Species differences in budburst responses in woody plants of North America

Deirdre Loughnan[1] and E M Wolkovich[1]

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[1] Department of Forest and Conservation, Faculty of Forestry, University of British Columbia, 2424 Main Mall Vancouver, BC, Canada, V6T 1Z4.

Corresponding Author: Deirdre Loughnan, deirdre.loughnan@ubc.ca

Introduction

1. Plant phenology is changing with climate change:
   (a) Timing of spring bb is changing with anthropogenic climate change
   (b) But changes are not uniform with some regions experience greater warming than others.
   (c) Responses are also species specific and highly variable
   (d) Important to understand and predict the drivers and extent of biogeographic trends, as changes in spring phenology determines growing season length, carbon cycle, species interactions
2. Variation in bb phenology across species in a community
   (a) To date, most work has been devoted to understanding how environmental cues shape phenology and what drives the high species level variation in budburst
   (b) Timing of bb in a forest community can span several weeks—species fill different temporal niche
   (c) e.g. understory spp tend to bb earlier than canopy species, likely reflecting overarching differences in traits.
   (d) But differences in budburst responses are likely to also exist across a species range.
3. Across a species spatial distribution—differences in cues and therefore in spp responses/bb
   (a) Species with large latitudinal distributions experience differences in cues—e.g. photoperiod cues
   (b) May also be experiencing different rates of temperature change over time—e.g. diff rates climate change across North America (Kunkel2004)
   (c) BB across diff pop = result of local selective pressures—abiotic (local envirt) and biotic (competition and herbivory)
   (d) But few studies have explored how cue use may differ across spatial gradient of the same species and the role of local environments and biotic communities in shaping budburst.

4. Cues that shape bb
    (a) For woody plants, we do know there are three important cues for bb:
        i. Forcing: spring temperatures
        ii. Photoperiod/daylength
        iii. Chilling: winter length and temperatures
    (b) But these cues interact—forcing can offset low chilling—photoperiod offsets weak forcing (Heide1993, Chuine2000, Caffarra2011, Flynn2018)
    (c) The consistency and strength of these interactions across populations remains unclear.
5. Linking the effects of these cues and geography on species differences across pops = critical for predicting future impacts on forest communitie dynamics and species composition.
    (a) Increasing winter and spring temperatures = faster accumulation of chilling and forcing (**?**)
    (b) Spp with strong photoperiod cues = limited in ability to advance (Korner2010)
    (c) Could disrupt species interactions or alter niche space—facilitating spp invasions or novel community assemblages
    (d) Knowing whether there are geographic trends in species responses will allow us to predict how local changes in climate will effect species fitness and ultimately persistence.
6. In this study we:
    (a) Combined results from two growth chamber studies of woody plant phenological cues
    (b) Data from four population, from eastern to western North America and a range of 4-6° latitude
    (c) Allows us to detect general trends in how bb of N Am. deciduous forest communities respond to forcing, chilling, photoperiod
    (d) But also community specific responses—detect differences between Western and Eastern forest communities, and at different latitudes

References