Investigating the interactions between soil carbon stocks, soil microbial communities and land-uses

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Purpose:

Soil organic matter (SOM) biogeography, the study of the SOM distribution and properties in wide spatial scales, aims at understanding the relationship between the organic matter fractions in the soil with the microbial and mesofauna communities. In the context of the positive feedback of soil carbon storage on global warming it is vital to improve our knowledge on the regulations and links between SOM pools and ecosystem biological functioning to preserve ecological goods and services such as maintenance of productivity and soil health.

Methods:

It is known that microbial biodiversity is central to soil fertility and carbon storage. However, the determinants influencing soil biodiversity in wide spatial scales is still inadequately understood. Concurrently, several recent land-use changes have resulted in declining soil health and organic matter levels which have adversely affected ecosystems and agro-ecosystems. Given the key roles of soil microorganisms in the regulation of soil carbon storage, the interactions between land-uses, and pedo-climatic factors driving soil biodiversity was determined in different ecosystems. This study performed an extensive studies to harmonize and incorporate large amounts of data on soil biodiversity, climate and geomorphology to produce comprehensive results that can be generalized and practically used to identify strategies to optimize future land-use practices.

Results:

This project identified the spatial patterns of microbial richness and diversity in soils and defined the key drivers of these spatial patterns. More precisely, the projects determined the covariance between soil bacteria, fungi, mycorrhizal fungi, or soil functions as indicated by enzyme activity and abundance of key functional genes in soil carbon cycles, as indicated by soil organic matter fractions, land-uses and pedo-climatic factors.

Conclusion:

This research produced a very unique and essential piece of research for: (1) measuring present state and monitoring future dynamics of microbial biogeography and soil carbon storage, (2) improving modeling of soil biodiversity response to climate change and thus pinpointing the best possible adaptation strategies to climate change, and (3) gain further understanding of soil carbon and biodiversity functioning under a changing climate and transfer this knowledge to the public and governments involved in ecosystems management decision-making.