Traitors Discussion

January 5, 2023

BROAD outline ...

1. Recap main result: 1-3 sentences

    (a) Some functional traits of woody plants relate to phenological responses in spring budburst

    (b) Results were in line with our predictions for chilling cues, but less so for forcing and photoperiod

    (c) Results suggest phenology does align with established gradients in trait variation—gradient from acquisitive early bb sp to conservative late bb species

2. Discuss deviations from predictions in more detail—discuss in context of trait lit

    (a) Not all our predicted trends were observed—may indicate variable roles of cues or tradeoffs in how traits mediate environmental factors and biotic interactions

    (b) Height and forcing: spring temperatures relate to wood traits and resource allocation to lateral growth, e.g. cambial meristem (Lenz2016), growth and height (Clements1972, Marquis2020)

    (c) We predicted to find strong relationships between species photoperiod cues and LNC (LNC related to photosynthetic rates) but trends were weak

    (d) Previous on budburst phenology and functional traits have found species specific trends, with some showing no relationships (Kitamura2007), while find similar results to our own (Osada2017)

    (e) Osada2017 - also found wood and leaf traits to relate to budburst, like SLA

    (f) Similarly to budburst, the timing of first-flowering were positively correlated with traits, with shorter spp flowering earlier for example (Konig2018)

3. Discuss findings in context of cues

    (a) Our results are in line with previous studies on species cues—strongest cue responses to chilling and forcing, weak responses to photoperiod

    (b) High fitness costs of premature growth may select for stronger responses chilling cues

    (c) Photoperiod cues may be driven by clade specific responses - cite Nacho's paper?

    (d) Results suggest that traits select less for photoperiod cues and are more correlated with temperature cues.

    (e) But given that cues like, forcing and chilling, are correlated in how they shape phenology, other traits may have complex interactive effects not addressed by this model

4. Limitations and future directions

    (a) Limitations:

        i. Despite using global trait databases, there was only a few species with numerous traits represented—small subset of woody plant diversity and biased toward wells studied spp

        ii. trait and phenology data collected independently of each other—more variation than if sampled the same populations and individuals—we account for this with study level effects

        iii. Our results are therefore general trends across populations and species, but we need more data and species and site specific data to make predictions, particularly at the population scale

    (b) Future directions:

        i. Forecasting future conditions ...

        ii. Chilling likely to be met earlier, warmer springs...

        iii. Our results suggest that acquisitive species will have an advantage under these novel conditions, potentially benefiting from longer growing seasons or longer periods of reduced competition in the spring

        iv. Link to invasive species perhaps—greater potential to shift phenologically—higher rates leaf production and favourable wood anatomy (Yin2016)

        v. how communities respond to novel species invasions and shifts in phenology will depend on species temporal niche and the ability of native species to fill available niche and resist invasions (Schuster2021)

5. Conclusion

    (a) Modelled joint relationships between functional traits and budburst cue responses and found associations between traits and species responses

    (b) species with acquisitive growth traits were less responsive to temperature and photoperiod cues while species with conservative traits had stronger cue responses

    (c) Provide insights into how we may be able to use traits to predict species cue requirements and possible changes in species budburst

    (d) the varying responses and deviation observed from our predictions also highlights gaps in our current knowledge of how traits mediate abiotic conditions

    (e) Complex relationships between traits, phenology, and environmental cues necessary to predict species future responses to climate change and cascading effects to trophic interactions and ecosystem services