Geophysical Research Abstracts
Vol. 16, EGU2014-15782, 2014
EGU General Assembly 2014

Agricultural use of soil, consequences in soil organic matter and hydraulic conductivity compared with natural vegetation in central Spain

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When ecosystems are under pressure due to high temperatures and water scarcity, the use of land for agriculture can be a handicap for soil and water conservation. The interactions between plants and soils are site-specific. This study provides information about the influence of the preence vs. The absence of vegetation on soil in a semi-arid area of the sout-east of Madrid (Spain, in the Tagus River basin.

In this area soil materials are developed over a calcareous-evaporitic lithology. Soils can be classified as Calcisols, having horizons of accumulation with powdered limestone and irregular nodules of calcium carbonate. They can be defined as Haplic Cambisols and Leptic Calcisols (WRB 2006-FAO). The area is mainly used for rainfed agriculture, olive groves, vineyards and cereals. There are some patches of bushes (Quercus sp.) and grasses (Stipa tenacissima L.) although only found on the top of the hills.
This study analyses the differences found in soils having three different covers: Quercus coccifera, Stipa tenacissima and lack of vegetation. This last condition was found in the areas between cultivated olive trees.

Soil organic matter, porosity and hydraulic conductivity are key properties of soil to understand its ability to adapt to climate or land use changes. In order to measure the influence of different soil covers, four replicates of soil were sampled in each condition at two soil depth, (0-10 cm and 10-20 cm). Hydraulic conductivity was measured in each soil condition and replicate using a Mini-disk® infiltrometer.

There were no differences between the two depths sampled. Similarly, there were no changes in electric conductivity (average 0.1±0.03 dS m-1); pH (8.7±0.2) or calcium carbonate content (43±20 %). Nevertheless, significant differences (p>0.001) were found in soil organic matter. The maximum was found in soils under Quercus (4.7±0.5 %), followed by Stipa (2.2±1.1 %). The soil without vegetation in the areas between olive trees had only 0.7±1.1 % soil organic matter; far from the usual limit advisable for cultivated soils.

Soil porosity was also affected in cultivated soils, being 39±5% (total porosity), significantly less than those found under Stipa (46%) and Quercus (51%).

Hydraulic conductivity presented a similar pattern to porosity, being higher in soils under Quercus, however further research is needed to clarify this result, as it can also be related to changes detected in soil texture. Sand content, which was different between soil conditions, is highly correlated to hydraulic conductivity. Changes in soil texture can be due to erosive processes that have to be studied to establish the causative relationships between these findings.

Acknowledgements: Project CGL 2008-04296. Environmental Impact evaluation through the assessment of soil organic matter resilient forms in soils.