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Geoestatistical analysis of soil properties in the South of Alicante: soil salinity.

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The southern coast of Alicante province (southeast of Spain) was largely occupied by a large lagoon until the eighteenth century when drainage infrastructures were built to turn much of the wetlands into irrigated farmlands. This area has a semiarid Mediterranean climate and the shortage of sufficient quality water for irrigation is a serious problem for agriculture and wetland maintenance. This study analyzes the spatial distribution of soil properties and their relationship with land-covers by the use of geostatistics and geographical information systems (GIS) as a tool for land-reclamation and management.

A field campaign was conducted and 98 soil samples were collected and spatially referenced with a GPS. Soils of the study area are Calcic Fluvisols according to the World Reference Base for Soil Resources (WRB, 2006). Soil samples were air dried at room temperature and sieve at 2mm (soil fraction to be analysed). Four soil properties were analysed: 1) electrical conductivity (EC) (1:5 w/v water extraction), 2) pH, 3) equivalent carbonates (Porta et al., 1986), and 4) soil organic matter (SOM) by wet chemical oxidation (Walkley and Black, 1934) with potassium dichromate oxidation (Nelson and Sommers, 1982). Geostatistics was used to model the spatial distribution of soil properties. The convex hull of soil samples was used to delimit the area to map. Semivariograms were applied to study the spatial pattern of the four soil properties and ordinary Kriging was used to predict their spatial distribution.

Descriptive statistics (mean $\pm$ standard deviation) showed that in general terms the soils studied was moderately saline (2.44 ± 0.32 dS·m^{-1}), with a basic pH (8.22 ± 0.32), low soil organic matter content (1.41 ± 0.37 %) and abundant equivalent carbonates (46.1 ± 4.3 %). Electrical conductivity, pH and SOM properties were significantly correlated according with the Pearson bivariate correlation test (with $P<0.05$). Soil samples were identified as saline (EC>4 dS·m^{-1}) or non-saline (EC<4 dS·m^{-1}). A one-way analysis of variance (ANOVA) test was used to identify significant differences ($P<0.05$) of soil properties values for saline/non-saline soils. Significant differences were observed for E.C., pH and SOM but not for equivalent carbonates. Equivalent carbonates were almost homogeneously distributed for all the study area. Higher EC and pH values were obtained for an area partially occupied by salt-marshes. Lower EC and pH values were obtained for better drained and vigorous crops. Lower SOM contents were associated to salt-marshes while higher SOM contents were obtained for well drained crops.

Different land-uses and land-management actions significantly affected soil properties of the study area. Geostatistical analysis provides a valuable tool to map soil properties and to analyse the relationship between soil properties and land-covers.

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