May 08, 2017

To the Editors of *Trends in Ecology & Evolution*,

Please find enclosed our manuscript "Linking evolutionary and ecological theory illuminates non-equilibrium biodiversity". This opinion piece puts forth a new analytical approach to understanding and predicting non-equilibrium processes in ecology and evolution. We do so by synthesizing insights gained from testing equilibrial ecological theory as a null model, with inference into the deep evolutionary history of communities from next generation sequencing-enabled population/phylogenetics theory applied at the scale of the entire community. While other researchers have proposed (and we briefly review) syntheses between ecology and evolution using population/phylogenetic data and/or tools, our approach represents a fundamentally novel contribution because

1. It proposes a joint modeling method using next generation sequencing data to simultaneously inform ecological theory of the evolutionary history underlying a community of interest, while also informing evolutionary inference of what ecological outcomes are realistic. No attempt has been made to achieve such a quantitative synthesis, let alone at the scale we are proposing. This represents a theoretical and bioinformatic breakthrough with far-reaching applications from microbial ecology to massive biodiversity assessments and analyses of macro-organism communities

2. It provides rigorous quantitative predictions not just of basic patterns in ecological and genetic/genomic datasets, but also what these patterns reveal in terms of the systems' current state of equilibrium or non-equilibrium and likelihood of transitioning to other dynamic states

3. It solves a long-standing challenge in ecological theory, namely that many dynamic processes map onto the same static "macroecological" patterns, such as the species abundance distribution or species area relationship. Our approach does so by creating new predictions and dimensions of data available for theory testing

4. Finally our framework sets up future opportunities for integrating cutting edge approaches from paleontology and functional genomics.

We are grateful for the chance to share our work via *Trends in Ecology & Evolution* and hope that our framework can initiate and invigorate new research into non-equilibrium biodiversity dynamics and the synthesis of theories from ecology and evolution.

Sincerely,

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