ORCHARD MANAGEMENT

Cold Hard Facts:
The Zones Have Shifted

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Climate change is real, and although there may be a general notion that the globe is warming, that is not the full picture. Climate change refers to the periodic modification of Earth's climate based on the atmosphere – ultimately meaning – **a long-term shift in average weather patterns of a region**. This has been shown across our nation with certain provinces experiencing weather extremes first-hand.

Canada's plant hardiness (PH) zones have updated to reflect the changes in climate that have been seen over the past few decades. Generally, across our nation PH zones have increased by half a zone to almost two full zones (Figure 1). Canada's PH zones are calculated using the formula below, which was originally developed by Ouellet and Sherk, 1967[a,b,c].

$$\text{Estimated index of suitability} = -67.62 + 1.734X_1 + 0.1868X_2 + 69.77X_3 + 1.256X_4 + 0.006119X_5 + 22.37X_6 - 0.01832X_7$$

Factors that contribute to calculating PH zones include:

- **X_1:** monthly mean of the daily minimum temperatures (°C) of the coldest month
- **X_2:** mean frost-free period above 0°C in days
- **X_3:** amount of rainfall from June to November
- **X_4:** monthly mean of the daily maximum temperatures (°C) of the warmest month
- **X_5:** winter factor
- **X_6:** mean maximum snow depth
- **X_7:** maximum wind gust in (km/hr) in 30 years

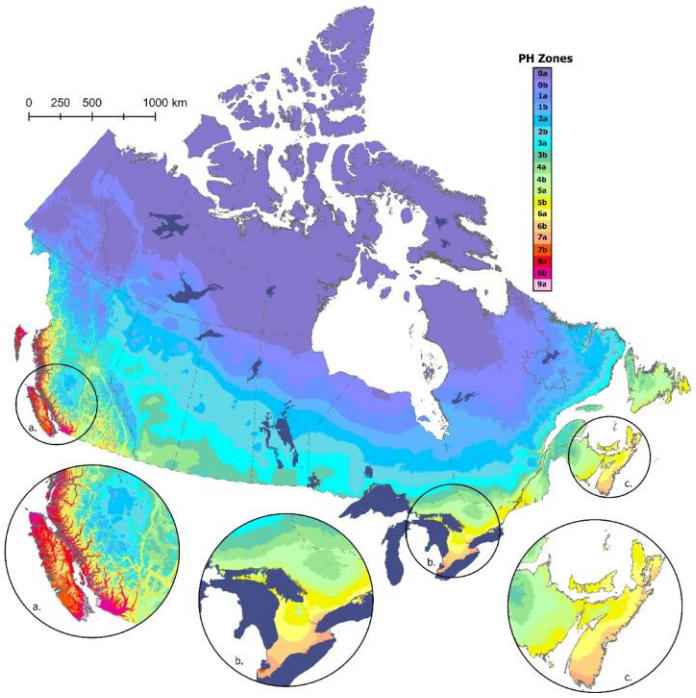

***Figure 1.** The Canadian plant hardiness zone map for the 1991–2020 climate period, with insets showing greater detail for: (a) southwestern British Columbia; (b) southern Ontario, and (c) the Maritime provinces of Nova Scotia, New Brunswick, and Prince Edward Island. (McKenney, D.W., et al., 2025).*

Counting the Cold

Canada's PH zone changes are demonstrated in Figures 2A, 2B & 2C showing the progression of zones in the map taking place over 30-year increments, beginning in 1961 and ending in 2020.

These zones are great indicators of general climate trends, but remember as stated, they are – **only indicators** – and should only be used as a guideline.

The Canadian PH zone index integrates a national-scale of climate variables. Certain regions have increased by either a half zone or a full zone, particularly in the southern western region. Using long-term Ontario weather data (Westerveld, 2025) shows how changes in each factor explain where zones are shifting and what that means for Ontario apple growers.

Coldest Month Min. Temperatures

In southern and eastern Ontario there is a trend of increasing temperatures in the winter months, along with roughly an 8.5˚C rise in December temperatures compared to historical numbers (Westerveld, 2025). Warmer temperatures during this time directly increase PH zones and are a main contributor to adjustments in Ontario zones.

Frost-free Period

This has increased by 35 to 40 days overall since 1883, where last spring frosts can be 2 weeks earlier and the first fall frost can be 3 weeks later. A longer frost-free period supports a zone increase in Ontario. This is a core variable in the hardiness index.

Rainfall from June to November

Rain has increased during this period by roughly 80mm each year. This is utilized as a moisture-related stress indicator, meaning that although rainfall is increasing, it isn't a primary driver regarding PH zones in Ontario.

Warmest Month Max. Temperatures

Average temperatures have remained stable, while extreme temperatures have declined. This contributes minimally to the increase in PH zones.

Winter Factor (Severity)

Ontario isn't as cold as it used to be, with winter averages and extreme temperatures increasing overall. The decrease in winter severity within the province supports a rise in PH zone.

Mean Maximum Snow Depth

A reduced snow cover has been a trend over time in Ontario, showing less consistent snow cover. Snow works as a protective insulation factor for the PH zone calculation, contributing to a rise in zone category.

Maximum Wind Gust

This has not been evaluated from an Ontario specific standpoint internally. External sources state that wind would not be a major driver regarding zone shifts in the province.

For further details regarding climate trends in Ontario at 6 different apple locations dating back to 1883, refer to Sean Westerveld's article titled "Climate Changes in Southern Ontario: Potential Impacts on Apple Growers" found in the 2025 Winter Issue of ONcore.

Overall, Ontario's PH zones are primarily increasing because of milder winters and higher minimum temperatures. This means that Ontario, specifically the southern regions will have less extreme winter cold temperatures and longer frost-free seasons. Although these initially may seem like lower risk situations, they are not.

Ripe Realities

The practical imposition associated with these zone changes **could imply** the following:

- Warmer winters may reduce the historic winter injury risk but could increase risk of premature deacclimation – potentially causing damage over time (weak growth, sudden apple decline).
- A longer frost-free period could allow for greater fruit size and suitability for later-ripening cultivars, but earlier budbreak and bloom would increase exposure to spring frost events.
- More rainfall may allow for improved fruit sizing and sustained growth, but could be paired with increased disease pressure, vegetative vigour, shading, and fruit cracking. The timing of rainfall could also require changes management due to equipment use within the orchard.
- Stable summer temperatures means more consistent fruit development, generally benefiting fruit size, firmness, and finish. Although a large proponent to consider is the **lack of night-time temperatures within PH zone calculations.**
- Less stable and warmer winters could lead to a higher risk of injury from warm–cold temperature swings. Rootstocks often lose hardiness before scions during warm spells, so subsequent freezes can girdle or kill rootstock tissue even when tops survive, leading to delayed decline.
- Lower snow depth could reduce insulation of roots and rootstock shank, leading to an increase the vulnerability to freeze–thaw damage during cold snaps.

Ontario's PH zones are increasing mainly because winters are milder and frost-free periods are longer, not because summers are hotter. For apple growers, this could mean (i) fewer trees lost to extreme winter cold and (ii) better potential for fruit size and (iii) use of later-ripening cultivars, **but** also (i) higher risks from earlier budbreak, spring frost damage, (ii) increased vigour and (iii) disease pressure from more rainfall, (iv) and greater vulnerability to winter temperature swings that can damage rootstocks and lead to delayed tree decline. **Together, these pressures may drive change in future management strategies such as thinning and harvest timing, increased pest management, greater attention to rootstock choice (winter stability rather than cold tolerance).**

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Icons (Flaticon.com). Arrow icons by Arzu C. Unknown icon by sonnycandra.

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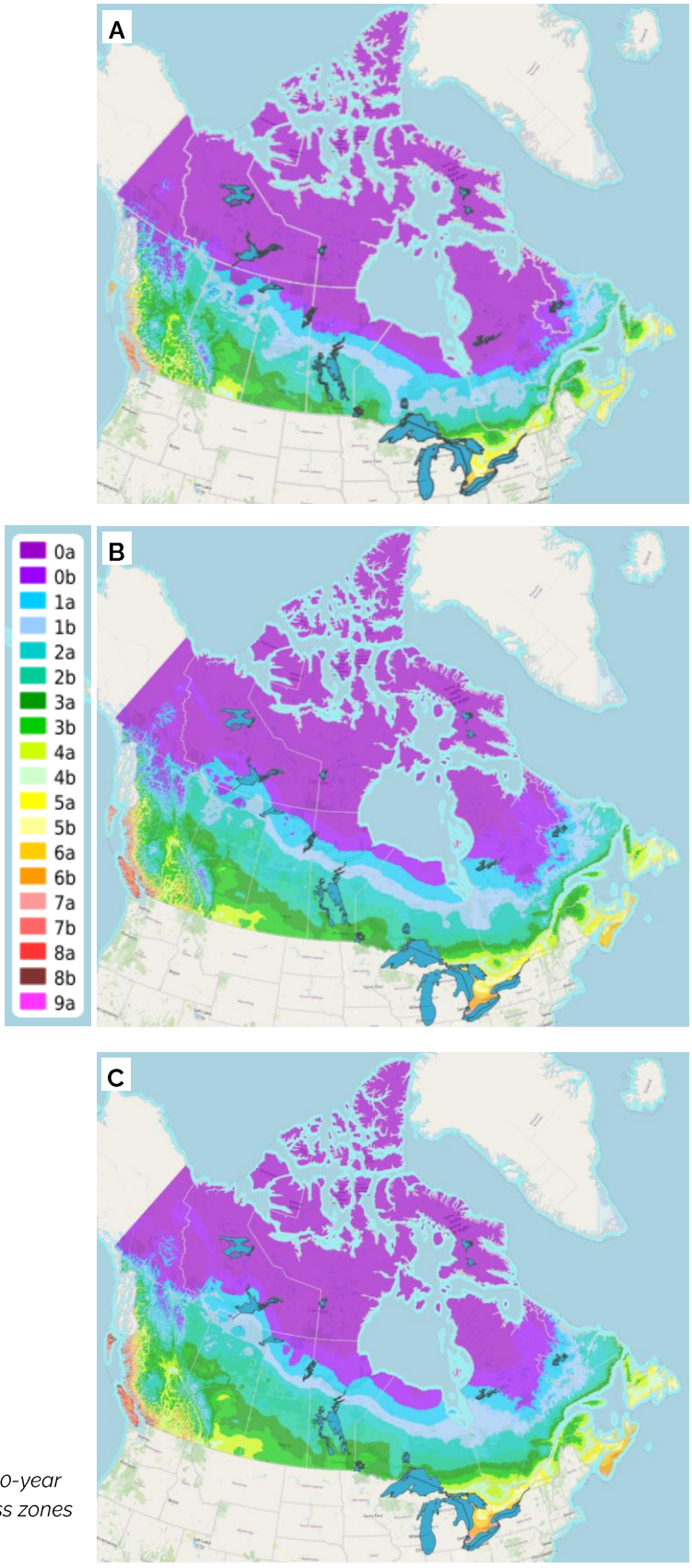

Figure 2. *Canadian plant hardiness zones over multiple decades in 30-year periods (A) Plant hardiness zones from 1961 – 1990 (B) Plant hardiness zones from 1981 – 2010 (C) Plant hardiness zones from 1991 - 2020*