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Urban soils: how can we preserve their carbon and nitrogen sink?

Globally, the population and size of urban areas is expected to rapidly increase in the next 30 years. Soils are important carbon sinks, and the effects of rapid urbanisation on this valuable service are unclear. A recent analysis reviews our present understanding of the impacts of urbanisation on soil, with particular emphasis on its role in carbon and nitrogen cycling.

Populations are expected to continue migrating to large urban areas. The fastest growing urban populations are in tropical regions. Urban areas are estimated to be responsible for 78 per cent of global carbon emissions, and the 'heat island' effect affects the local climate. Fuel combustion, pet wastes and garden fertilisers are major sources of nitrogen compounds in the urban environment. The authors report that a better understanding of the impacts of urban life on soil can help us manage urban soil's functions and help mitigate climate change.

Nitrogen and carbon are naturally cycled between soil, water, vegetation and air. Urbanisation alters this cycling process in many ways. For example, the unusual composition of many urban soils may alter the way they store and release nitrogen and carbon. Many are dominated by material from human activity. They may be constructed from industrial wastes, perhaps containing a higher percentage of coarse material, oil, plastics, building materials or sewage sludge than rural soil. Different combinations may be very acidic or alkaline. Additionally, the soil may be compacted, or deeply mixed, covered (e.g. by tarmac) or uncovered. These disturbances also alter the cycling process. Healthy soil will help to sequester nitrogen and carbon in the ground, and, with improved knowledge, the authors suggest urban soils could be managed to mitigate climate change.

Domestic gardening, using water and fertilisers, and urban woodland promote productivity and carbon cycling, but often replace natural vegetation. Mowed grass, for example, is a greater source of carbon than the natural cover it replaces. Also, cutting and clipping of plants and removing plant litter extracts nutrients from the system. Soil erosion is accelerated by factors including deliberate topsoil removal (in landforming), irrigation or vehicles. Disturbance by atmospheric and stormwater pollutants also increase in urban areas.

The variety of soil properties, climate and land use combinations in urban areas suggests that many urban planning strategies need to consider soil function. Based on what is currently known, several measures are recommended, including:

- design urban soils to enhance ecological functions, such as retention of nutrients and hazardous compounds, and carbon sequestration
- confine future construction within cities to unproductive soils and retain more productive areas for vegetation
- minimise soil disturbance during construction
- plant trees
- reduce urban sprawl

As little is currently known about the biogeochemical processes within urban soils, the authors recommend a substantial programme of research to help planners manage cities more sustainably and enhance the role of urban areas in mitigating climate change.

Source: Lorenz, K. and Lal, R. (2009). Biogeochemical C and N cycles in urban soils. *Environment International*. 35:1-8.

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