EGU24-13244, updated on 12 Mar 2024
https://doi.org/10.5194/egusphere-egu24-13244
EGU General Assembly 2024


# Promoting Carbon Storage and Health in Urban Soils through Sustainable Management Practices

**Atefeh Movassagh**[1], Bibiana Betancur Corredor[1], and Martin Hamer[2]
[1]University of Bonn, Center for Development Research (ZEF), Ecology and Natural Resources Management, Bonn, Germany (amovassa@uni-bonn.de)
[2]International Centre for Sustainable Development (IZNE) - Bonn-Rhein-Sieg University of Applied Sciences, Germany

Sustainable urban soil management is becoming increasingly crucial due to its vital role in climate and water regulation and its significant potential for storing soil organic carbon (SOC). This significance is emphasized considering the ongoing urbanization and climate change issues. Although SOC is influenced by many factors, such as soil type and climate fluctuations (temperature, precipitation patterns), on a regional scale, land use and management practices (e.g., fertilization, irrigation) can have a more significant impact on SOC storage and the balance of soil-atmosphere carbon fluxes. However, there is still a limited understanding of the amount of humus content in urban soils and the effects of urban development and management practices on soil health and carbon storage. We investigated how management practices in urban green spaces influence soil carbon storage as the primary indicator of soil health.

The present study was carried out in the Bonn-Rhein-Sieg area, as the region is vital in terms of sustainable urban and regional development with a high population density (Rhein-Sieg district: 338.4, Bonn: 520.9 inhabitants/km2) in Germany. A survey was conducted with owners and managers of urban private (e.g., allotment and backyard garden) and public green spaces on the practices for the most common vegetation types (e.g., lawn, vegetable, ornamental). In the autumn and winter of 2022, 248 soil samples (0–20 cm depth) were collected from 95 private and public green spaces in the study area and analyzed for physiochemical and biological properties. Multivariate Analysis of Variance (MANOVA) was performed to assess the effects of different management practices on soil properties.

Our results indicate that the average SOC stock in public green areas (94.67 Mg ha-1) is substantially higher than in private ones (house garden 67.72 Mg ha-1, allotment garden 73.15 Mg ha-1). Moreover, urban green spaces with vegetables (91.66 Mg ha-1) and ornamentals (85.05 mg ha-1) show greater SOC stock levels when comparing vegetation types (lawn 62.48 Mg ha-1). Significant differences in SOC are also found for various management practices. Specifically, the monthly fertilization schedule resulted in higher SOC levels (127.37 Mg ha□¹) compared to the yearly fertilization schedule (76.88 Mg ha□¹). Additionally, the use of organic fertilizers contributed to increased SOC levels (84.40 Mg ha□¹) in contrast to mineral fertilizer applications (65.31 Mg ha□¹). The average SOC stock in all the studied urban green spaces (85 mg ha-1) was higher than

the average SOC stock in arable soils in Germany (47.30 Mg ha-1). The higher SOC in the region could be due to vegetation types and fertilization frequencies, which show statistically significant effects (p-value <0.001). Other management practices (e.g., irrigation type and frequency) did not show a significant effect. Our findings highlight the significance of soil management practices, particularly in selecting vegetation types and determining fertilization frequency, as essential factors influencing urban SOC.