THE UNIVERSITY OF BRITISH COLUMBIA

Dear Dr. Öpik

Please consider our paper, "How temperature, photoperiod and evolutionary history shape forest leafout" for publication as a full paper in *New Phytologist*.

Global shifts in the timings of species life history events with climate change has led to increasing interest in how communities assemble in time (Cleland & Wolkovich, 2024; Cope *et al.*, 2022). Yet progress has been slow, as species timings are highly variable, especially in systems where shifts have been greatest. Experiments can decompose this variability into predictable responses to environmental cues, such as temperature and daylength (Basler & Körner, 2014; Vitasse *et al.*, 2014; Zohner *et al.*, 2016). Given their logistical challenges, however, most experiments have focused on only a few species—providing limited insights into community dynamics under future climates.

What hypotheses or questions does this work address? Accurately forecasting phenological shifts and its impact on communities requires answering: which environmental cues are most important at the population-, species-, and community-levels? We provide an answer to this for North American forests combining experiments that alter temperature and daylength with a model that can robustly partition variation, including the role of evolutionary history.

How does this work advance our current understanding of plant science? By using a large-scale experiment of 47 species spanning 6° latitude and 55° longitude, our results provide compelling evidence for similar leafout across temperate forests and functional groups. A surprisingly large amount of variation in species timings was unexplained by different responses to cues, however, suggesting important unexplained variation in our mechanistic model of leafout.

Why is this work important and timely? Our results highlight fundamental gaps in our model of one of the best studied and most important phenological events—woody plant budburst—through unexplained species-level differences. Such differences may structure plant communities and ecosystems. Further, our findings of no detectable population-level variation and smaller than expected differences in functional groups has major implications for forecasting forest leafout.

Both authors contributed to this work and approve this version for submission. The manuscript is 4083 words with a 199 word summary, and 4 figures and is not under consideration elsewhere. We hope you find it suitable for publication in *New Phytologist*, and look forward to hearing from you.

Sincerely,

Deirdre Loughnan

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Basler, D. & Körner, C. (2014) Photoperiod and temperature responses of bud swelling and bud burst in four temperate forest tree species. *Tree Physiology* **34**, 377–388.

Cleland, E.E. & Wolkovich, E.M. (2024) Effects of phenology on plant community assembly and structure. *Annual Review of Ecology, Evolution, and Systematics* **55**, 471–492.

Cope, O.L., Burkle, L.A., Croy, J.R., Mooney, K.A., Yang, L.H. & Wetzel, W.C. (2022) The role of timing in intraspecific trait ecology. *Trends in Ecology and Evolution* **37**, 997–1005.

Vitasse, Y., Basler, D. & Way, D. (2014) Is the use of cuttings a good proxy to explore phenological responses of temperate forests in warming and photoperiod experiments? *Tree Physiology* **34**, 174–183.

Zohner, C.M., Benito, B.M., Svenning, J.C. & Renner, S.S. (2016) Day length unlikely to constrain climate-driven shifts in leaf-out times of northern woody plants. *Nature Climate Change* **6**, 1120–1123.