Soil organic carbon stock development in chernozemic soils following agricultural abandonment

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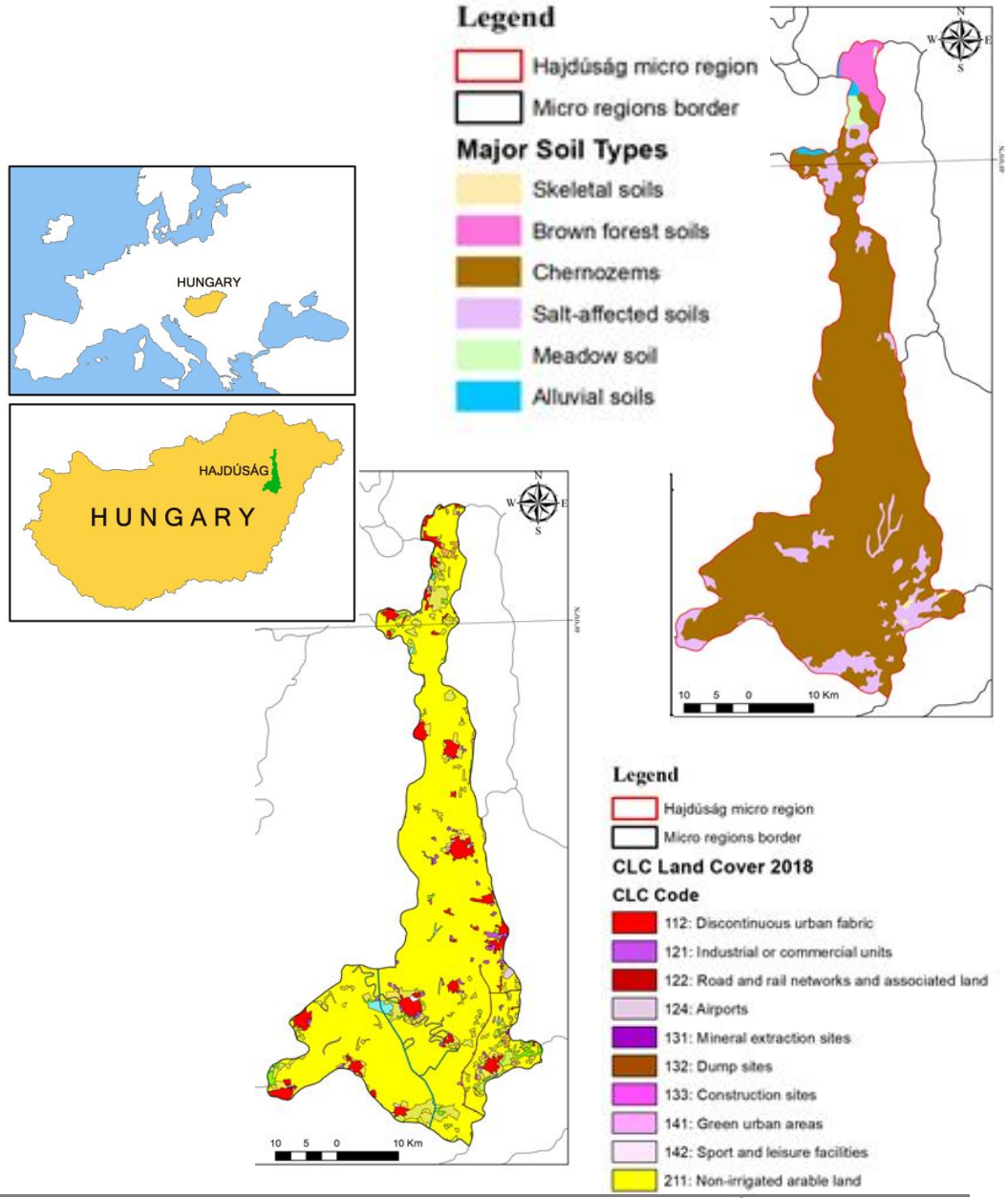
Introduction & aims

- Post agricultural development of traditionally intensively cultivated high fertility soils is a relevant question in surroundings of towns affected by urban sprawl, where extent areas of former cultivated soils are converted into residential, industrial or infrastructural surfaces.
- In the study area around settlements totally 18.2 km^2 was converted from arable to other land cover classes (dominantly into residential and industrial) between 1990 and 2018.
- Aim of study: to compare SOC concentrations and stocks of agricultural and postagricultural soils
- Estimate SOC stock development following agricultural abandonment.

Study area

- agricultural landscape (totally 1515 km^2), Hajdúság, Eastern Hungary
- dominated by Chernozemic soils with deep mollic or chernic horizons (1297 km^2, 85%)
- dominated by arable lands (82 %)



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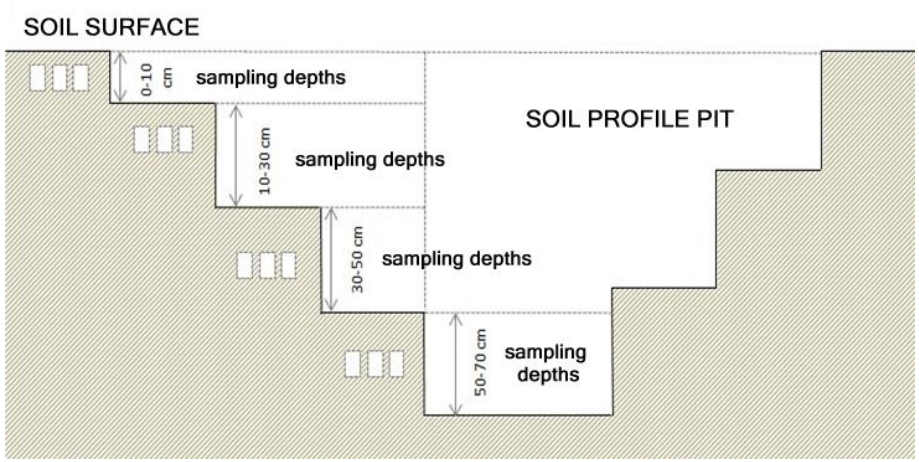
Sampling methods and sites

Profiles:

- 3 arable soil profile
- 3 arable, occasionally irrigated soil profile
- 3 postagricultural soils (1 garden, 1 roadside, 1 abandoned farmyard)

Samples

- 4 standardized depths,
- each depths 1 x sample for basic analyses and 3 x undisturbed samples

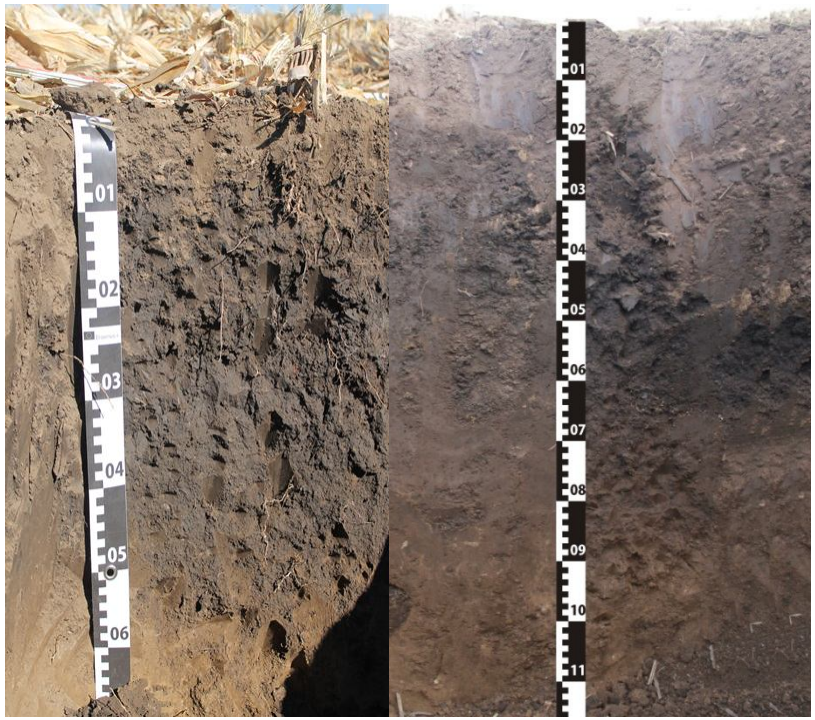


Results

- Besides of other regeneration processes, concerning to the improvement of soil structure, we found that soil organic carbon stocks in the 0-30 cm soil layer are significantly higher in post agricultural soils (9.4±0.5 $kg \cdot m^{-2}$) as in arable fileds (6.4±0.8 $kg \cdot m^{-2}$) or in occasionally irrigated arable fields (5.6±0.7 $kg \cdot m^{-2}$) profiles.

- The difference was found to be significant not only until the depth of the cultivated layer (30 cm), but until the sampled 70 cm depth throughout (17.8±0.9; 10.8±3.3 and 10.6±2.7 $kg \cdot m^{-2}$ respectively). Our results point on the high carbon recovery potential of suburban areas converted from fertile cultivated soils.

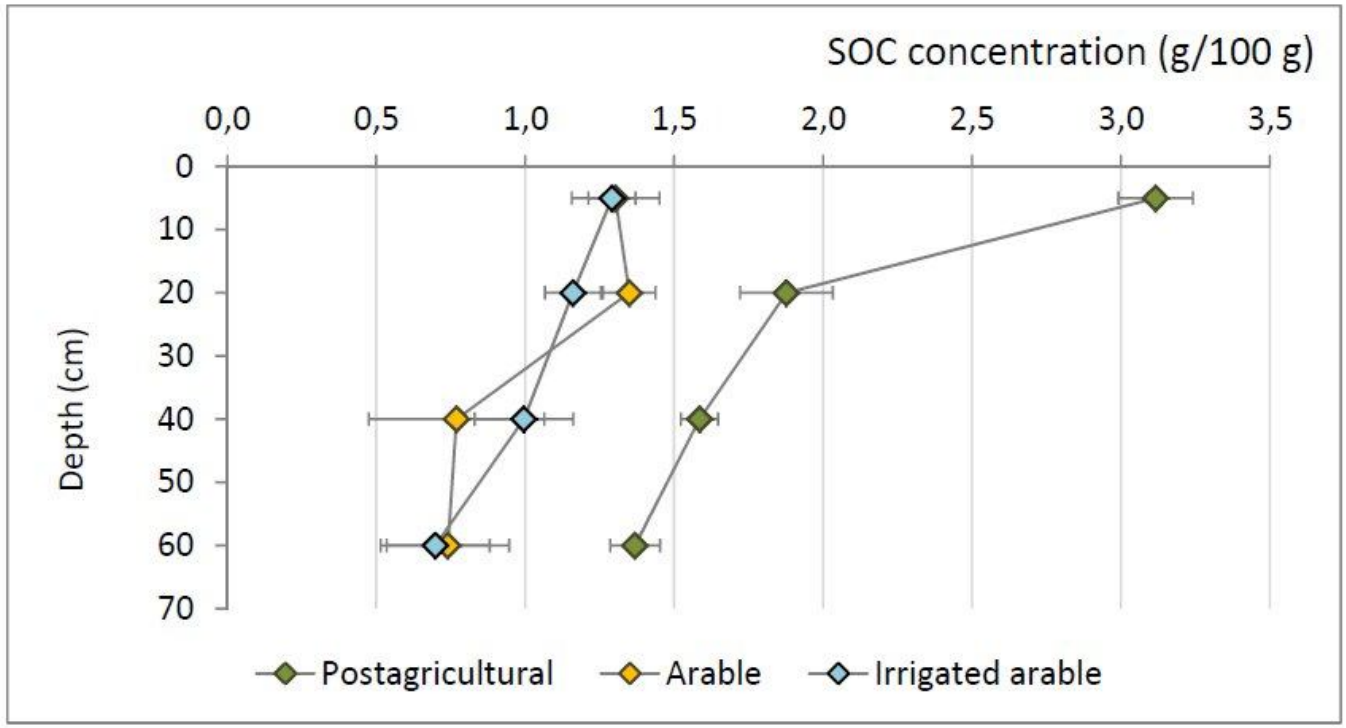
Agricultural and postagricultural soil profiles



Agricultural soil profile, arable land, Látókép, Hungary

Postagricultural soil profile, roadside, and artefacts from soil layer 0-40 cm, Látókép, Hungary

SOC concentrations at different depths



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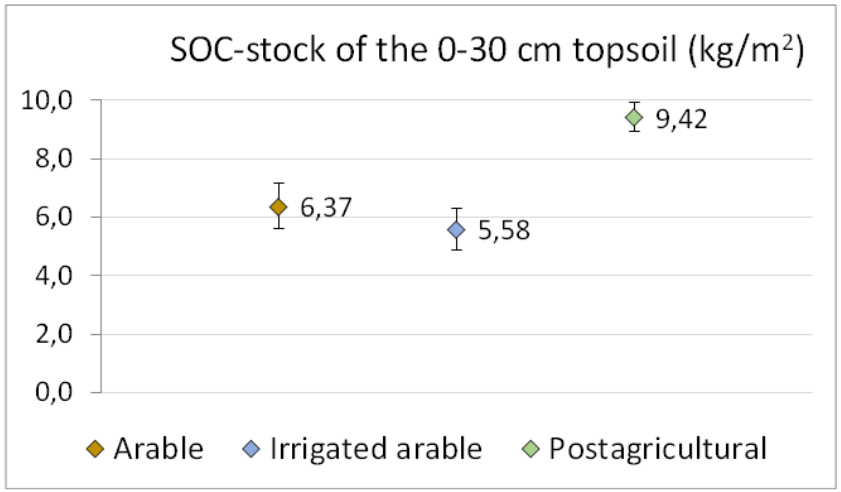
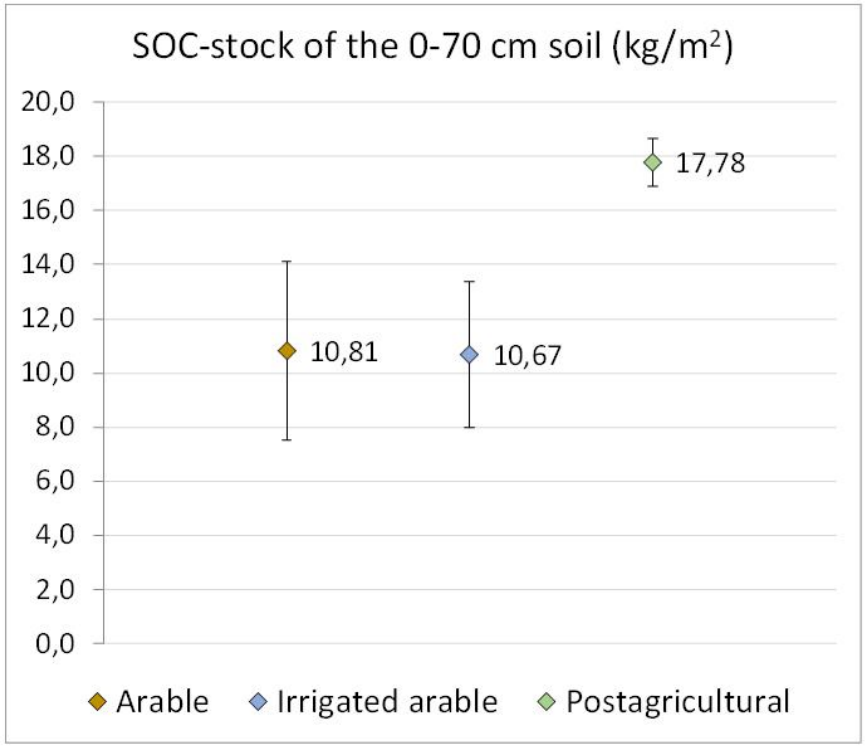
SOC-stocks in 0-30, and 0-70 cm soil layers

Soil organic carbon stocks in the 0-30 cm soil layer are significantly higher in post agricultural soils (9.4±0.5 $kg \cdot m^{-2}$) as in arable fileds (6.4±0.8 $kg \cdot m^{-2}$) and irrigated arable fields (5.6±0.7 $kg \cdot m^{-2}$) in 0-70 cm (17.8±0.9; 10.8±3.3 and 10.6±2.7 $kg \cdot m^{-2}$ respectively).





Thank you very much for your attention!

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