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Effects of microbial diversity on the development of soil structure

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Soil microbial activity plays a vital role in ecosystem processes, in addition to creating and maintaining soil structure. Since soil is one of the most complex ecosystems in the environment, changes to the microbial diversity are thought to cause various impacts on the physical structure (and *vice versa*). A fundamental question yet to be resolved, is how microbiologically diverse does a soil need to be in order to develop and maintain its physical structure and functioning? Using macrocosms of soil, three different treatments containing (1) bare soil, (2) soil and *Plantago lanceolata* and (3) soil with *P. lanceolata* and arbuscular mycorrhizal fungi (AMF) were inoculated to two differing background biodiversity complexities. These macrocosms were incubated for up to 7 months, with intermediate harvests taking place over this period to monitor the microbial communities and the physical structure. Examination of the 2-D soil porous architecture was made non-invasively through X-ray Computed Tomography (CT). Furthermore, other structural evaluations were made including the distribution of soil aggregates, their stability and repellency. Microbial diversity and relative abundance was quantified by a modification of Terminal Restriction Fragment Length Polymorphism analysis (T-RFLP) and functional richness measured using Biolog GN2 microtitre plates. The presence of *P. lanceolata* within these macrocosms significantly increased aggregate stability (P <0.001) compared to the bare soil treatments. Macocosms containing AMF, had significantly less root biomass (P=0.001),

and this contributed to a significant reduction in porosity (P <0.001) relative to the non-mycorrhizal, but planted soils. By comparing the presence and absence of *P. lanceolata* and AMF with varying background microbial diversities, we have started to resolve the effect microbial diversity has towards soil structure development.