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Biological and physical factors controlling aggregate stability under different climatic conditions in Southern Spain.

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Soil aggregation is a key factor determining the soil structure. The presence of stable aggregates is essential to maintain a good soil structure, that in turn plays an important role in sustaining agricultural productivity and preserving environmental quality. A wide range of physical and biological soil components are involved in the aggregate formation and stabilization, namely clay mineral content; the quantity and quality of organic matter, that can be derived from plants, fungal hyphae, microorganism and soil animals; and the soil water content. Climatic conditions, through their effect on soil water content, vegetation cover and organic matter content, are supposed to affect soil aggregation. Thus the main objective of this research is to analyse the effect of organic matter, clay content and soil water content on aggregate stability along a climatic transect in Southern Spain.

This study was conducted in four catchments along a pluviometric gradient in the South of Spain (rainfall depth decreases from west to east from more than 1000 mm year-1 to less than 300 mm year-1) and was based on a methodology approximating the climatic gradient in Mediterranean conditions. The selected sites shared similar conditions of geology, topography and soil use, which allowed making comparisons among them and relating the differences to the pluviometric conditions.

In February 2007, 250 disturbed and undisturbed samples from the first 5cm of the soil were collected along the transect. We measured the aggregate stability, organic matter, clay content and bulk density of every sample. In the field we measured rainfall, air temperature, relative humidity, wind speed, wind direction, solar radiation, potential evapotranspiration, soil water content, vegetation cover and presence of litter.

Our results suggest that aggregate stability is a property determined by a great number of highly variable factors, which can make extremely difficult to predict its behavior taking in account only a few of them. The climate exerted a great influence in aggregate stability and could determine by itself the soil structure along the climate transect. As a result, properties unrelated in a specific point of the climate transect became highly associated if we took it into account completely. Along the climate transect analyzed could be defined two areas, separated by a threshold located between 573.6 mm y-1 and 335.9 mm y-1. In the wettest part soil structure was mainly determined by biotic factors and in the driest part was highly probable that abiotic factors play a key role determining aggregate stability.