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A spatial Upscaling Strategy to Assess Soil Microbial Community Assembly and the Impact of Land-Use

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Soil microorganisms are one of the most abundant and diverse living organisms on earth. The environmental filters shaping soil microbial community abundance and assembly were studied through spatial approaches at different scales during the last decade without a consensus: similar environmental filters were involved in shaping microbial community at different spatial scales but also particular filters prevailed at particular spatial scales. In this context, it is now crucial to investigate multiple spatial scales simultaneously to determine with genericity: i) which filter(s) for which scale(s); and ii) the relative influence of environment *vs* human activities on soil microbial diversity across scales.

We characterised soil microbial diversity and abundance (pyrosequencing and DNA yield) at different spatial scales: microscale (µm²), plot scale (m²), landscape scale (km²), regional scale (hundreds of km^2) and territory scale (>100,000 km²). The sampling strategy involved multiple systematic sampling grids sharing sampling sites representing several tens, hundreds and thousands of soils samples for plot to territory scales, respectively. Samples from the plot scale were fractionated for their micro- and macroaggregates to investigate the microscale. Soil physico-chemical, land-use and climatic characteristics were described and used in a variance partitioning approach. In parallel, taxa-area relationship (TAR) was calculated for each scale to better evaluate the microbial community diversity turnover and the processes involved.

Significant TAR were observed at every spatial scale, highlighting the heterogeneous distribution of soil bacterial communities. At each scale, environmental selection was the main process shaping soil bacterial communities, essentially by means of pH, SOC, C:N and land-use, but habitat size and soil texture were strongly involved at particular spatial scales. Interestingly, land-use (human activities) was more important than soil characteristics in shaping soil microbial communities at the landscape scale, highlighting that land-use changes are a leverage to manage these communities at this scale.

Keywords: upscaling strategy, soil microbial community, biogeography, pyrosequencing