Soils in the urban critical zone – Analyses of anthropogenic pressures and current proposals to preserve soil functions and ecosystem services

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By 2017, the book "Soils within cities" (Levin et al., 2017) is moving away from the description of urban soils to a broader understanding of this compartment of urban ecosystems, including the functions and the services they provide. This approach, which complements the naturalistic description of the soil, corresponds to the concept proposed by the Millennium Ecosystems Assessment (Morel et al., 2015; Walter et al., 2015). It is considered to be relatively anthropocentric and thus favors the integration of the soil in the urban socio-ecosystem.

Considering the soil by both its pedogenesis and functioning in ecosystems induces taking into account the dynamics of this system, but raises, with regard to the literature on urban soils, the existing lack to qualify and quantify the processes of genesis and evolution, especially in relation to ongoing climate change (Baveye et al., 2016). On the other hand, the description of soil ecosystem services (regulation, provisioning, cultural services) immediately reveals the interdependence of soil biophysicochemical processes with those occurring in the hydrosphere, the atmosphere and the biosphere (Adhikari and Hartemink, 2016). In this respect, the soil plays a role of interface, but is deeply disturbed in urban areas.

**Soil functions and ecosystem services vs anthropogenic pressures**

- Urban activities threaten soil functions
- (Peri)urban land use and urban planning tend to take into account preserved soil functions

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The objective of the communication will be to review the status of urban soil in the "urban critical zone" concept. Through methodologies and results from projects implemented in French major cities that have enabled the development of databases, we will review the classification of these atypical soils and the changes in their properties and functions. Through the definition of the services they provide, we will propose a more integrated vision of this compartment of the urban ecosystem, by specifying the forcing caused by its interface position, but also the opportunities of improvement foreseen by the development of solutions for revegetation and de-sealing. We will see how the timeframe of soil evolution in urban zones can influence the data collection of soil parameters and mapping.

**Challenge: preservation of soil functions and ‘wise’ uses & practices of urban soils**

**Projects developed at various scales : function/urban project/ urban planning**

**SUPRA**

- Propose a procedure for evaluating services provided by urban soils at the city scale
- Quantify functions of open urban soils: e.g. organic carbon storage
- Propose a Decision Support System to take better account of soil resource in urban projects and build cities with a high level of ecosystem services

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**DESTISOL**

- Assess the potential of soils on the basis of the ecosystem services they can provide
- Establish a zoning on the scale of a site to be developed on the basis of soil indicators
- Optimization of urban design by taking urban soil survey into account through the Destisol DSS

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Co-selection of soils functions with stakeholders

Development of indicators and mapping soil quality with territorial available « data »

Test the implementation of methodology in urban planning documents with cities planners

Technical and participative solutions in European cities (NBS)

To create a decision support tool offering a reference base around Nature Based Solutions (NBS), and providing technical solutions and methods
• A city/citizen co-construction of a Healthy Corridor

• Territorial NBS: green spaces and urban agriculture

• Biophysicochemical quality to ensure vegetation growing and safe food production

Some references


Levin M. J.; John Kim K-H; Morel J L; Burghardt W; Charzynski P; Shaw R K. (2017) Soils within Cities - Global approaches to their sustainable management - composition, properties, and functions of soils of the urban environment, Catena-Schweizerbart, 253 pages


Some questions we would like to address

1. Do you address the issue of urban soil in your projects on the critical zone and how (naturalistic description, functioning, soil and society (nature in the city), soil and health)?

2. Urban soils are highly heterogeneous. How do you deal with this in terms of sampling and very high spatial heterogeneity?

3. Which typology of urban soils do you use (WRB typology or use of typologies more adapted to your needs (more operational or according to the scales of approach)? Do you develop databases on urban soils and associated mapping (which methodology for the definition of soil units)?

4. What soil functions and/or ecosystem services provided by soils are you working on and at what scale? Examples: urban soil and climate change; infiltration and storage of water; CO2 storage; soil support of vegetation; peri(urban)soil and healthy food
5. Do you observe a confrontation of functions with uses and practices by urban actors? (cf also chat SSF 8.2 May8th 16.15 MUSE project)

![Image showing a bar chart with different categories such as Urban sprawl, Flood risks, Pollutions, etc.]

*What are soil surveys for? (SUITMA10 conference 2019, Marseille et al., Towards taking into account the multifunctionality of soils in French urban planning regulation - Perspective of territorial stakeholders) © Authors. All rights reserved*

6. Do you deal with de-sealing and renaturation issues in your research project? On which aspects? Are you involved in projects on soil de-sealing?