

Linking Soil Properties, Functions, and Ecosystem Services to integrate Soil Quality into Urban Planning

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Abstract Urban soils are often neglected in spatial planning and urban management, where they are frequently viewed as just a two-dimensional support surface or even as waste material. The limited awareness of soil functions and ecosystem services, and of their importance for the society, hampers their recognition into urban planning and management processes. The targets of “no net land take” and “no net soil sealing” set by the European Commission focus exclusively on quantitative restrictions, with no reference to soil quality, i.e. the ability of soil to function effectively within ecosystem and land-use boundaries, sustaining biological productivity, maintaining environmental quality, and supporting the health of plants and animals. However, an explicit consideration of soil functions and ecosystem services could support planning and management processes in limiting their negative impacts and promoting effective compensation and restoration measures.

This study aims at comparing frameworks that link soil properties (SP), soil functions (SF), and ecosystem services (ES) to support urban planning and management. The frameworks were identified through a review of the scientific literature. Four original frameworks relevant to urban planning and management, described in a total of 12 publications, were identified and analysed. The comparison focused on methods, indicators, and input data for the assessment of SP, SF, and ES. Moreover, it considered the approaches to describe the links between the different components and to construct soil quality indices.

SP were evaluated either in situ or in the laboratory, and used as input or proxies to determine SF. Two frameworks implemented pedo-transfer functions to connect SP with SF. Links between SF and ES were established based on either the literature or expert opinion. All four frameworks developed synthetic indices for evaluating SQ: three indices were based on SF, with one of them additionally linking SF to ES, while one index was derived directly from an ES assessment and considered SF only indirectly.

Our results provide an initial overview of existing frameworks to assess the quality of urban soils in support of planning and management and highlights their strengths and weaknesses. The findings can support the development of standardized urban soil quality assessments, although data availability remains a critical factor limiting their broader application.