Assessing temporal and spatial dynamics of soil carbon dioxide emissions in a Shenzhen urban park

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With the acceleration of urbanization, cities have become one of the major sources of global carbon dioxide (CO_2) emissions. Besides anthropogenic emissions (such as from transportation, industry, and buildings), urban soil respiration (respiration from soil microorganisms and plant roots) is also an important source of CO_2 emissions. Accurately quantifying the CO_2 flux in urban soil is crucial for formulating emission reduction policies and assessing the potential of carbon sinks.

To accurately quantify urban soil CO_2 flux, this study took Longcheng Park in Shenzhen and the campus of Shenzhen BeiLi Moscow University as the research areas. Utilizing the LI-8100A soil carbon flux measurement system, combined with QGIS software and vegetation indices such as NDVI, we systematically evaluated the spatiotemporal dynamics of CO_2 emissions from urban green spaces under varying degrees of human disturbance, as well as their primary controlling factors.

The results showed that the CO_2 flux in green space soil under different levels of disturbance exhibited significant spatial heterogeneity. Canopy coverage had a very strong negative correlation with CO_2 flux (r=-0.93), which was the core driving factor; soil organic matter (LOI) had a strong negative correlation with CO_2 flux (r=-0.75); temperature had a weak positive correlation with CO_2 flux (r=0.29). Canopy coverage had a strong positive correlation with soil organic matter, while temperature had a negative correlation with both. The study confirmed that urban green space soil CO_2 emissions have obvious spatial differentiation characteristics. Increasing canopy coverage and soil organic matter content can effectively reduce CO_2 flux, providing a scientific basis for Shenzhen's carbon neutrality goal.