ORGANIC CARBON STOCKS IN THE CHERNOZEMS OF SERBIA

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INTRODUCTION

The aim of this study was to quantify current SOC stocks in Chernozem in the Republic of Serbia. Chernozems are amongst the most productive soil types in Serbia where crop production is concentrated. Organic carbon stocks were estimated for soil layers 0-30 cm and 0-100 cm based on the results from a database and using soil maps.

MATERIALS AND METHODS

The assessment of organic carbon stocks in the Republic of Serbia was carried out in the period 2009-2013 (Vidojevic et al, 2015). To establish the relationship between organic carbon content and soil type, a soil map of Serbia was adapted to the WRB classification and divided into 15,437 polygons (map units). Organic carbon stocks were calculated for the area covered by Chernozem which occupies 1,369,962 ha or 17.68 % of the territory of Serbia (Table 1). Organic carbon stocks in soil (SOC t ha^{-1}) were calculated on the basis of the values of SOC g kg^{-1}, bulk density and soil depth applying the following formula:

$$SOC(t\ ha^{-1}) = \frac{SOC(g\ kg^{-1})}{1000000} x depth(m) x BD(Mgm^3) x 10000(m^2 ha^{-1}) x 1000(kgMg^{-1})$$

The formula was derived after the method of Evrendilek & Wali (2001):
(1) soil weight (kg ha^{-1}) = depth (m) x bulk density (Mg m^{-3}) x 10,000 (m^2 ha^{-1}) x 1,000 (kg Mg^{-1})
(2) SOC stocks (Mg ha^{-1})= (g SOCkg^{-1}/1,000,000) x soil bulk (kg ha^{-1})

Based on the area of the Chernozem reference group and the SOC mean value, we calculated the total SOC stocks for Chernozems of Serbia.

Table 1. Soil groups in Republic of Serbia according to the WRB classification

Reference Soil Group Code		Area	
		ha	%
AT	Anthrosol	11,519	0.15
AR	Arenosol	55,836	0.72
CL	Calcisol	27,284	0.35
CM	Cambisol	2,168,581	27.99
CH	Chernozem	1,369,962	17.68
FL	Fluvisol	586,221	7.58
GL	Gleysol	484,545	6.25
HS	Histosol	442	0.01
LP	Leptosol	1,231,952	15.9
LV	Luvisol	219,583	2.83
PH	Phaeozem	72,840	0.94
PL	Planosol	429,472	5.54
PZ	Podzol	34,313	0.44
RG	Regosol	168,689	2.18
SC	Solonchak	25,022	0.32
SN	Solonetz	85,858	1.11
UM	Umbrisol	131	1.69
VR	Vertisol	644,689	8.32
Total		**7,747,401**	**100**

RESULTS AND CONCLUSION

In the north of the country, in Vojvodina Province, the region with the most intensive agricultural production, the organic carbon content at 30 cm was mostly low, amounting to 1.93% (Vidojevic et al, 2013). The most common soil type in this part of the country is Chernozem, which covers 57.9% of the area (Figure 1). The values of organic carbon content for this reference group, at 30 cm, ranged from 7.89 to 133.51 t ha^{-1}, with the mean value of 73.82 t ha^{-1}. The organic carbon content at 100 cm ranged from 24.21 to 341.37 t ha^{-1}, with he mean value of 168.20 t ha^{-1}. The obtained values indicated that Chernozems have a greater depth of the humus horizon (Ah), which went up to 100 cm (Figure 2), then Cambisols with the humus horizon up to the depth of 60 cm. Chernozem and Gleysol, the two most common soil reference groups in Vojvodina Province, which occupy 76.03% of the area, were found to have larger organic carbon stocks than Cambisol, the most common soil reference group in Central Serbia (Figure 3). The results obtained for Chernozems in the territory of the Republic of Serbia indicated that the organic carbon stocks for the soil layers 0-30cm and 0-100cm amounted to 101.13 x 1012 g (Tg) and 230.43 x 1012 g (Tg), respectively (Table 2).

The spatial distribution of organic carbon stocks and its variability is caused by various factors, such as clay content, land use pattern, altitude, and climate.

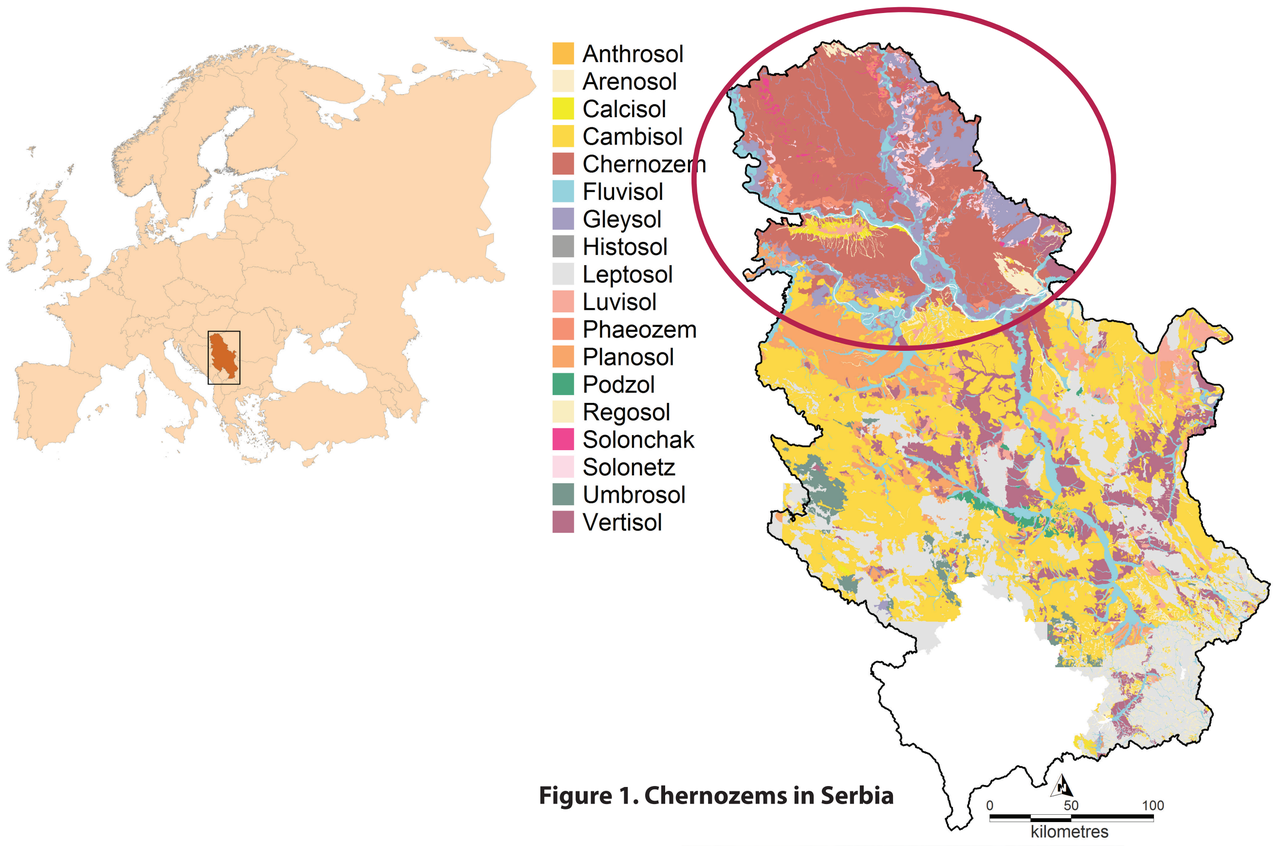

Figure 1. Chernozems in Serbia

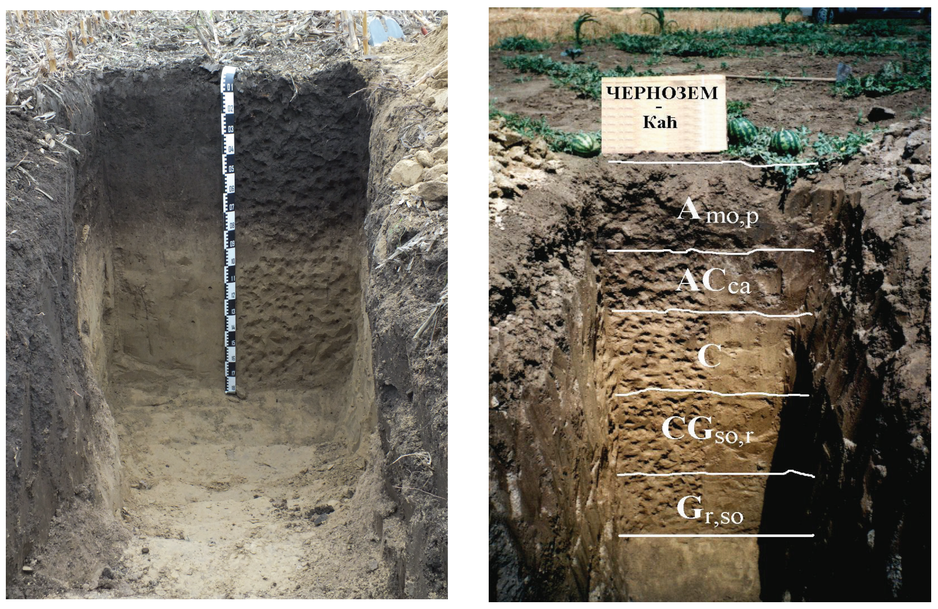

Figure 2. Chernozems in Serbia

Table 2. Soil organic carbon content (SOC) and SOC stocks in Chernozems in the Republic of Serbia

RSGC	n	0-30cm					0-100 cm				
		SOC content (t ha^{-1})				SOC stock	SOC content (t ha^{-1})				SOC stock
		Mean	Min	Max	SD	(Tg)	Mean	Min	Max	SD	(Tg)
CH	216	73.82	7.89	133.51	21.86	101.13	168.2	24.21	341.37	57.88	230.43

RSGC: Reference Soil Group Code; **n**: Number of soil profiles in the database; **SD**: Standard deviation

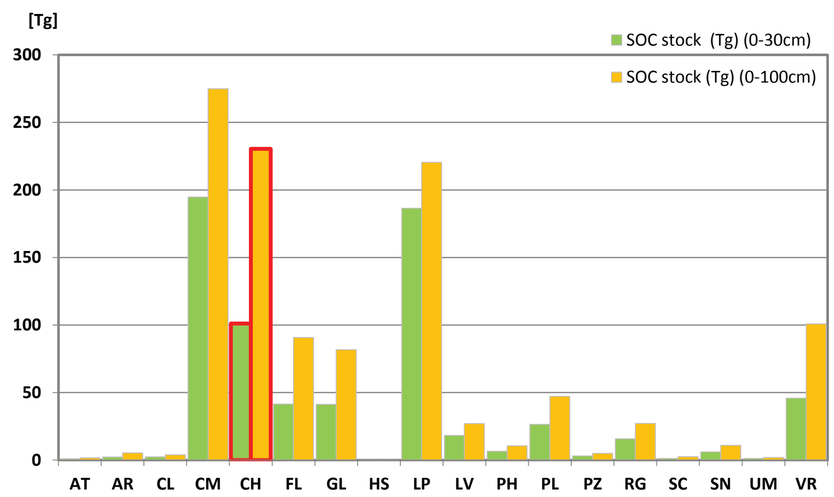

Figure 3. Soil organic carbon content (SOC) and SOC stocks in the major WRB soil groups in the Republic of Serbia

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