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Influence of Scots pine encroachment into alpine grassland in the quality and stability of soil organic matter aggregation

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Ecotone areas are dynamic zones potentially suitable for detecting ecosystem sensitivity to climate change effects. Climate change scenarios proposed by IPCC predict a temperature increase in Mediterranean areas with the consequent altitudinal advance of Scots pine treeline (Pinus sylvestris L.) at the extent of grassland-shrubland areas. Therefore, variations in physical, chemical and biological properties of soils due to plant dynamics are expected.

We present a study located in the grassland-forest ecotone of Scots pine on a Mediterranean mountain in Central Spain, considering three different vegetation types: high mountain grassland-shrubland, shrubland-Scots pine high mountain forest and Scots pine mountain forest. We worked on the hypothesis that different plant species compositions influence both the size distribution and aggregate protection of the organic carbon (C), as a result of the different quality of C inputs to the soil from different vegetation types. To test this assumption, topsoil samples were firstly separated into four aggregate fractions (6-2 mm, 2-0.250 mm, 0.250-0.053 mm and < 0.053 mm) by dry sieving; secondly, free light fraction was isolated from intra-aggregate particulate organic matter (iPOM) in a soil/water suspension by centrifuging and decanting the supernatants; and thirdly, different iPOM (coarse iPOM and fine iPOM) and mineral associated soil organic C were released from each remaining aggregate fraction by sonication at 300 J ml-1 and further quantified by wet sieving.

We expect differences between light fraction, different iPOM and mineral associated soil organic C from the different aggregates fractions obtained among vegetation types as a result of different quality and quantity organic matter inputs to the soil. Thus, we will be able to predict (i) the evolution of protected soil organic matter with the encroachment of Scots pine on Mediterranean mountains due to climate change effects, (ii) the rate of macroaggregate formation and degradation in those vegetation areas, and (iii) whether they will behave as source or sink of atmospheric C.