THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Forestry

Dear Dr. Thrall:

Please consider our paper, "Current environments and evolutionary history shape forest temporal assembly" for publication as a letter in *Ecology Letters*.

Climate change is impacting species phenologies—timing of life history events—reshaping communities, and altering ecosystem functioning. While most species are advancing phenologically, there is considerable species-level variation in the rate of these changes. Theory suggests this variation comes from species partitioning time to reduce competition for resources. But shared evolutionary history and differences in environmental cues may further moderate the temporal assembly of a community. Understanding this variability is critical to accurate forecasts of future community dynamics and requires large-scale community-level experiments to identify the drivers of community assembly.

Focusing on woody plants for which phenological cues—specifically temperature and photoperiod—are well known, we directly test the role of populations, species and community-level variation, including the role of evolutionary history in shaping species differences. Using samples collected from 47 tree and shrub species from four populations that span North America, we conducted two controlled environment studies in which observed differences in the start of leaftout under varying temperature and photoperiod cues. Pairing the results of these two studies with a Bayesian phylogenetic model, we are one of the first to mechanistically test the relationships and variability in leafout cues and evolutionary relationships, using a powerful analytical approach that has broad applications across diverse species assemblages and phenologies.

Our findings provide novel insight into the drivers of the high species-level variation we observe in leafout phenology. We observed very little site-level variation in leafout timing, but greater species-level variation with cues generally leading to advances in budburst. But while many models critical for future forecasts assume temperature and light explain forest leafout, we found cues to only explain between 38.4 and 67.6% of variation. This remaining variation, which is partially explained by evolutionary history, suggests our understanding of leafout phenology is incomplete and that other unidentified traits or cues also shaping the temporal assembly of forest communities.

All authors contributed to this work and approved this version for submission. The manuscript is 3773 words with a 150 word summary, and 3 figures. It is not under consideration elsewhere. We hope you find it suitable for publication in *Ecology Letters*, and look forward to hearing from you.

We recommend the following reviewers: Dr. Jason Fridley, Dr. Meredith Zettlemoyer, Dr. Mason Heberling, Dr. Rong Yu, and Dr. Ameila Caffara.

Sincerely,

Deirdre Loughnan

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