Faculty of Water and Soil

Soil Science Department

Thesis for Obtaining an MSc Degree in Soil Resource Management - Soil Resource and Land Evaluation

Title

Soil Digital Mapping of Carbon Storage in the Wetland Soils of Arid Region (Case Study: Hamoun Biosphere Reserve)

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February 2022

Abstract

Soil organic carbon is the most important indicator among different soil properties in soil quality and evaluation. On the other hand, accurate soil properties maps are an important tool for accurate spatial monitoring and management of soil. This study was done to digital soil mapping of the storage of various types of carbon (organic and inorganic) in the soils of Hamoun International Wetland. 150 points were selected based on five common vegetation and their surface soil was sampled. Then the bulk density of soil, soil microbial respiration, types of carbon including mineral carbon (equivalent calcium carbonate) and total organic carbon, dissolved carbon, biomass carbon and permanganate oxidizable carbon (labile carbon) were measured using standard laboratory methods. After estimating the amount of soil carbon storage (organic and inorganic), spatial modeling and digital mapping of soil carbon storage were performed using conventional geostatistical methods and random forest method. The results showed that the soil under *Phragmites communis* vegetation had the highest average values of clay (36.16 %), bulk density (1.65 g/cm3) the soil under *Tamarix stiicta* vegetation had highest mean of sand content (26.84 %) and microbial respiration (0.06), soil covered with *Cyperus rotundus* had highest percentage of soil saturated moisture (52.04 %) and total soil organic carbon (1.41 %), the soil under *Aeluropus lagoespoid* vegetation had most microbial respiration (0.06) and mineral carbon (calcium carbonate equivalent) (30.2%) and the soil under *Halocnenum strobilaceum* vegetation had highest microbial respiration (0.06), permanganate oxidizable carbon or labile carbon (activate carbon) (2.83), silt (55.84 %), soil soluble calcium and magnesium (75.52 meq/l) and hot water solution carbon (0.12). It should be noted that the Soil without vegetation cover had the highest amount of EC (23.07 dS/m), soil pH (8.6852), soil soluble sodium (521.87 meq/l), SAR (96.18), microbial biomass (0.074), soil soluble carbon (0.34) and cold water soluble carbon (0.24). It seems that the vegetation in the bed of the Hamoun wetland is directly related to soil properties and the presence of studied vegetation has a positive and key role in improving soil properties and the loss of vegetation cover, the salinization and solodization processes of the soil due to climatic and geomorphological conditions of wetlands is very active and causes land degradation

in this area. Spatial modeling of soil carbon storage (organic and inorganic) showed that the best variogram model for both types of soil carbon storage was the Gaussian model and showed a strong spatial correlation class. Among the usual geostatistical methods and random forest method for preparing soil carbon storage map (organic and inorganic), maps produced by random forest method had higher accuracy and permanganate oxidizable carbon was the most important variable in preparing the map by random forest method.

Keywords: Spatial modeling, Soil organic carbon, Soil inorganic carbon, Hamoum International Wetlands, Sistan