Identification of land degradation evidences in an organic farm using probability maps (Croatia)

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Land degradation is a biophysical process with important impacts on society, economy and policy. Areas affected by land degradation do not provide services in quality and with capacity to full-field the communities that depends on them (Amaya-Romero et al., 2015; Beyene, 2015; Lanckriet et al., 2015). Agricultural activities are one of the main causes of land degradation (Kraaijvanger and Veldkamp, 2015), especially when they decrease soil organic matter (SOM), a crucial element for soil fertility. In temperate areas, the critical level of SOM concentration in agricultural soils is 3.4%. Below this level there is a potential decrease of soil quality (Loveland and Weeb, 2003). However, no previous work was carried out in other environments, such as the Mediterranean. The spatial distribution of potential degraded land is important to be identified and mapped, in order to identify the areas that need restoration (Brevik et al., 2016; Pereira et al., 2017). The aim of this work is to assess the spatial distribution of areas with evidences of land degradation (SOM bellow 3.4%) using probability maps in an organic farm located in Croatia. In order to find the best method, we compared several probability methods, such as Ordinary Kriging (OK), Simple Kriging (SK), Universal Kriging (UK), Indicator Kriging (IK), Probability Kriging (PK) and Disjunctive Kriging (DK). The study area is located on the Istria peninsula (45°3' N; 14°2' E), with a total area of 182 ha. One hundred eighty-two soil samples (0-30 cm) were collected during July of 2015 and SOM was assessed using wet combustion procedure. The assessment of the best probability method was carried out using leave one out cross validation method. The probability method with the lowest Root Mean Squared Error (RMSE) was the most accurate. The results showed that the best method to predict the probability of potential land degradation was SK with an RMSE of 0.635, followed by DK (RMSE=0.636), UK (RMSE=0.660), OK (RMSE=0.660), IK (RMSE=0.722) and PK (RMSE=1.661). According to the most accurate method, it is observed that the majority of the area studied has a high probability to be degraded. Measures are needed to restore this area.

References

Amaya-Romero, M., Abd-Elmabod, S., Munoz-Rojas, M., Castellano, G., Ceacero, C., Alvarez, S., Mendez, M., De la Rosa, D. (2015) Evaluating soil threats under climate change scenarios in the Andalusia region, Southern Spain. Land Degradation and Development, 26, 441–449.

Beyene, F. (2015) Incentives and challenges in community based rangeland management: Evidence from Eastern Ethiopia. Land Degradation and Development, 26, 502–509.

Brevik, E., Calzolari, C., Miller, B., Pereira, P., Kabala, C., Baumgarten, A., Jordán, A. (2016) Historical perspectives and future needs in soil mapping, classification and pedological modelling, Geoderma, 264, Part B, 256-274.

Kraaijvanger, R., Veldkamp, T. (2015) Grain productivity, fertilizer response and nutrient balance of farming systems in Tigray, Ethiopia: A Multiprespective view in relation do soil fertility degradation. Land Degradation and Development, 26, 701–710.

Lanckriet, S., Derudder, B., Naudts, J., Bauer, H., Deckers, J., Haile, M., Nyssen, J. (2015) A political ecology perspective of land degradation in the North Ethiopian Highlands. Land Degradation and Development, 26, 521–530.

Loveland, P., Weeb, J. (2003) Is there a critical level of organic matter in the agricultural soils of temper-

ate regions: a review. Soil & Tillage Research, 70, 1–18.

Pereira, P., Brevik, E., Munoz-Rojas, M., Miller, B., Smetanova, A., Depellegrin, D., Misiune, I., Novara, A., Cerda, A. Soil mapping and process modelling for sustainable land management. In: Pereira, P., Brevik, E., Munoz-Rojas, M., Miller, B. (Eds.) Soil mapping and process modelling for sustainable land use management (Elsevier Publishing House) ISBN: 9780128052006