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Resistance and resilience of N and P cycling microbes in differently managed agricultural systems after heat perturbation

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Agricultural management and resistance and resilience of microbial communities is key to long-term agricultural sustainability. Agricultural management practices impact soil through physical disturbance, inputs of fertilizers and pesticides, and cultivation of monoculture or low-diversity plant systems. Resistance and resilience of soil microbial communities to disturbance events is a topic of growing importance with predicted rising temperatures and large unpredictability in rainfall patterns associated with global climate change. Diverse microbial communities are essential for the sustainability of agriculture. Previous research has focused on the resistance of soil systems in relation to total microbial biomass but has ignored relationships with specific functional groups of microbes. Denitrifiers are key organisms in N cycling and these organisms control the pools of plant-available N in soil, while alkaline phosphatase is a key microbially produced enzyme involved in the regulation of pools of available phosphate. In this soil incubation experiment abundance of total bacteria and archaea were quantified along with denitrifying and alkaline phosphatase genes after subjecting differently managed agricultural soils to severe temperature perturbation (60 oC for 15 minutes). The organic treatment showed the lowest resistance and resilience in terms of total bacterial and archaeal abundance but was resilient in terms of respiration activity. The high input systems show lower resistance for key functional groups of N and P cycling organisms compared to low input systems. However, all of the differently managed soils have similar resilience and show higher levels of N cycling organisms and lower levels of P cycling organisms after 30 days compared to starting levels.