Estimation of soil organic carbon stocks of two cities : New York City and Paris

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In cities, the strong heterogeneity of soils, added to the lack of standardized assessment methods, serves as a barrier to the estimation of their soil organic carbon content (SOC), soil organic carbon stocks (SOCS) and soil organic carbon citywide totals (SOCCT). **However, are urban soils, even the subsoils and sealed soils, contributing to the global stock of C?**
To address this question, the SOCS and SOCCT of two cities, Grand Paris Metropolis and New York City, were compared.

METHODOLOGY

Grand Paris Metropolis (Paris)

- 815 km², 7 million inhabitants
- sedimentary parent material
- foundation 50 BC
- 1993-2016: 8 000 organic carbon data but **no dry bulk density**

Data selection

- 0-30 cm depth
- sites > 2000m²
- parks, woodlands, gardens, sealed soils

593 samples in 0-30 cm open areas

58 pedons in open areas

New York City (NYC)

- 772 km², 8.5 million inhabitants
- parent material: crystalline bedrock, sedimentary rocks, unconsolited deposits
- foundation 1624
- 1995-2015: **58 pedons** sampled

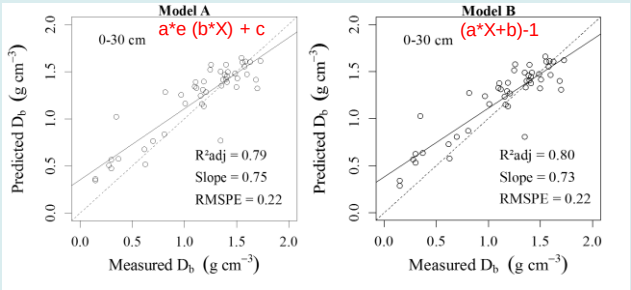
Data selection

- 0-30 cm and 30-100 cm depth
- sites > 2000m²
- parks, woodlands, fallows, salt marshed, sealed soils

RESULTS & DISCUSSION

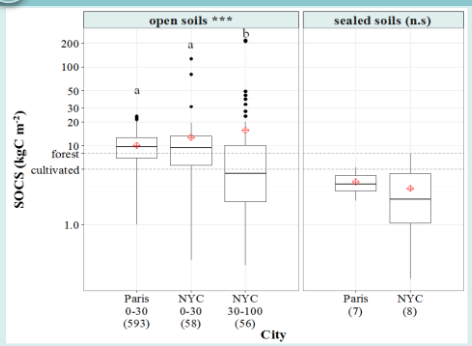
1 Estimation of the bulk density D_b

Two pedotransfer functions (Chen et al., 2018) were developed to estimate the bulk density of the fine earth (g cm^{-3}) in NYC.



The model A provided the best predictions for NYC 0-30 cm and NYC 30-100 cm and was chosen to estimate unknown Paris 0-30 cm **D_b**.

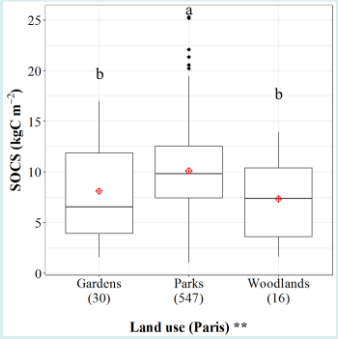
2 Soil organic carbon stock (SOCS) distribution

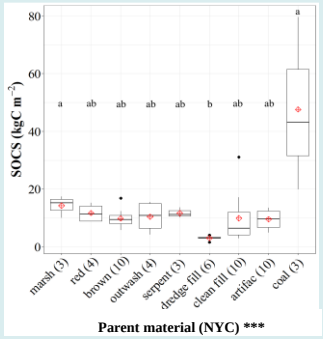


→ SOCS values not significantly different in open topsoils (0-30 cm) between Paris and NYC.

→ SOCS values not significantly different in sealed soils between Paris and NYC but significantly lower than in open soils.

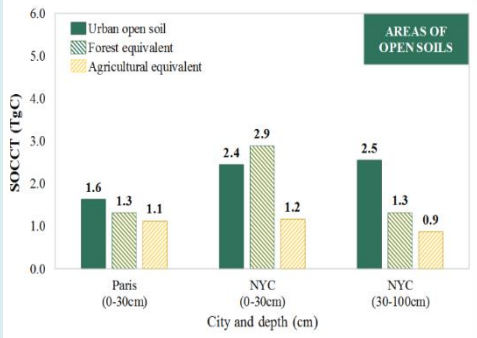
3 Factors influencing SOCS in 0-30 cm open soils





In Paris, the land use type displayed a significant effect on SOCS.
In NYC, the parent material had a significant effect on SCOS.

4 Soil organic carbon citywide totals (SOCCT)



→ SOCCT was similar between both cities.

→ A comparison with SOCCT in agricultural and forest soils showed that city's open soils are important pool of organic carbon.

CONCLUSIONS

The SOCCT in NYC and Paris were very close when comparing open soils and sealed soils and could be greater than forests and agricultural soils. To enhance standardization of the SOCS assessment in urban soils, we suggest to (1) collect a relevant number of samples, (2) study SOCS along the whole urban soil profile (0-100 cm), (3) determine bulk density of each horizon and (4) include coarse fraction in SOCS calculation.

Cambou et al, 2018. Estimation of soil organic carbon of two cities: New York City and Paris, STOTEN, 644: 452-464