



Effects of land use change and management on SOC and soil quality in Mediterranean rangelands areas

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INTRODUCTION

Rangelands in the Iberian Peninsula occupy more than 90,000 km². These rangelands were created from the former Mediterranean oak forests, mainly composed of holm oak and cork oak (*Quercus ilex rotundifolia* and *Quercus suber*), by clear-cutting shrubs, removing selected trees and cultivating. These man-made landscapes are called 'dehesas' in Spain and 'montados' in Portugal. Between 1955 and 1981, more than 5,000 km² of dehesas was converted from pastureland to cultivated land. This process has been accelerated since 1986 owing to subsidies from the European Common Agricultural Policy (Parras-Alcántara et al., 2015a).

The role that natural rangelands play in the global carbon cycle is extremely important, accounting for 10-30% of the world's total soil organic carbon (SOC), in addition, SOC concentration is closely related to soil quality and vegetation productivity (Brevik, 2012).

Therefore, to study the land use and management changes is important, particularly in Mediterranean soils, as they are characterized by low organic carbon content, furthermore, the continuous use of ploughing for grain production is the principal cause of soil degradation. Therefore, land use decisions and management systems can increase or decrease SOC content and stock (Corral-Fernández et al., 2013; Parras-Alcántara et al., 2014, 2015a and 2015b; Parras-Alcántara and Lozano-García, 2014)

MATERIAL AND METHODS

A field study was conducted to determine the land use change (Mediterranean evergreen oak woodland to olive grove and cereal, all of them managed under conventional tillage and under conservationist practices) effects on SOC stocks and the soil quality (Stratification Ratio) in Los Pedroches valley, southern Spain.

RESULTS

Results for the present study indicate that management practices had little effect on SOC storage in dehesas. The stratification ratio was >2 both under conventional tillage and under organic farming, so, soils under dehesa had high quality. Nevertheless, in olive grove and cereal conservationist practices increased the SOC stocks. Therefore, conservationist practices contributed to a better soil quality and to increased carbon sequestration and, consequently, this management is an excellent alternative to conventional tillage.

A change in land use from dehesa to olive grove or cereal under conservationist practices appeared to increase the SOC. When calculated for the total soil profile these differences were equivalent to 20-25 Mg ha⁻¹ of SOC. This is potentially very important for many agricultural soils in the Mediterranean area which are characterized by low organic matter content. These differences in the SOC stock were not apparent when the change in land use occurred under conventional tillage; even in the land use change from dehesa to cereal the SOC stock was reduced.

This suggests that management in addition to change in land use is an important consideration and particularly the degree of soil disturbance which should be minimized.

REFERENCES

- Brevik, E.C., 2012. Soils and climate change: gas fluxes and soil processes. *Soil Horizons* 53(4). <http://dx.doi.org/10.2136/sh12-04-0012>
- Corral-Fernández, R., Parras-Alcántara, L., Lozano-García, B. 2013. Stratification ratio of soil organic C, N and

C:N in Mediterranean evergreen oak woodland with conventional and organic tillage. *Agriculture, Ecosystems and Environment* 164, 252-259. <http://dx.doi.org/10.1016/j.agee.2012.11.002>

Parras-Alcántara, L., Díaz-Jaimes, L., Lozano-García, B., Fernández Rebollo, P., Moreno Elcure, F., Carbonero Muñoz, M.D., 2014. Organic farming has little effect on carbon stock in a Mediterranean dehesa (southern Spain). *Catena* 113, 9-17. <http://dx.doi.org/10.1016/j.catena.2013.09.002>

Parras-Alcántara, L., Lozano-García, B., 2014. Conventional tillage versus organic farming in relation to soil organic carbon stock in olive groves in Mediterranean rangelands (southern Spain). *Solid Earth*, 5, 299- 311. <http://dx.doi.org/10.5194/se-5-299-2014>

Parras-Alcántara, L., Díaz-Jaimes, L., Lozano-García, B. 2015a. Management effects on soil organic carbon stock in Mediterranean open rangelands-treeless grasslands. *Land Degradation & Development* 26, 22-34. <http://dx.doi.org/10.1002/ldr.2269>

Parras-Alcántara, L., Díaz-Jaimes, L., Lozano-García, B. 2015b. Organic farming affects C and N in soils under olive groves in Mediterranean areas. *Land Degradation & Development* 26, 800-806. <http://dx.doi.org/10.1002/ldr.2231>