Dear Dr. Hetherington,

Please find attached our manuscript “Time will tell: the temporal and demographic contexts of plant-soil microbe interactions” submitted as an invited Tansley Review to New Phytologist.

There is an increasing recognition that interactions between plants and soil microbes, often studied under the framework of plant-soil feedback (PSF), influence the structure and dynamics of plant communities. Although there is now evidence that soil microbes affect plant performance and species interactions across almost every terrestrial ecosystem, our ability to translate results from short-term PSF experiments into predictions of long-term plant dynamics in the field remains limited. We argue that explicitly accounting for the natural temporal contexts of plant-soil microbe interactions can help bridge this gap. Our review begins with a synthesis of the contemporary understanding of the temporal dynamics of plants and soil communities during the conditioning and response phases of the classic PSF experimental design. Next, we highlight microbial effects on different plant demographic transitions, which are often overlooked in PSF studies that focus only on microbial impact on plant biomass performance. Finally, we argue that the current theoretical paradigm makes it difficult to incorporate the temporal and demographic dimensions of plant-soil microbe interactions and present avenues for new theoretical frameworks better equipped to integrate this complexity. Throughout the manuscript, we suggest avenues for future experiments and theoretical developments that will enable more nuanced predictions of the long-term consequences of plant-soil microbe interactions in nature.

We believe this study would interest the broad range of readership of New Phytologist. In our review, we summarize the temporal aspects of PSF experiments in the literature, thereby demystifying the experimental decisions associated with quantifying microbial effects for newcomers to the field. For empirical studies, our review highlights the necessity of considering the temporal context in designing experiments and interpreting results. For theoretical studies, we suggest how patch occupancy models and demographically explicit models can be applied to study plant-soil microbe interactions. The feedback loop between empirical and theoretical approaches, as exemplified in our review, provides an exciting avenue to understand the influence of soil microbes on plant communities.

Thank you for considering our submission.

Sincerely, Po-Ju Ke, Suzanne Ou, Gaurav Kandlikar, Gen-Chang Hsu, Joe Wan, Meghna Krishnadas