Traitors intro

December 23, 2022

BROAD outline ...

1. Open with phenological diversity (lots of it across spp. most of it unexplained, cite Laube, Flynn etc. work)
   (a) Timing plant phenological events (budburst) define species' temporal niche = the partitioning of resources across species over time (Gotelli & Granves 1996 - ch5).
   (b) Differences along this niche axis contribute to community assembly, defining the abiotic environment experienced during growth and biotic interactions – competitive landscape and pressures from herbivory.
   (c) Studies of woody plants show diversity in species temporal niche e.g spring budburst and variability to environmental cues (Laube2014, Flynn2018)
   (d) Changes in climate are altering spp temporal niche, however, with earlier spring growth having cascading effects to ecological communities and spp interactions
   (e) But still have a limited mechanistic understanding of how specific spp will respond
2. Set up early vs. late phenology and frost versus competition (could maybe mention invaders within this)? Try to basically set up the idea of traits, without saying traits.
   (a) The timing of bb in woody spp appear to range from early spring species — bb prior to canopy closure — and later canopy spp.
   (b) Early in the spring = greater abitoic pressures, such as risk of false spring events and frost = affects early budbursting spp = potential loss of tissue
   (c) Late spp have greater selection from biotic pressures = less light available and competition for resources
   (d) Differences in bb phenology within communities = important in shaping community dynamics including competition & herbivory.
   (e) But also 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.
3. Now get to phenology (as day of year/early-late) x traits and how that connects to 2.
   (a) Considerable work on the functional traits related to species growth strategies and competitive abilities — few studies include phenology
   (b) Leaf economic spectrum: spp fall along gradients of acquisitive (fast) growth to more conservative (slow) growth
   (c) Decades of research linking functional traits to species responses to abiotic and biotic factors and community assembly
   (d) Strategies that favour fast growth should promote early bb, often associated with traits realted to species responses to abiotic factors (eg frost risk, light caputrue)

(e) Spp that are better competitors with conservative growth bb later - associate this with traits that biotic factors, like competition

(f) But whether other there are associations between other functional traits and the cues responses that define species temporal niche is unknown.

4. Get into complexity of cues after hypotheses

(a) Previous studies have shown 3 cues are most important for spp responses:

i. Chilling - the period of cold temperatures from late fall to late winter, releases buds from dormancy

ii. Forcing - the occurrence of warm temperatures in spring that initiate bud developement

iii. Photoperiod - daylength

(b) field obs of phenology are highly variable — but under controlled environments and set cues, bb is highly predictable

(c) traits themselves can be highly variable, both across and within spp - Violle paper 'viva la variability'

(d) trait ecology's goal = predict sp-level characteristics by traits alone — how well we can do this to highly variable and species specific traits like phenology is unclear

(e) Potential to use phenological data from controlled environment studies to identifying the relationship between sp cue responses and traits

5. Set up hypotheses...

(a) We predict that spp with traits associated with acquisitive growth (high SLA, high LNC, short heights, small seeds) will have will have cue requirements associated with low forcing, chilling, and photoperiod cue requirements

(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

6. Here's what we do here.

(a) we test for associations between plant phenological responses to environmental cues and common functional traits

(b) use available trait data from trait databases with bb data from controlled environment studies of woody plant species from the OSPREE database.

(c) We focus on the effects of forcing, chilling, and photoperiod cues and four easy to measure traits — SLA, LNC, height, & seed mass

(d) Our model attributes phenological variation (day of bb) to species' trait values while including residual variation from species (partial-pooling).

(e) 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.

(f) Potential to use phenological data from controlled environment studies to identifying the relationship between sp cue responses and traits

7. Our model ...

(a) Our model attributes phenological variation (day of bb) to species' trait values while including residual variation from species (partial-pooling).

(b) 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

Fig 1: i) Can you confirm the slopes (when trait effect = 0) are constant across the top conceptual panels? If not, we should make them that way I think to minimize what changes across them? DLDec15: Yes they are, the betaChill slope is always -2, betaForceSp =5 and betaPhotoSp = 1 for each plot
ii) Make sure the figure in the Supp that is similar has the same y axis scale - DLDec15: I will fix that in the next draft for sure