Species differences in budburst responses in woody plants of North America

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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: within communities
   (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 forest communities.
3. Across a species geographic range—differences in spp cues and therefore bb
   (a) Species with large latitudianl distributions—experience differences in photoperiod cues
   (b) experiencing different rates of climate change across North America (Kunkel2004)
   (c) In addition to differences in community composition and biotic interactions—competition and herbivory
   (d) But few studies have explored how cue use may differ across populations 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 on species specific differnces and geographic trends across pops is critical for predicting future climate change impacts on forest communities and the community dynamics of species within them.
    (a) In many ecosystems winter and spring temperatures are increasing with climate change = faster accumulation of chilling and forcing (**?**)
    (b) Spp with strong photoperiod cues would be limited in their 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 phenology and ultimately species coexistence
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
    (e) Our study further builds on previous community wide studies of budburst phenology by adopting recent phylogenetic methods to better partition ecological processes from species evolutionary history.

References