Traitors intro

February 3, 2023

1. Spring phenology is both ecologically important—carbon sequestration, species interactions etc—and highly variable across years and species
   (a) At the start of spring we see the budburst and leaf out of understory shrubs and spring ephemerals
   (b) Followed later in the season by budburst of taller trees and the closure of the forest canopy.
   (c) Have identified differences in spp. phenological events and key environmental cues shaping these differences (cite Flynn, and Laube)
   (d) But our understanding of why budburst is so diverse is still limited—does not relate to species larger niche space.
2. Timing of plant phenological events (budburst) define species' temporal niche = the partitioning of resources across species over time (Gotelli & Granves 1996 - ch5).
   (a) temporal niche differences determine the abiotic environment during growth and biotic interactions – competitive landscape and pressures from herbivory.
   (b) This diversity of selective pressures (biotic and abiotic) is likely to correlate with diversity in other plant traits as well
   (c) A more holistic framework of the drivers of species temporal niches differences = important — climate change is changing environmental conditions and habitats = shifting phenologies
3. In budbursting over the span of several weeks, plants experience different selective pressures.
   (a) Species that bb in early in the spring = greater abiotic pressures, such as risk of false spring events and frost = potential loss of tissue, but benefit from more light and resource availability
   (b) Late spp have greater selection from biotic pressures = less light available and competition for resources
   (c) Distribution of temporal niche within community influences the potential invasibility of a community— invasive spp tend to be early bb with the potential to fill vacant niche space early in the season.
4. Considerable research on how functional traits relate to species growth strategies and competitive abilities — few studies include phenological traits.
   (a) timing of species growth likely to be related to species leaf and wood traits
   (b) Shrubs and other woody understory species tend to budburst earlier— soil resources and light availability is greatest— shorter, with leaf traits favourable to higher light availability (i.e. photosynthetic potential) and tolerance of late spring frost.
   (c) Canopy species budburst later— taller, requiring greater wood densities, but more constant light compensates for their slower overall growth rates.

   (d) But later budbursting species must be better competitors — compete with more species
   (e) Associations are intuitive but few studies have tested for similar gradients in growth strategies in phenological events across diverse species

5. trait ecology's goal = predict sp-level characteristics by traits alone
   (a) Many leaf and wood traits do follow predictable gradients in their trait values, having associations that range from acquisitive (fast) growth strategies to more conservative (slow) growth strategies.
   (b) Collectively, these trait relationships lead to the development of the leaf economic spectrum and the wood economic spectrum
   (c) These frameworks have been built into decades of research linking functional traits to species responses to abiotic and biotic factors and community assembly
   (d) However, traits themselves can be highly variable, both across and within spp, highlighting the need for trait research that spans diverse species across geographic scales—Violle paper 'viva la variability.

6. We tested for possible relationships between budburst phenological cues and other commonly measured functional traits.
   (a) We predict that spp with traits associated with acquisitive growth (high SLA, high LNC, short heights, small seeds) will have cue requirements associated with low forcing, chilling, and photoperiod
   (b) Spp that are better competitors with conservative growth and later budburst, with low SLA and LNC, tall heights, and large seeds, will have phenological response associated with high forcing, chilling, and photoperiod requirements

7. Previous studies of budburst in woody trees have shown 3 cues are most important for spp responses:
   (a) Chilling - the period of cold temperatures from late fall to late winter, releases buds from dormancy
   (b) Forcing - the occurrence of warm temperatures in spring that initiate bud development
   (c) Photoperiod - daylength
   (d) While field observations of phenology are highly variable — under controlled environments and set cues, bb is highly predictable
   (e) This suggests there is potential to use phenological data from controlled environment studies to identifying the relationship between species cue responses and traits

8. We used available trait data from trait databases and bb data from the OSPREE database of controlled environment studies of woody plant species to test for associations between budburst responses to environmental cues and common functional traits
   (a) Focus on the effects of forcing, chilling, and photoperiod cues and four commonly measured traits — SLA, LNC, height, & seed mass
   (b) Our model attributes phenological variation (day of bb) to species' trait values while including residual variation from species (partial-pooling).
   (c) When traits explain a significant portion of the variation, spp will explain only a small amount — may be able to predict spp growth strategies and phenological responses from trait values.

Need to fit in into intro, not sure where:

1. Cues address phenological variability
2. Be sure to clearly set up acquisitive vs. conservative

Stuff we had, but could cut:

1. details of phenological responses - ectodormancy transition to endodormancy – Cutting this, too much other content
2. detailed definition of forcing, chilling, photoperiod