Effects of aridity and plant community change on soil organic matter chemistry and nitrogen fluxes

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Climate change affects soil function directly by altering biogeochemical processes and the microorganisms that control them, and indirectly through shifts in plant species that change the chemistry of inputs and foster different microbial communities. We sampled an established bioclimatic transect following the mainland portion of the Adelaide Geosyncline in South Australia, from the temperate Fleurieu Peninsula for ca. 800 km north to Murnpeowie Station in the arid zone. We studied the effects of increasing aridity and associated plant community shifts on the relationships between: 1) soil organic matter chemistry; 2) soil nitrogen chemistry and fluxes; and 3) the diversity of soil bacterial, archaeal and microeukaryotic communities. Samples were collected from 42 long-term monitoring sites along the transect in the 2016 Austral autumn, comprising a composite of 20 individual surface soil samples from within a 25 × 25 m plot established at the corner of each site. Soil organic matter chemistry was quantified by spectroscopic techniques including NMR and MIR spectroscopies. Nitrogen pools and fluxes, with particular focus on organic nitrogen, were quantified by a range of N-15 pool dilution and sensitive C-14 tracer techniques, with concurrent decreases in soil N content and increases in isotopic enrichment with increased aridity. Microbial community composition was determined by next-generation sequencing. Relationships between these datasets and existing information from the monitoring sites (including plant community composition, basal area, and other characteristics) are investigated using multivariate data analysis approaches with some congruence between plant and microbial communities beyond that which is explained by climate factors alone.