

Uncertainties in estimating soil carbon sequestration service

Soil function and ecosystem services in a
changing global environment (SSS8.11)



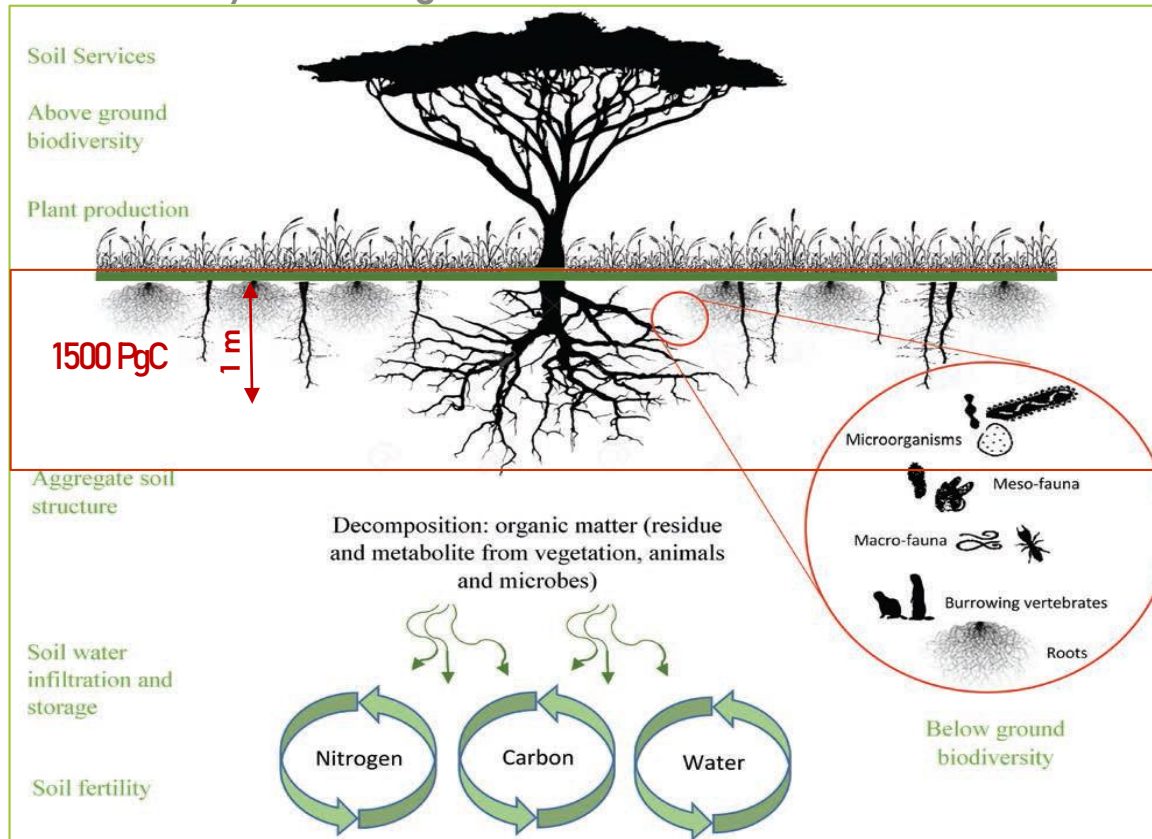
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INTRODUCTION

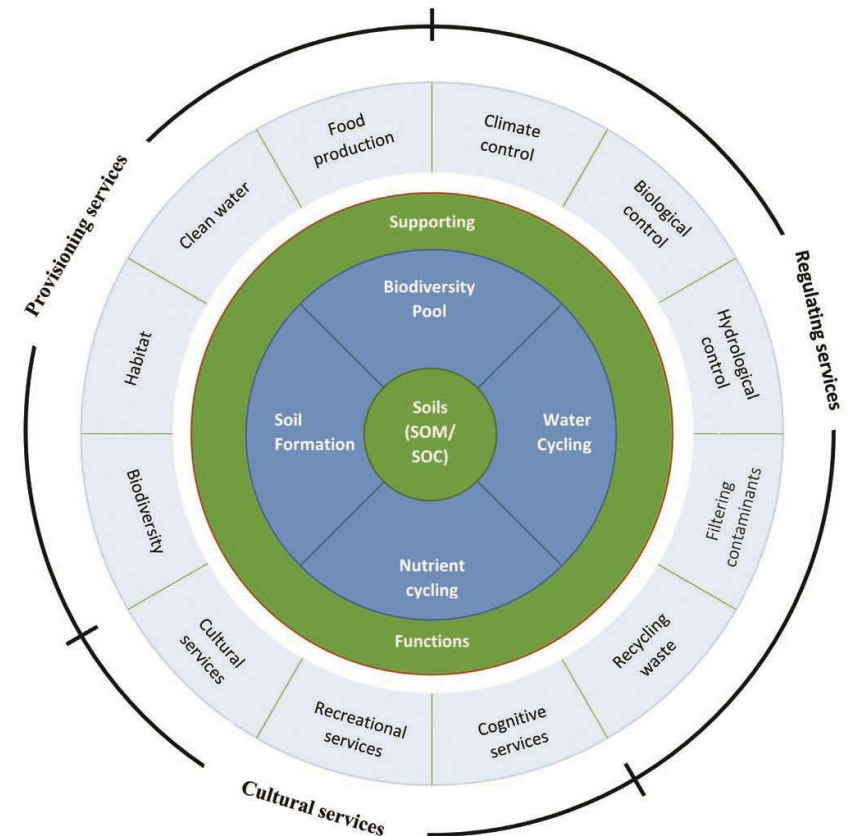
Soil carbon storage service

- ✓ Carbon storage: critical ecosystem service to contribute mitigating climate changes
- ✓ Soil organic carbon stock: services regulation of carbon sequestration

Soil biodiversity and soil organic carbon

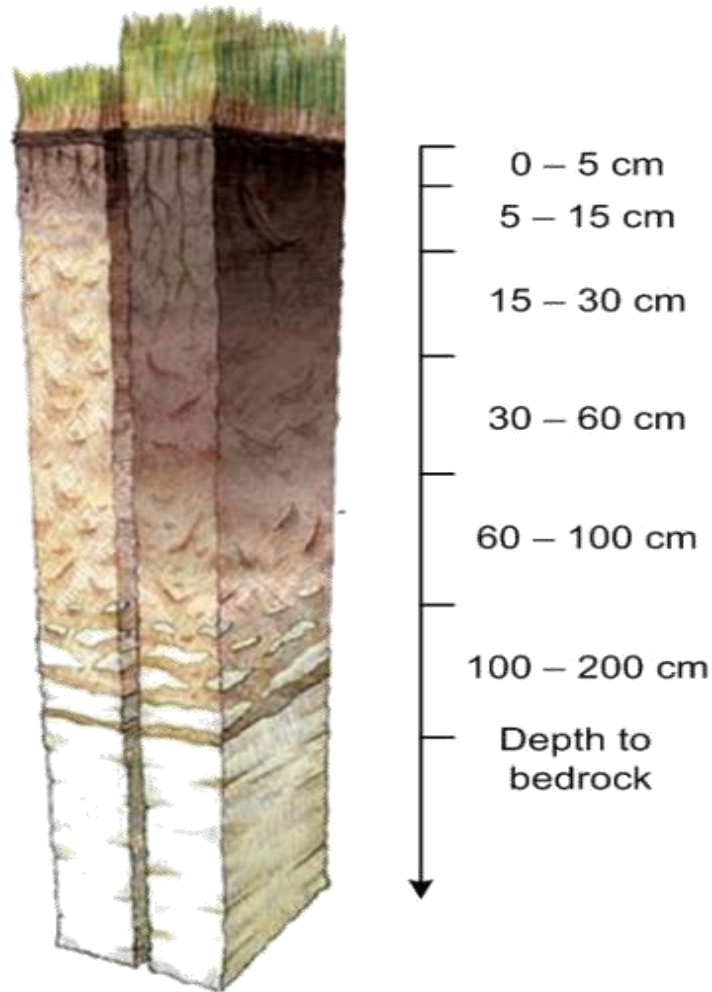


Soils and their ecosystem services and benefits



Images source: Laban, P., Metternicht, G., Davies, J., 2018. Soil biodiversity and soil organic carbon: keeping drylands alive. Soil Biodivers. soil Org. carbon Keep. drylands alive. Gland, Switzerland

SOC stock accuracy



Soil organic carbon (SOC), two different concepts:

- SOC content (**SOC_c**)= density or concentration of SOC in fine earth soil for a specific depth (% or g kg⁻¹)
- SOC stock (**SOC_s**)= amount of SOC mass per unit of area for a certain “i” depth (tC ha⁻¹):

$$SOCs_i = f(SOCc, BD, CFC, depth_i)$$

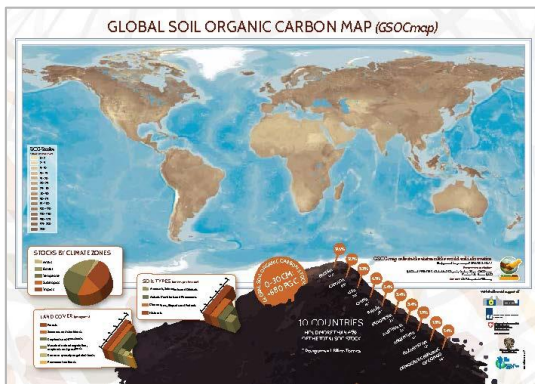
Where BD is the bulk density, CFC is the coarse fragment content and depth_i is the depth of the respective soil layer (i)

Accuracy of SOC_s prediction will depend on the availability and quality of the data as well as the calculation approaches

SOCc and SOCc products

Global products:

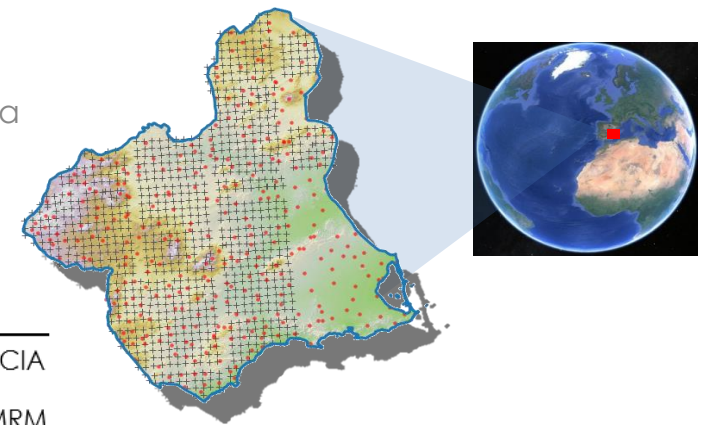
GSOCmap V1.0 (GSOC)
(FAO, 2017)



Comparison of SOC products

Comparison of different available SOCc and SOC products in the same region: at national and local area.

Local area: Mediterranean south Iberia Peninsula
(The Region of Murcia)



SPITAL DOMAIN			GLOBAL	GLOBAL	EUROPE	EUROPE	SPAIN	MURCIA
AVAILABLE PRODUCTS			GSOC	SG	OTCOP	ocCont (LUCAS)	SCSS	OCMRM
National (Spain)	SOCs (GgC)	Sum	$3.19 \cdot 10^6$	$5.07 \cdot 10^6$	$3.50 \cdot 10^6$	$1.89 \cdot 10^6$	$2.82 \cdot 10^6$	-
		Mean	-	26.62	22.71	24.38	25.89	-
	SOCc (g/kg)	SD	-	17.94	23.69	16.62	20.47	-
Local (Murcia)	SOCs (GgC)	Sum	52,689.62	73,364.37	-	39,983.88	44,421.16 [3.93]	-
		Mean	-	13.78	11.6	18.88	19.5	14.07
	SOCc (g/kg)	SD	-	5.87	7.15	7.85	6.06	14.88

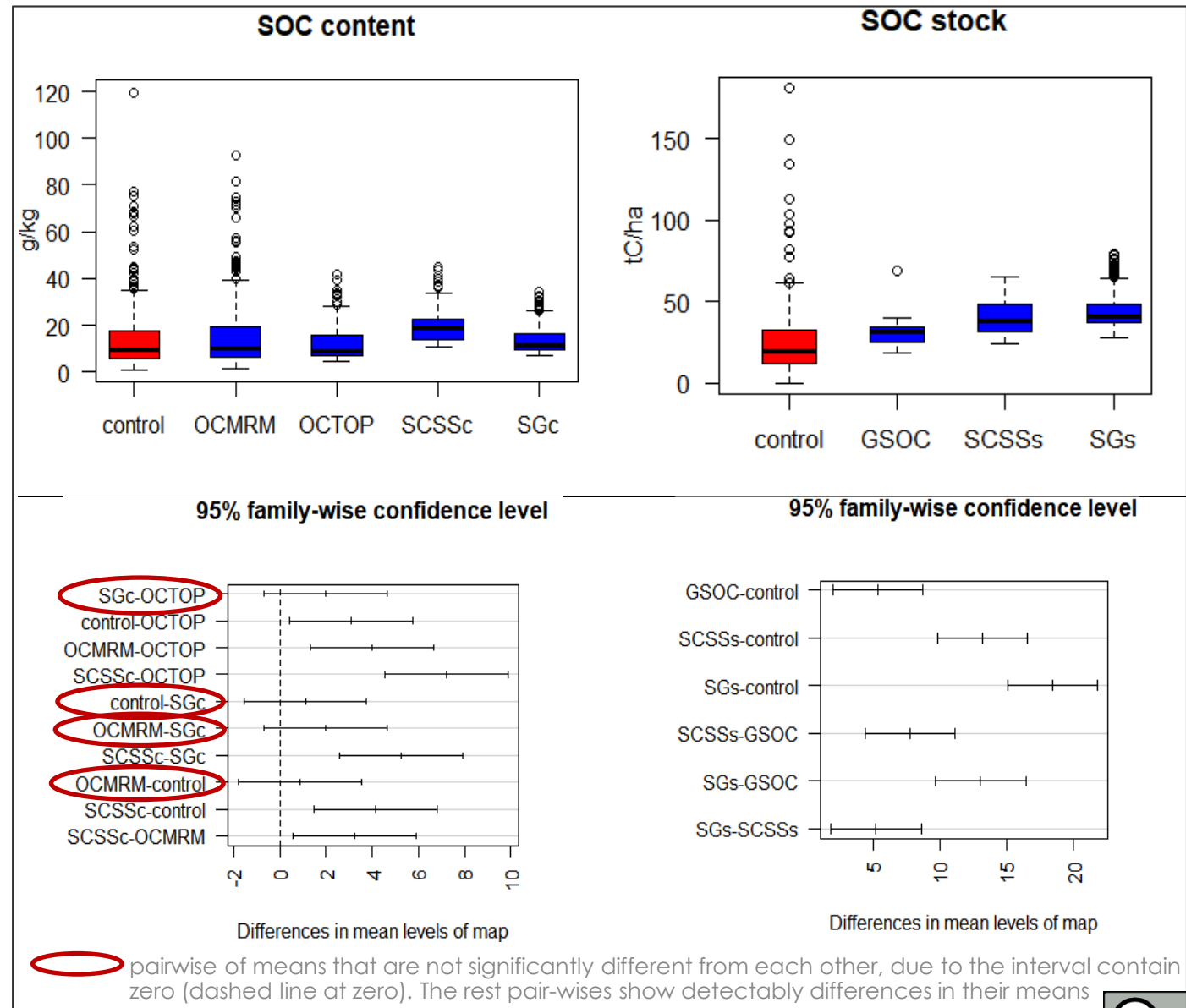
RESULTS

Comparison of SOC products. Descriptive statistics

Graphical representation of multiple comparison procedures.

Comparison of SOC products with data of profile sample locations (= control).

Boxplot (top) and 95% confidence interval of Tukey's test (bottom)



External validation

External validation of the SOC products with the data of profile sample locations (local database=MurDB)

AVAILABLE PRODUCTS	SOCs		SOCc	
	R ²	RMSE (tC/ha)	R ²	RMSE (g/kg)
MurDB vs. SG (Global)	0.055	25.73	0.211	11.316
MurDB vs. GSOC (Global)	0.00	20.88	-	-
MurDB vs. OCTOP (Europe)	-	-	0.067	12.74
MurDB vs. SCSS (Spain)	0.033	21.86	0.017	14.90
MurDB vs. OCMRM (Mur)	-	-	0.524	14.740

Thank you very much
for your attention

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