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Spatial patterns of soil bacterial communities at the European scale

P. Plassart^{*1,2}, N. Chemidlin Prevost-Bouré³, S. Terrat², S. Dequiedt², R. Creamer⁴, D. Stone⁴,
P. Lemanceau³, L. Ranjard^{2,3}

¹*Observatoire Français des Sols Vivants, France*, ²*INRA, UMR 1347 Agroécologie, Plateforme GenoSol, Dijon, France*, ³*INRA, UMR 1347 Agroécologie, Dijon, France*, ⁴*Teagasc, Wexford, Ireland*

Here, soil bacterial diversity was studied at the European scale, under various environmental conditions (soil physico-chemical properties, climate, land use) in order to: (1) characterize the spatial distribution of this diversity and (2) identify and rank the environmental factors structuring bacterial diversity in European soils. Thus, 81 sites were selected along a transect spread across 11 European countries. Sites were selected on the basis of soil, climate and land use maps (Joint Research Council, LUCAS - land cover survey). For each site, one composite soil sample (5 soil cores) was taken, except for 17 sites in which a pseudo-triplicate sampling strategy was applied. A total of 115 soil samples was characterized regarding their physico-chemical and microbial properties. After microbial DNA extraction, pyrosequencing of 16S rRNA genes was performed to investigate soil bacterial richness, evenness, diversity (H') and community structure.

Along this European transect, a significant turnover of soil microbial community composition was observed, highlighting that they are distributed following non-random spatial patterns. Bacterial richness ranged from 653 to 1931 OTUs (95% similarity level), evenness ranged from 0.6 to 0.8, and H' from 4.0 to 6.2. A variance partitioning approach demonstrated that bacterial richness was mainly determined by soil texture and pH, whereas bacterial evenness and H' were first driven by land use and secondly by soil texture and pH. Land use, total C, pH and texture equivalently affected soil bacterial community structure. For soil bacterial richness, evenness, diversity and community structure, climatic factors were never significant, while remaining spatial autocorrelation was found. Soil bacterial community structure was also influenced by latitude. Altogether, this study helped to estimate the range of variation for bacterial richness, evenness and diversity; identify their distribution patterns and understand the environmental factors driving bacterial communities at the European scale.

Keywords: European scale, Soil bacterial communities, biogeography