October 23, 2019

Dear Drs. Chase and Hillebrand:

Please consider our manuscript, entitled "How environmental tracking shapes communities in stationary & non-stationary systems," for publication as a Review & Synthesis in *Ecology Letters*. This submission follows from an invitation in May of this year (with submission expected in mid-October, apologies for the delay).

This paper presents the first review of environmental 'tracking'—how much an organism can shift the timing of key life history events in response to the environment. Growing empirical research highlights that environmental tracking is linked to species performance, and may contribute to the assembly of communities and determining species persistence, especially as anthropogenic climate change is reshaping the environment of all species. Yet research in this area has often been focused on understanding the impacts of climate change, and comparatively less often been guided by testing or developing ecological theory. Current models of coexistence, however, are clearly primed for understanding how the environment can shape the formation and persistence of communities, but generally ignore non-stationary environments (i.e, where the underlying distribution shifts across time)—even though most or all environments today are non-stationary.

Here we unite empirical and theoretical approaches to provide a framework to advance research in environmental tracking towards prediction. We begin with a review of environmental variability in stationary and non-stationary environments as well as current coexistence theory for variable environments. We then provide an initial test of how well basic theory supports the current paradigm that climate change should favor species with environmental tracking. Our model results show how non-stationarity can drive local species extinction and reshape the underlying assembly mechanisms of communities. Our results also support empirical work showing a trade-off where trackers are also inferior resource competitors. Finally, our results highlight that non-stationarity may reshape the balance of equalizing versus stabilizing mechanisms.

Upon acceptance for publication, data from a systematic literature review included in the paper will be freely available at KNB (knb.ecoinformatics.org); the full dataset is available to reviewers and editors upon request.

I. Breckheimer, D. Buonaiuto, E. Cleland, J. Davies and G. Legault have previously reviewed the manuscript. We recommend the following reviewers: Charles Willis, Ally Phillimore, Stephen Thackeray, Louie Yang. Both authors substantially contributed to this work and approved of this version for submission. The manuscript is approximately 5,830 words with 196 word abstract, 4 figures, 3 boxes and 93 references. It is not under consideration elsewhere. We hope that you will find it suitable for publication in *Ecology Letters* and look forward to hearing from you.

Sincerely,

Elizabeth M Wolkovich
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University of British Columbia