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Spatial analysis of total content of microelements in the agricultural soils of southern Serbia - GIS study

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The occurrence and availability of microelements in agricultural soils is of great importance for the environment, the quality of food and water, as well as for human health. United States Environmental Protection Agency (USEPA) has been specified elements such as As, Cd, Cr, Cu, Hg, Ni, Pb and Zn as key contaminants. The Geographic Information System (GIS), together with the technologies of the Global Navigation Satellite System (GNSS), made possible for the agricultural fields, parcels, not to be seen in their entirety anymore, but now, greater attention can be paid to optimizing the accuracy and reliability of the location for collecting soil samples, which provides reliable data for obtaining soil and special purpose maps. The data about the content of microelements in agricultural soils in the area of Southern Serbia are scarce.

The aim of this research was to determine the total content of eleven microelements (As, B, Cd, Cr, Cu, Hg, Mn, Mo, Ni, Pb and Zn) in the agricultural soils of southern Serbia and to create a database using GIS technology with spatial analysis. A total of 150 soil samples at a depth of 0-30 cm were examined. Spatial positioning of soil sampling points was done with a handheld, professional PDA/GNSS Trimble TDC 100 4G (Android 6) device. The database was created in ArcMap 10.1. Concentrations of microelements in the soil were determined by inductively coupled plasma with optical emission spectrometry (ICP-OES).

The obtained results of analyses showed that in the agricultural soils of southern Serbia (Jablanica and Pčinja District), the content of B and Pb was slightly increased at a depth of 0-30 cm, compared to the maximum allowable concentrations set by the national regulations. Among the studied elements, the lowest total content was measured for Mo and Pb (< 1mg/kg) whereas Mn had the highest total content (> 2000 mg/kg). This can be seen clearly on the special purpose maps provided using GIS technology.

Keywords: soils, agriculture, microelements, GIS, southern Serbia