The plant-soil interface: understanding dynamic interactions in the context of environmental change

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Introduction. The ultimate, long-term goal is to determine what drives source-sink relationships that control the cycling of plant nutrients belowground. To fully appreciate the complexities of this dynamic process, one must consider the ecosystem in the context of plants as interactive systems growing in a highly active and highly interactive below ground microcosm of bacteria and plant-associating fungi (e.g. mycorrhizae). The proposed project describes an integrative study to probe how plant roots develop and respond in an interactive framework involving the surrounding soil microbial community. Results from these studies will also be useful for understanding how anthropogenic impacts on plant ecosystems may control microbial processes. The partitioning of nutrients to the roots and their exchange with the soil environment is likely controlled by a number of physico-chemical factors (including elevated CO2, temperature, water, etc.) that are either perceived by the plant or by the microorganisms in the rhizosphere, triggering a hierarchy of 'decisions' within the active terrestrial ecosystem that can impact biosequestration of carbon into recalcitrant pools, and the movement of essential nutrients controlling plant and microbial growth and productivity. The proposed work seeks to define this decision network with the ultimate goal of predictive models that can be used to enhance bioenergy crop production and mitigate the negative impacts of climate change.