

Bacterial communities and taxa as emerging indicators of soil condition

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Bacterial communities are important for the health and productivity of soil ecosystems, and have great potential as novel indicators of environmental perturbations. To assess their ability to provide alternative metrics of environmental health, we sought to determine which soil variables bacteria respond to, and whether these responses can be observed despite confounding spatial influences. We determined the composition of bacterial communities in soil samples from 110 natural or human-impacted sites, located up to 300 km apart. Overall, the largest portion of variability in bacterial composition was explained by physicochemical soil variables (29%) and in particular by soil pH and the level of Olsen P. Furthermore, we identified strong correlations between the relative abundance of members of Pirellulaceae and soil pH, Bradyrhizobium and the levels of Olsen P, members of Chitinophagaceae and the concentration of aluminium, and members of Sinobacteraceae and the concentration of chromium. The relationships between specific soil attributes related to land use and individual soil taxa demonstrates their ability to reflect the impact of anthropogenic activity, even when comparing samples across large geographic areas and diverse soil types. This indicates that there is scope to use bacterial communities, and relative taxa abundances, as biological indicators of soil condition. Our ability to effectively manage land use for the conservation and protection of our natural biological resources could be greatly enhanced through the application of biological data, which can complement current monitoring methods used by regional councils, to gain a more rapid, and biologically relevant indication of the state of our soil environment.