



POPULAR ARTICLE

Healthy soils for healthy cities: difficulties solution and policy initiatives

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Introduction

In the context of escalating climate challenges, soil systems are increasingly recognized for their capacity to contribute to climate mitigation, particularly through carbon sequestration. Although often overlooked in urban environments, soil forms a critical foundation for sustainable and livable cities. Its influence extends beyond the ground surface, affecting air quality, temperature regulation, ecological balance, and human well-being. By 2026, the importance of urban soil health has become integral to discussions on urban resilience and public health. Functional and biologically active soils not only support vegetation growth but also contribute to climate adaptation strategies and improved living conditions in densely populated areas. As cities continue to expand, maintaining soil quality is essential for ensuring long-term environmental sustainability and enhancing the quality of urban life.

Significance of urban soils

Urban soils perform multiple ecological and social functions that are vital for sustainable city development. One of their key roles lies in climate regulation. Healthy soils act as carbon sinks, thereby helping to reduce atmospheric greenhouse gas concentrations. Additionally,

their capacity to absorb and retain water plays a crucial role in minimizing urban flooding and improving groundwater recharge. Soils also contribute to mitigating the urban heat island effect. By supporting vegetation growth, they facilitate cooling through shade and evapotranspiration, thereby reducing ambient temperatures in cities. Furthermore, urban agriculture supported by fertile soils has emerged as an important contributor to food systems, supplying a notable share of vegetables and legumes while strengthening local food security. Beyond environmental benefits, soils have important social and health implications. Community gardens and green spaces built on healthy soils promote mental well-being, social cohesion, and a stronger connection between people and nature. Exposure to soil biodiversity, including beneficial microorganisms, has been linked to improved immune function and psychological health.

Emerging trends and innovations

Recent developments highlight a growing emphasis on monitoring, restoration, and sustainable management of urban soils. Technological advancements, including digital platforms and sensor-based systems, are being utilized to track soil quality and remediation efforts in real time. Policy frameworks are also



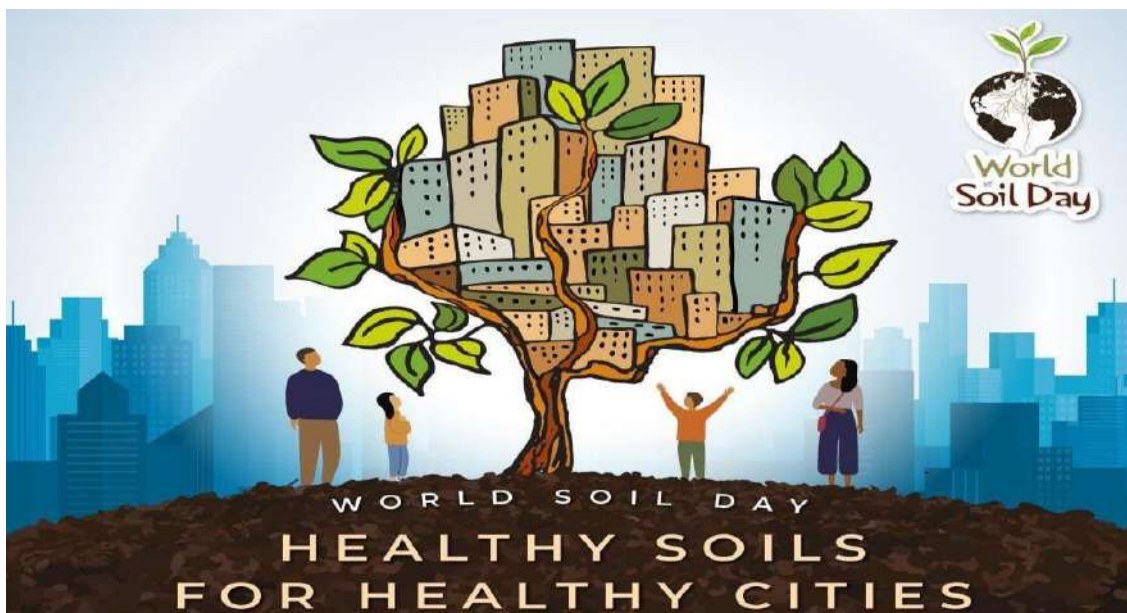
evolving, with increasing support for maintaining a significant proportion of permeable surfaces in urban design to enhance soil functionality. The concept of a circular economy has further strengthened the role of soils in urban systems. Organic waste generated in cities can be processed into compost, thereby returning essential nutrients to the soil and reducing landfill burdens. Additionally, the use of engineered soils, often referred to as technosols, has gained prominence in urban construction and land reclamation projects. Scientific discourse has also begun to acknowledge the extent of human influence on soil formation, leading to proposals for new soil classifications that account for anthropogenic modifications.

Challenges facing urban soils

Despite their importance, urban soils face numerous threats that compromise their

functionality. One of the most significant issues is soil sealing, where surfaces are covered with impermeable materials such as concrete and asphalt. This restricts the movement of air and water, ultimately disrupting biological processes within the soil.

Soil compaction is another major concern, often resulting from heavy pedestrian and vehicular traffic. Compacted soils exhibit reduced porosity, limiting root growth and water infiltration. Contamination further degrades soil quality, as pollutants such as heavy metals accumulate from industrial activities, vehicular emissions, and construction materials. A critical underlying issue is the limited recognition of soil as a valuable ecological resource in urban planning. Inadequate policy attention and lack of public awareness often result in the neglect of soil conservation and sustainable land management practices.



Strategies and policy directions

Efforts to improve urban soil health are increasingly reflected in policy initiatives and practical interventions. One approach involves the removal of impermeable surfaces and the introduction of permeable materials to restore

natural soil functions. Such measures enhance water infiltration and support ecological processes. Waste management policies are also being reoriented toward sustainability, with regulations encouraging the conversion of organic waste into compost. This not only reduces environmental pollution but also



enriches soil fertility. Biological methods such as bioremediation and phytoremediation are gaining attention as eco-friendly solutions for soil decontamination. These approaches utilize microorganisms and plants to neutralize or absorb pollutants, thereby restoring soil health. Additionally, the establishment of dense urban forests and green patches contributes to rapid ecological restoration and biodiversity enhancement. Government policies increasingly promote urban greening and the integration of soil management into city planning. Initiatives aimed at eliminating legacy waste sites and improving soil monitoring systems demonstrate a growing commitment to sustainable urban ecosystems.

Practical actions for individuals

Individual actions, though small in scale, can collectively contribute to improving soil health in urban settings. Engaging with natural environments, supporting local agriculture, and practicing composting are effective ways to reconnect with ecological processes. Cultivating native plant species and maintaining soil-based gardening systems can further enhance biodiversity and soil vitality at the household level.

Conclusion

The sustainability of urban environments is closely linked to the condition and management of soil systems. As cities continue to expand and intensify resource consumption, the concept of urban metabolism highlights the growing demand for energy and materials, as well as the increasing generation of waste. A significant proportion of global greenhouse gas emissions and energy use is

associated with urban activities, underscoring the urgency of adopting environmentally responsible practices.

Healthy soils serve as a fundamental component of resilient cities by supporting ecosystem services such as climate regulation, water management, and food production. However, these contributions are often undervalued or overlooked in urban planning and policy frameworks across both developed and developing regions. This disconnect limits the integration of soil conservation strategies into broader sustainability agendas.

Reimagining cities as ecosystems that prioritize soil health requires a shift in perspective from viewing soil as an inert substrate to recognizing it as a dynamic and living resource. Urban landscapes should be designed to incorporate green spaces, community gardens, and permeable surfaces that allow natural processes to thrive. Encouraging public awareness and participation in soil conservation can further strengthen this transition. Ultimately, the health of urban populations is intrinsically linked to the health of the soil beneath them. Ensuring soil vitality is not merely an environmental concern but a prerequisite for achieving long-term social, economic, and ecological well-being. A concerted effort involving policymakers, researchers, urban planners, and citizens is essential to restore and protect this critical resource. By prioritizing soil health, cities can move toward a more sustainable and resilient future, where environmental integrity and human well-being are mutually reinforced.

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