6 days per decade.



Figure 1. Lilacs in Pittsford, Vermont

In fact, the dates of lilac first leaf and the ice-out dates for Stile's Pond are closely correlated. These are very different climate indicators, but they depend on the same late winter and spring temperatures — and in most years they occur within less than a week of each other. *Both dates have advanced by about three days per decade*, indicating the trend towards warmer temperatures in late winter and early spring.

Looking ahead

This shrinking of the cold season and lengthening of the growing season in Vermont are almost certain to continue in the next few decades, as the Earth's climate warms. In the short run this will help our transition to a local food economy — but unless we drastically reduce our burning of fossil fuels, this transformation of Vermont's climate will accelerate and threaten the survival of Vermont's forests and wildlife.

Alan Betts is a past president of the Vermont Academy of Science and Engineering. His research is supported by the National Science Foundation. Contact him for the complete analysis.