
Impact of root profile on soil microbial functioning: what are the consequences for belowground ecosystem services?

Yogan Monnier*¹, Yves Le Bissonnais², Jean-Luc Maeght^{3,4}, Amandine Erktan^{5,6}, and
Alexia Stokes⁵

¹Botanique et Bioinformatique de l'Architecture des Plantes (AMAP) – Institut national de la recherche agronomique (INRA) : UR0931, Institut de recherche pour le développement [IRD], CNRS : UMR5120, Centre de coopération internationale en recherche agronomique pour le développement [CIRAD] : UMR51, Université Montpellier II - Sciences et techniques, Institut National de la Recherche Agronomique - INRA – Bd de la Lironde TA A-37/ PS 1 34398 Montpellier cedex 5, France

²Laboratoire d'étude des interactions entre sols, agrosystèmes et hydrosystèmes (LISAH) – Institut national de la recherche agronomique (INRA) – SupAgro - Campus de la Gaillarde - 2 place Pierre Viala - 34060 Montpellier Cedex 01, France

³Institut d'écologie et des sciences de l'environnement de Paris (IEES) – Institut de recherche pour le développement [IRD] : UMR242, Université Paris-Est Créteil Val-de-Marne (UPEC), Université Pierre et Marie Curie (UPMC) - Paris VI, CNRS : UMR7618 – 46 rue d'Ulm, 75005 Paris, France

⁴Soils and Fertilisers Research Institute – Hanoi, Vietnam

⁵Botanique et Bioinformatique de l'Architecture des Plantes (AMAP) – Institut national de la recherche agronomique (INRA) : UR0931, Institut de recherche pour le développement [IRD], CNRS : UMR5120, Centre de coopération internationale en recherche agronomique pour le développement [CIRAD] : UMR51, Université Montpellier II - Sciences et techniques – Bd de la Lironde TA A-51/ PS 2 34398 Montpellier cedex 5, France

⁶Botanique et Bioinformatique de l'Architecture des Plantes (AMAP) – Institut national de la recherche agronomique (INRA) : UR0931, Institut de recherche pour le développement [IRD], CNRS : UMR5120, Centre de coopération internationale en recherche agronomique pour le développement [CIRAD] : UMR51, Université Montpellier II - Sciences et techniques – Bd de la Lironde 34398 Montpellier cedex 5, France

Abstract

Recent evaluations of ecosystem services highlight the need to fill the major knowledge gap concerning the role of belowground biodiversity on services linked to soil. Key processes in carbon and nitrogen cycling occurred in the rhizosphere but most studies are based on shallow soil layers although many plants develop deep roots that can play a significant role on soil biochemical properties in interaction with microbial activity. We investigate soil erodibility and carbon and nitrogen cycling under different root profiles and soil microbial functioning in sites with different land covers in temperate and tropical climates. Roots and soils are sampling in several agroforests in France and in the North Vietnam. The soil profile

*Speaker

is studied from the soil surface to 2 m. We use a standard method for coring to quantify root distribution along the profile. We use the MicroResp™ method as a viable indicator for microbial activity and microbial community level physiological profile. Organic carbon content and higher soil aggregate stability in the surface zone is associated with higher root biomass and specific morphological characteristics. Fine roots are found down to the bedrock and to 2 m deep. Future results may show that land use change be a driver of microbial functioning linked to land cover and specificity of root systems. The presence of roots deep in the soil profile, in agroforest systems and natural vegetation, should be taken into account as a significant contributor to belowground ecosystem services and long-term carbon storage.

Keywords: agroforestry, microbial diversity, rhizosphere, soil functioning, deep roots