

Soil, Cities and Sustainability

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Introduction

Local Climate

Vegetation decreases the Urban Heat Island effect

Clean Air

Vegetation captures particles and pollution, helping provide clean air



Carbon Storage

Vegetation in greenspaces allows carbon to be sequestered, helping to mitigate climate change.

Access to Greenspace

Access for all to green and open space is important for physical and mental health

Biodiversity

Soil and the habitats it provides allow greater biodiversity in cities

Flood Mitigation

Greenspaces allow water to infiltrate into the soil, improving water storage and mitigating flooding

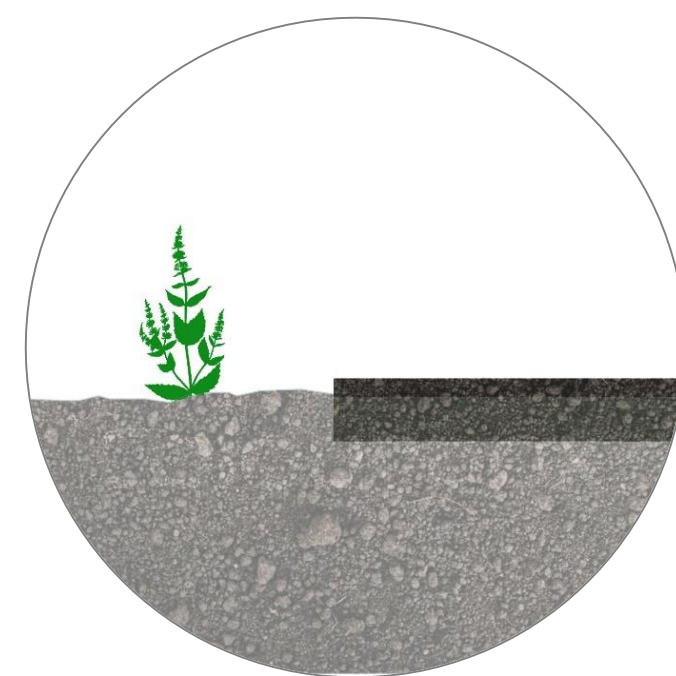
Urban Food

Healthy soil in gardens and allotments supports urban food growing for many communities

Research questions

Urban soil research has focused on **park or garden soil**. Greenspace and garden soils make up a surprisingly large area of cities. However, there is a lack of research on soil under '**sealed**' **impermeable surfaces** such as roads or pavements. Only two studies have considered the carbon in soil under sealed surfaces^{3,4}.

This project aims to increase our understanding into **organic carbon and nutrients** in soils under **sealed surfaces and unsealed soils** in urban areas. To do this, data is being collected to answer the following research questions:



Sealed & unsealed soil

Does unsealed soil have more organic carbon and nutrients than sealed soil?



Connectivity

Does the network of unsealed soil facilitate movement of water and nutrients into sealed soil?



Disturbance

Does soil that was disturbed less recently have more organic carbon and nutrients?

Sampling strategy

The sampling strategy aims to collect soils across Manchester from:

- **sealed soils** – roadworks for water and gas pipes, construction sites
- **unsealed soils** – from parks, amenity greenspaces, transport green spaces and public open spaces.

Sampling is designed to collect soil from a range of spatial contexts: inner city, suburban, amenity spaces etc.

Sample analysis

Total N, C & P	<ul style="list-style-type: none">• CN ratio• Total P
Plant available	<ul style="list-style-type: none">• Total C & inorganic C• Ammonia & nitrate
Labile C	<ul style="list-style-type: none">• Physical fractionation
	<ul style="list-style-type: none">• Loss on ignition• Bulk density• pH

Soil organic matter as a proxy

Soil organic matter plays an important role in **soil function** and improves **soil properties**¹ including:

- soil structure and aggregation
- biodiversity
- carbon storage
- water holding capacity
- cation exchange capacity and nutrient provision

Soil organic matter is measured in terms of **soil organic carbon** (SOC).

SOC in cities is important for both **multiple ecosystem services & carbon storage**².

To date, few studies have considered SOC as a proxy for multiple ecosystem services in cities.

SOC stores in urban soils may have been **underestimated** in national inventories³ – little data is available on urban soil carbon storage².

Urban soil and the SDGs

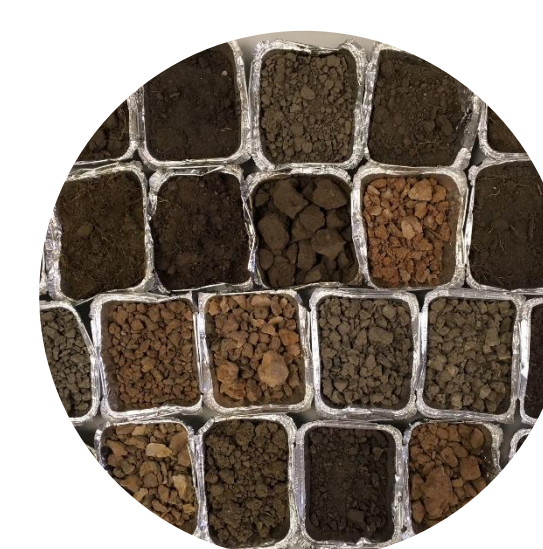
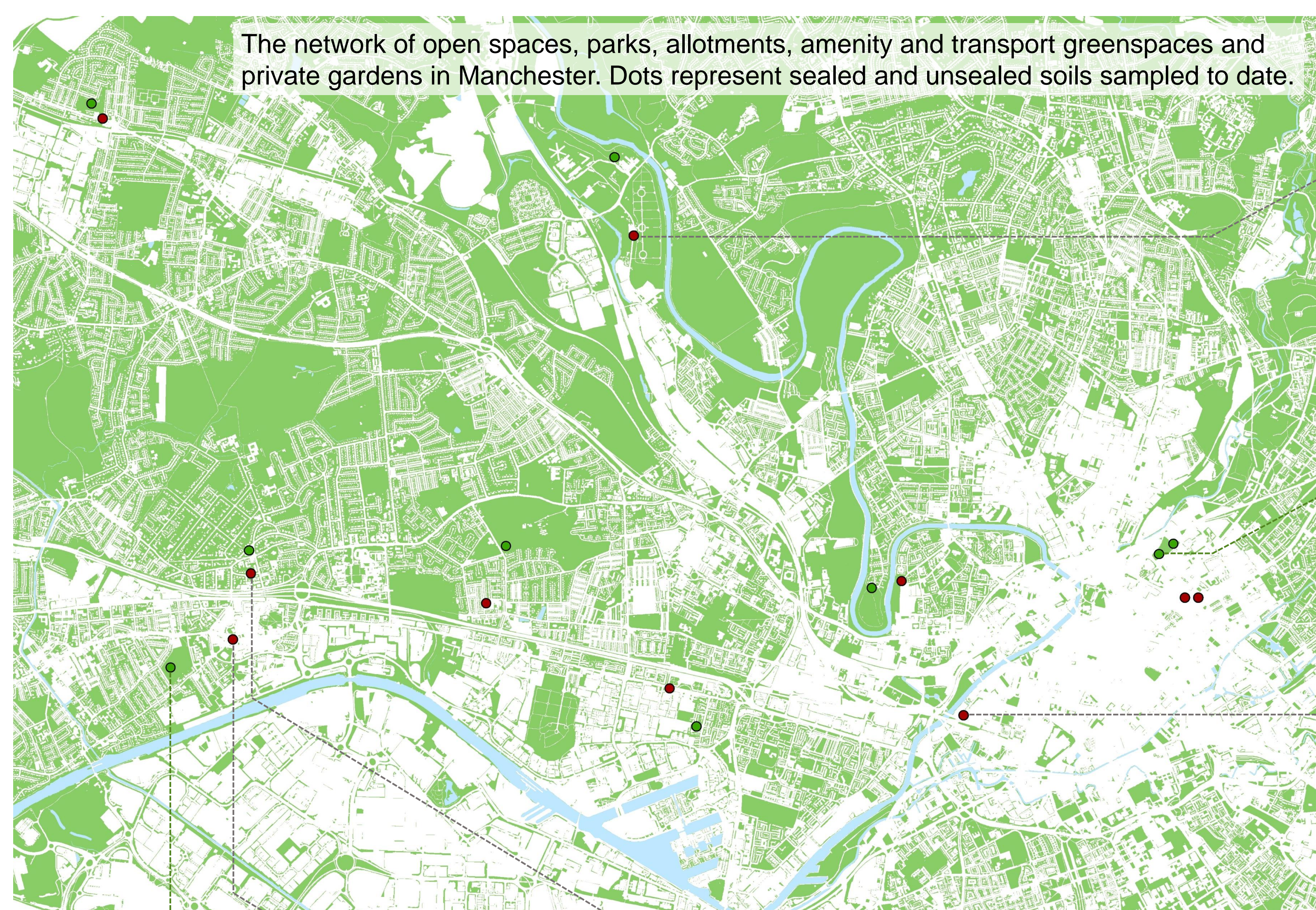
Recognising the benefits urban soil provides can help meet the targets for goal 11: Sustainable Cities & Communities.



11.6 Reduce environmental impact – air quality & waste

11.B Implement policies on climate change mitigation & adaptation

11.7 Access to green & public space



● Sealed soil
● Unsealed soil

Future plans

Complete sample collection and data analysis

Investigate the dynamics of sealed soils - **transect or chronosequence study** (effects of disturbance over time)

- Duration of soil sealing and its influence on soil organic carbon
- The effects of sealing over time on nutrients

Consider modelling urban soil carbon

- Use **process based soil model**, N14CP, in an urban context

Keywords

- Soil
- Urban Soil
- Cities
- Ecosystem Services
- Sustainable Development Goals
- Soil Organic Matter
- Soil Organic Carbon
- Greenspace
- Soil sealing

