Dr. Tim Coulson, Editor-in-Chief, Ecology Letters

Dear Dr. Coulson,

We have enclosed our manuscript, ‘Traits affecting nutrient recycling by mobile consumers can explain coexistence and spatially-heterogeneous trophic regulation across a meta-ecosystem’, in the hope that you will consider it for publication as a Letter in Ecology Letters.

There has been growing awareness that spatial flows of nutrients have important implications for the dynamics and functioning of ecosystems (McCann et al. 2021, Ecol. Lett.) Although mobile organisms are widely recognized to drive flows of nutrients across ecosystems through nutrient recycling (Polis et al. 1997, Annu. Rev. Ecol. Evol. Syst*.*), we lack a theory of trophic regulation and of community assembly integrating the effects of nutrient recycling by mobile organisms that couple ecosystems across scales.

We present a meta-ecosystem theory examining how nutrient recycling by mobile consumers, that couple ecosystems through foraging, impacts trophic regulation and coexistence of different mobile species. Motivated by empirical observations indicating how consumers feed and use habitat across landscapes can influence where they distribute recycled nutrients (e.g., Subalusky et al. 2018, Ecology), we explicitly test the significance of consumer traits related to feeding and habitat preferences. Our results show consumer recycling leads to spatially heterogeneous trophic regulation across the meta-ecosystem, which is enabled by spatial cascades mediated by the mobility of the consumers. We show consumer traits can modify the strength of the regulatory effects of recycling and can determine which ecosystem experiences top-down versus bottom-up effects. Depending on consumers’ traits, we further show recycling can both promote or prevent coexistence of different mobile species by creating ecosystem feedbacks that either weaken or enhance competitive differences between species.

Our study represents a major advance to Ecology as it illustrates the ecological significance of nutrient recycling by mobile organisms that carry out a major form of organism movement observed to couple ecosystems in nature (Gounand et al. 2018, Trends. Ecol. Evol). ***Relative to recent developments in community and ecosystem ecology, our manuscript is outstandingly novel as it provides a theoretical framework for integrating foraging and movement traits with theories of species assembly and ecosystem functions across spatial scales. Further, it extends meta-ecosystem theories beyond passive flows of nutrients and integrates a trait-based perspective****.* We believe Ecology Letters is the perfect venue for this work because it has been at the forefront of developments of three topics our paper integrates: spatial coupling via mobile consumers (McCann et al. 2005, Rooney et al. 2008, Ecol. Lett.), meta-ecosystem ecology (Loreau et al. 2003, Marleau et al. 2015, Ecol. Lett.), and the role of species traits (Haddad et al. 2008, De Bie et al. 2012, Ecol. Lett.).

We thank you for considering our manuscript for publication in Ecology Letters*.*

Best regards,

Tianna Peller

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