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## CarboCity – Solving biogenic carbon cycle in urban environments

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Urban areas are a large source of carbon dioxide (CO<sub>2</sub>) to the atmosphere. Cities are seeking solutions to reduce the CO<sub>2</sub> emissions and to achieve carbon neutrality. Thus, there is a growing interest in maximizing the carbon sinks of urban vegetation and soil. Current knowledge on the carbon sinks is mainly based on data from non-urban environments. In the cities, environmental controls of carbon flows are different compared to the surroundings: temperatures are higher and water cycles altered compared to non-urban areas, green areas are managed (e.g. mowed and irrigated), and trees typically have very limited space for their roots but less competition at the canopy-level. In order to reduce uncertainties particularly in observation based urban carbon emission estimation, biogenic fluxes and their behaviour need to be correctly described/presented.

In the CarboCity project (Urban green space solutions in carbon neutral cities; 2019–2023), we aim to achieve a thorough understanding of atmosphere-plant-soil carbon dynamics in urban areas, and to find the best practices for designing the green areas to maximise their carbon sinks and stocks. In Helsinki, Finland, we have three sites in the footprint area of the SMEAR III ICOS station (SMEAR – *Station for Measuring Earth surface-Atmosphere Relations*; ICOS – *Integrated Carbon Observation System*): a botanical garden, a small urban forest, and a street site. The measurements were started in 2020, and include photosynthesis and fluorescence of trees (*Tilia cordata* Mill., *T. × europaea* L., *Betula pendula* Roth) and soil respiration, together with several supporting measurements (e.g. air and soil temperature, relative humidity, soil water content, sap flow, LAI). Ecosystem-level CO<sub>2</sub> exchange over the whole area of all three sites is measured at the SMEAR III ICOS station. Since late 2020, we are measuring also carbonyl sulphide exchange at the neighbourhood scale, which is used as a proxy for GPP. In addition to the measurements in Helsinki, we will use measured data from London, Minneapolis-Saint Paul, Beijing and São Paulo – cities that differ in the climate regions, vegetation types, and management styles of their green areas. Furthermore, the measurements will be used to parameterise land surface model SUEWS (*Surface Urban Energy and Water balance Scheme*), soil carbon model Yasso and dynamic land-surface models.