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The role of urbanization in the global carbon cycle

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Increasing urbanization and global environmental change are two of the grand challenges of the Anthropocene. There are many important connections between these two challenges, which are still poorly understood. The role of urbanization in the global carbon cycle is one of them. Until now, the known facts about the its role encompassed only CO_2 emissions. Urban areas account for more than 70% of CO_2 emissions from burning fossil fuels. Urban expansion in tropics is responsible for 5% of the annual emissions from land use change. Here I show that the effect of urbanization on the global carbon cycle extends beyond these emissions. I quantify the contribution of urbanization to the major carbon fluxes and pools globally and identify gaps crucial for predicting the evolution of the carbon cycle in the future. Urban residents currently control ∼22 (12-40)% of the land carbon uptake (112 PgC/yr) and ∼24 (15-39)% of the carbon emissions (117 PgC/yr) from land globally. Urbanization resulted in the creation of new carbon pools on land such as buildings (∼6.7 PgC) and landfills (∼30 PgC). Together these pools store 1.6 (±0.3)% of the total vegetation and soil carbon pools globally. The creation and maintenance of these new pools has been associated with high emissions of CO_2, which are currently better understood than the processes associated with the dynamics of these pools and accompanying uptake of carbon. Predictions of the future trajectories of the global carbon cycle will require a much better understanding of how urban development affects the carbon cycle over the long term.