



Role of soil biology and soil functions in relation to land use intensity.

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The delivery of the ecosystem's functions is predominantly controlled by soil biology. The biology found in a gram of soil contains more than ten thousand individual species of bacteria and fungi (Torsvik et al., 1990). Understanding the role and the requirements of these organisms is essential for the protection and the sustainable use of soils. Soil biology represents the engine of all the processes occurring in the soil and it supports the ecosystem services such as: 1) nutrient mineralisation 2) plant production 3) water purification and regulation and 4) carbon cycling and storage. During the last years land management type and intensity have been identified as major drivers for microbial performance in soil. For this reason land management needs to be appropriately studied to understand the role of soil biology within this complex interplay of functions. We aimed to study whether and how land management drives soil biological processes and related functions. To reach this objective we built a land use intensity index (LUI) able to quantify the impact of the common farming practices carried out in Irish grassland soils. The LUI is derived from a detailed farmer questionnaire on grassland management practices at 38 farms distributed in the five major agro-climatic regions of Ireland defined by Holden and Brereton (2004). Soils were classified based on their drainage status according to the Irish Soil Information System by Creamer et al. (2014). This detailed questionnaire is then summarised into 3 management intensity components: (i) intensity of Fertilisation (Fi), (ii) frequency of Mowing (Mi) and (iii) intensity of Livestock Grazing (Gi). Sites were sampled to assess the impact of land management intensity on microbial community structure and enzyme behaviour in relation to nitrogen, phosphorus and carbon cycling. Preliminary results for enzymes linked to C and N cycles showed higher activity in relation to low grazing pressure (low Gi). Enzymes linked to P and S cycles showed higher activity in relation to higher fertilizer application (high Fi). However, microbial biomass did not show a strong correlation with the three components of the LUI. Plant and microbial community are currently being assessed to investigate deeply the impact of land management on the overall soil biological processes. The results indicate that the proposed index is an efficient tool to identify the impact of land use on the ecological processes.

Creamer, R.E., et al. (2014). Irish Soil Information Synthesis Report (2007-S-CD-1-S1). http://gis.teagasc.ie/soils/downloads/EPA_RR130_PRINT.pdf

Holden, N. and Brereton, A.J., (2004). Definition of agroclimatic regions in Ireland using hydro-thermal and crop yield data. *Agricultural and Forest Meteorology* 122: 175 - 191.

Torsvik, V., et al. (1990). Comparison of phenotypic diversity and DNA heterogeneity in a population of soil bacteria. *Applied and Environmental Microbiology* 56.3 776-781.