Geophysical Research Abstracts
Vol. 18, EGU2016-10713, 2016
EGU General Assembly 2016

Modelling global change impacts on soil carbon contents of agro-silvo-pastoral Mediterranean systems

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To assess the impact of climate change on soil organic C (SOC) stocks in agro-silvo-pastoral environments, different models have been applied worldwide at local or regional scales, such as as RothC (Francaviglia et al., 2012) or CENTURY (Alvaro-Fuentes et al., 2012). However, some of these models may require a high number of input parameters or can underestimate the effect of soil depth. CarboSOIL (Muñoz-Rojas et al., 2013) is an empirical model based on regression techniques and developed to predict SOC contents at standard soil depths (0-25, 25-50 and 50-75 cm) under a range of climate and/or land use change scenarios. CarboSOIL has been successfully applied in different Mediterranean areas ,e.g. Southern Spain (Muñoz-Rojas et al., 2013; Abd-Elmabod et al., 2014), Northern Egypt (Muñoz-Rojas et al., 2014) and Italy (Muñoz-Rojas et al., 2015). In this study, CarboSOIL was applied in the Cardeña and Montoro mountain range Natural Park. This area covers 385 km2 and is located within Sierra Morena (Córdoba, South Spain) and has a semiarid Mediterranean climate. It is characterized by agro-silvo-pastoral systems. The Mediterranean evergreen oak woodland (MEOW-dehesa) is savanna-like open woodland ecosystem characterized by silvopastoral uses, being an ancient human modified Mediterranean landscape (Corral-Fernández et al., 2013; Lozano-García and Parras-Alcántara 2013). The most representative soils in the Cardeña and Montoro mountain range Natural Park are Cambisols, Regosols, Leptosols and Fluvisols. These soils are characterized by low fertility, poor physical conditions and marginal capacity for agricultural use, together with low organic matter (OM) content due to climate conditions (semiarid Mediterranean climate) and soil texture (sandy). The model was applied at different soil depths: 0-25, 25-50 and 50-75 cm (Parras-Alcántara et al., 2015) considering land use and climate changes scenarios based on available global climate models (IPPC, 2007). A total of 38 sampling points were selected under two management practices and six different land uses: (1) MEOW-dehesa (D); (2) MEOW-dehesa + some pine trees (D+P); (3) MEOW-dehesa + some cork oaks (D+C); (4) MEOW-dehesa + some gall oaks (D + G); (5) MEOW-dehesa after a clarified process and transformed to olive grove but maintaining isolated oaks (OG) and (6) MEOW-dehesa after a clarified process and transformed to cereal pasture with isolated oaks (C). Preliminary results showed a high heterogeneity of SOC contents along the soil profile for different climate and land use scenarios. The methods used here can be easily implemented in other Mediterranean areas with available information on climate, site, soil and land use.

Keywords: CarboSOIL model, land use change, climate change, soil depth, dehesa

References:

Abd-Elmabod, S.K., Muñoz-Rojas, M., Jordán, A., Anaya-Romero, M., De la Rosa, D., 2014. Modelling soil organic carbon stocks along topographic transects under climate change scenarios using CarboSOIL. Geophys. Res. Abstr. vol. 16 EGU2014-295-1, EGU General Assembly.)

Álvaro-Fuentes, J., Easter, M., Paustian, K., 2012. Climate change effects on organic carbon storage in agricultural soils of northeastern Spain. Agric. Ecosyst. Environ. 155, 87–94.

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. Agric. Ecosyst. Environ. 164, 252–259.

Francaviglia, R., Coleman, K., Whitmore, A.P., Doro, L., Urracci, G., Rubino, M., Ledda, L., 2012. Changes in

soil organic carbon and climate change – application of the RothC model in agrosilvo-pastoral Mediterranean systems. Agric. Syst. 112, 48– 54.

IPCC, 2007. Technical summary. In: Climate Change 2007. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change http://www.ipcc.ch/.

Lozano-García, B., Parras-Alcántara, L. 2013. Land use and management effects on carbon and nitrogen in Mediterranean Cambisols. Agric. Ecosyst. Environ. 179, 208– 214.

Muñoz-Rojas, M., Jordán, A., Zavala, L.M., González-Peñaloza, F.A., De la Rosa, D., Pino-Mejias, R., Anaya-Romero, M., 2013. Modelling soil organic carbon stocks in global change scenarios: a CarboSOIL application. Biogeosciences 10, 8253–8268.

Muñoz-Rojas, M., Abd-Elmabod, S.K., Jordán, A., Zavala, L.M., Anaya-Romero, M., De la Rosa, D., 2014. Potential soil organic carbon stocks in semi arid areas under climate change scenarios: an application of CarboSOIL model in northern Egypt. Geophysical Research Abstracts Vol. 16 EGU2014-638-3, EGU General Assembly.

Muñoz-Rojas, M., Doro, L., Ledda, L. and Francaviglia, R. 2015. Application of CarboSOIL model to predict the effects of climate change on soil organic carbon stocks in agro-silvo-pastoral Mediterranean management. Agriculture, ecosystems and environment 202, 8-16.

Parras-Alcántara, L., Lozano-García, B., Brevik, E.C., Cerdá, A. 2015. Soil organic carbon stocks assessment in Mediterranean natural areas: A comparison of entire soil profiles and soil control sections. Journal of Environmental Management 15, 155-215.