Why are plant-soil feedbacks so unpredictable, and what to do about it?

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Plants grow in the soil and can change certain properties of the soil as they grow. This can affect how plants grow in that same soil at a later time. This phenomenon is called plant-soil feedback. Plant-soil feedback is receiving increased attention in ecology because plant-soil feedbacks can be useful to help predict how plant communities, and the ecosystem processes they control, might change over time. However, most plant-soil feedback studies have been conducted independently of other factors that could affect their strength and change whether or not the plants experience negative or positive feedbacks. This is problematic because it has led to limited understanding of plant-soil feedbacks in 'the real world'. Here, we present a framework to help understand how drivers such as temperature, soil moisture, aboveground plant consumers (i.e., foliar pathogens, herbivores) and belowground top-down control of soil pathogens and mutualists could affect plant-soil feedbacks. We focus on these factors because they are known drivers of plants and soil organisms and the ecosystem processes they control. Our framework describes the proposed mechanisms behind these drivers and explores their effects on plant-soil feedbacks. We demonstrate the impacts of these drivers using the fast- to slow-growing plant economics spectrum. We use this well-established paradigm because plants at

opposite ends of this spectrum differ in their relationships with soil biota and have developed contrasting strategies to cope with different environmental conditions. Finally, we present suggestions for improved experimental designs and scientific inference that will capture and elucidate the influence of above- and belowground drivers on plant-soil feedbacks. Better understanding of the external drivers of PSFs will allow us to make more accurate predictions of how plant-soil feedbacks impact on ecosystem function.