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| Dr Peter H. Thrall  Editor-in-Chief  *Ecology Letters* |  |
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| Zurich, XX INSERT DATE BEFORE SUBMITTING XX | |
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Dear Dr Peter H. Thrall,

We have enclosed our manuscript, ‘Ecosystem size mediates the effects of resource flows on biodiversity and ecosystem function at different scales’, to be considered for review as a Letter Article in *Ecology Letters*.

The size of ecosystems and the movement of non-living resources among them, such as leaf litter and inorganic nutrients, are essential factors that affect both biodiversity and ecosystem function. However, there has been a lack of attention given to whether and how ecosystem size and flows of non-living resources interact with each other, affecting ecosystems. This is likely due to the fact that controlling for ecosystem size and resource flow in natural settings is challenging. Ignoring this interaction could mean ignoring a ubiquitous mechanism that drives biodiversity and ecosystem function, as natural ecosystems come in different sizes and are connected to other ecosystems through the movement of non-living resources (Gounand et al., 2018, *Nat. Commun.*).

Here, we conducted a microcosm experiment to examine how ecosystem size asymmetry affects the biodiversity and function of two-patch meta-ecosystems whose patches were connected through flows of non-living resources. To do this, we mimicked resource flows between ecosystems of different sizes, yet otherwise being identical or between ecosystems of the same sizes that were also identical. **We found that meta-ecosystems with asymmetric patch sizes had higher levels of α-diversity, but lower levels of β-diversity and ecosystem function (total biomass) compared to their unconnected counterparts. The effects of resource flows were mediated by patch size asymmetry, as these effects were not observed in meta-ecosystems with identical patch sizes.**

**Our study stands as a significant contribution to the field of Ecology, as it enhances our understanding of how ecosystem size and flows of non-living resources influences biodiversity and ecosystem function.** Our manuscript addresses the critical need for … We believe *Ecology Letters* is the perfect platform to share our work, as it has been at the forefront of research on how diversity and function are driven by non-living resource flows (e.g., Leroux & Loreau, 2008; Cole et al., 2006; Murakami & Nakano, 2002, *Ecol. Lett.*) and ecosystem size (e.g., Rybicki & Hanski 2013, Drakare et al., 2006, Crist & Veech, 2006, *Ecol. Lett.*).

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

Best regards,

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Emanuele Giacomuzzo, Dr Tianna Peller, Dr Isabelle Gounand, and Dr Florian Altermatt

WHAT THE PROBLEM IS.

Recent research demonstrates the spatial flow of non-living resources (e.g., nutrients, detritus; herein, “resource flows”) between ecosystems can drive ecosystem dynamics and functions from local to meta-ecosystem scales (Gounand et al. 2014, Gülzow et al. 2019, *Am. Nat*.; Peller et al. 2022, *Ecol. Lett.*). In nature, resource flows can form networks comprised of many ecosystems, spatially coupled via resource flows (Jacquet et al. 2022, *Oikos*). Yet, the significance of resource flows for ecosystem function has primarily been understood by studying two-patch meta-ecosystems. Consequently, the broader resource flow network and its spatial structure have been largely overlooked, despite extensive theory demonstrating a critical influence of network structure on the dynamics of different types of ecological networks (e.g., dispersal networks; Holland & Hastings 2008, *Nature*; Zhang et al. 2021, *Ecol. Lett.*).

HOW WE FILL THE GAP, WITH THE MAJOR RESULT (THE NOVELTY AND KEY RESULTS IN BOLD)

We present a theory examining how the spatial structure of resource flow networks influences meta-ecosystem function (i.e., biomass production). With the objective of drawing generic predictions, we compare meta-ecosystem models with resource flow networks exhibiting homogeneous versus heterogeneous degree distributions, but otherwise equivalent characteristics. **We show meta-ecosystems with contrasting degree distributions of resource flows can exhibit strong differences in meta-ecosystem function, which arise through the scaling-up of nonlinear local processes.** Notably, however, we show that neither network structure consistently exhibits the greatest meta-ecosystem function. Rather, meta-ecosystem function depends on a combination of resource flow network structure, as well as the biotic (organism traits) and abiotic (resource flow rates) properties of the network.

WHAT YOUR IMPACT IS IN THE FIELD OF ECOLOGY AND WHY ECOLOGY LETTERS IS THE BEST AVENUE (E.G., ECOLOGY LETTERS HAVE BEEN AT THE FOREFRONT OF THIS FIELD, PUT EXAMPLES OF PAPERS THAT THEY PUBLISHED ON THE TOPIC).

**Our study represents a major advance in Ecology as it identifies a mechanism by which non-living resource flows can drive ecosystem function at landscape spatial scales.** In doing so, our manuscript answers urgent calls for an improved understanding of the drivers of ecosystem function across scales (Gonzalez et al. 2020, *Ecol. Lett.*), while simultaneously bridging gaps between the mechanistic field of meta-ecosystem ecology and the descriptive field of landscape ecology. We believe *The American Naturalist* is the perfect venue for this work because it has been at the forefront of developments on non-living resource flows (Loreau & Holt 2004, Gounand et al. 2014, Gülzow et al. 2019, *Am. Nat.*) and ecological networks (Andreazzi et al. 2017, Gauthier et al. 2021, Benadi et al. 2022, *Am. Nat.*).