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*.

Ecological communities are shaped by many environmental cues and species interactions across both time and space. Climate change is reshaping the underlying processes, with warmer temperatures leading to novel species interactions and community structure. The strongest evidence of these changes is from species' temporal niche—particularly the timing of their life history events or phenologies—which in general have advanced in response to warming. While previous studies have found phenology to be variable across species and interannually, we are still limited in our understanding of what cues shape the phenology of most species. Experiments have the potential to mechanistically test the causes of phenological shifts and variability, but they are logistically challenging and to date, have focused on only a few species. This lack of large-scale, community-level experiments, limits our ability to accurately forecast the composition and dynamics of communities under future climates.

Our study is one of the first to directly test the role of populations, species and community-level variation in shaping phenologies. Our study focuses on woody plants for which phenological cues—specifically temperature and photoperiod—are well studied. Conducting two large-scale controlled environment studies, we observed leafout in 47 tree and shrub species from four populations under variable temperature and photoperiod cues. To further account for the effects of species evolutionary history, we paired our experimental data with a phylogenetic tree and used a Bayesian phylogenetic model to mechanistically test the relationships and variability in phenological cues and evolutionary relationships.

We found greater cues to lead to earlier phenologies, but with very little site-level variation. In fact, the considerable phenological differences observed across species were only partially explained by evolutionary history and the three cues thought to best explain leafout in woody plant. Our findings suggest our understanding of leafout—a well studied phenological event—is still incomplete and that other unidentified traits or cues also shaping the temporal assembly of communities.

Our study also presents a powerful analytical approach that has broad applications across diverse species assemblages and phenologies. The phylogenetic model we use in our analysis could be applied to other types of phenological events or suites of species, allowing us to test for differences between invasive and native species in a community or across species in distinct trophic-levels or functional groups.

All authors contributed to this work and approve 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.

Sincerely,

Deirdre Loughnan

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