

# Graphical Abstract

Temperate plants are at risk of being exposed to late spring freezes—called false springs—which are a major factor determining range limits, can impose high ecological and economic damage, and may be increasing with climate change. Currently, many false spring studies simplify the myriad complexities involved in assessing false spring risks and damage. Here we review major areas that could improve predictions: understanding how species have evolved to avoid or tolerate false springs (for example, through shortening how long they are at risk), identifying the cues that underlie spring phenology, and studying how local climate impacts false spring risk.

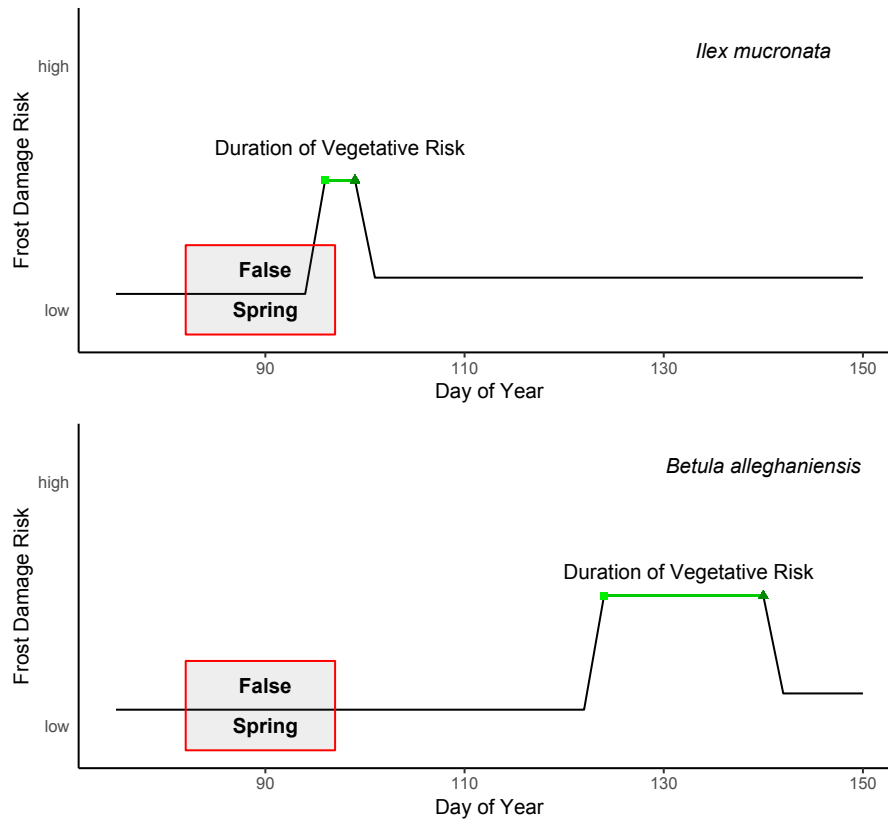


Figure 1: Differences in spring phenology and false spring risk across two species: *Ilex mucronata* (L.) and *Betula alleghaniensis* (Marsh.). We mapped a hypothetical false spring event based on historical weather data and long-term observational phenological data collected at Harvard Forest (O’Keefe, 2014). In this scenario, *Ilex mucronata*, which bursts bud early and generally has a short period between budburst (squares) and leafout (triangles), would be exposed to a false spring event during its duration of vegetative risk (i.e., from budburst to leafout), whereas *Betula alleghaniensis* would avoid it entirely (even though it has a longer duration of vegetative risk), due to later budburst.