Graphical Abstract

- ² 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
- 4 climate change. Currently, many false spring studies simplify the myriad complexities involved in assessing
- 5 false spring risks and damage. Here we review major areas that could improve predictions: understanding
- 6 how species have evolved to avoid or tolerate false springs (for example, through shortening how long they
- ⁷ are at risk), identifying the cues that underlie spring phenology, and studying how local climate impacts false
- 8 spring risk.

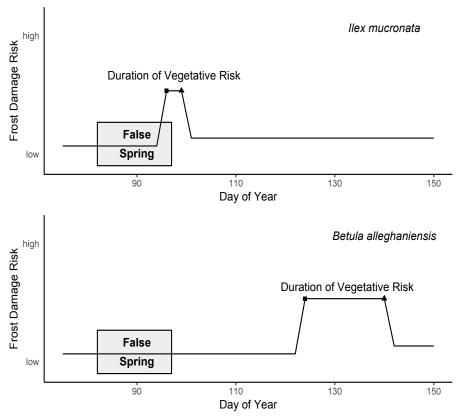


Figure 1: Differences in spring phenology and false spring risk across two species: *Ilex mucronata* (L.) and *Betula alleghaniensis* (Marsh.). We mapped a hypothetical false spring event based on historical weather data and long-term observational phenological data collected at Harvard Forest (O'Keefe, 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.