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The Land-use influence on soil GHG emission in condition of Moscow megalopolis

Maria Vizirskaya (1), Anna Epikhina (2), Ivan Vasenev (3), and Riccardo Valentini (4)

(1) Russian Timiryazev State Agrarian University, Laboratory of agroecological monitoring, modeling and prediction of ecosystems, Moscow, Russian Federation (mvizir@gmail.com), (2) Russian Timiryazev State Agrarian University, Laboratory of agroecological monitoring, modeling and prediction of ecosystems, Moscow, Russian Federation (mvizir@gmail.com), (3) Russian Timiryazev State Agrarian University, Laboratory of agroecological monitoring, modeling and prediction of ecosystems, Moscow, Russian Federation (mvizir@gmail.com), (4) University of Tuscia, Viterbo, Italy, Russian Timiryazev State Agrarian University, Laboratory of agroecological monitoring, modeling and prediction of ecosystems, Moscow, Russian Federation (mvizir@gmail.com)

he modern Global climate change problems are closely connected to greenhouses gases (GHG) balance in dominated landscapes. This problem is especially actual in case of sharply man-changed urban landscapes. Up to now not so many studies have deal with urbanization (functional zoning, land-use type, soil contamination etc.) effect on soils GHG emission spatial-temporal variability at the local and regional scale, although the global scale land-use changes and human impacts are reported to be the main factors behind soil CO_2 emission. Moscow megalopolis (with population 12-16 million) is the biggest one not only for European territory of Russia but for Europe too.

Our study has been done in representative urban landscapes with different land-use practices typical for Moscow: urban forest (widespread in the North of Moscow) and green lawns with different functional zoning (11 sites in total). Forest sites have been studied during 7 years and differ in mesorelief (small hill summit and two slopes). Green lawns vary in the functional use (residential, recreational and industrial) and level of human impact (normal and high).

In each plot soil respiration was measured in field conditions using Li-6400-XT system. We separate autotrophic (root-derived) and heterotrophic (microbial-derived) soil respiration in the field using micro (1mm) and macro (1 cm) pore meshes. The measurements have been done weekly since June till October 2012 in 3 replicas per each plot. Additionally we analyze CH4 emission using the exposition chamber measurements method.

The conducted research have shown high temporal and spatial variability of CO_2 and CH4 fluxes due to functional zoning, slope, vegetation type, land-use practice, soil microclimate characteristics. The highest CO_2 emission is typical for green lawns where the CO_2 fluxes reached 3.3 μmol CO_2m-2s-1, which is 2.5-3 times more than the one of the urban forest. Comparative analysis of the roots and microorganisms contribution in total soil respiration showed the domination of microbial respiration which is 79.1% and 72.0% for forest and green lawns sites respectively. The significant increase in CO_2 emissions is accompanied by essential rise in root derived respiration: in 1.35 times – compared to urban forest ecosystems. Another important feature of green lawn sites is CH4 sink domination. The soil of the forest ecosystems is almost in a state of CH4 equilibrium.

For integral assessment of green lawns and forest ecosystem GHG emission potential in Moscow megalopolis it is especially important to take into attention the local soil moisture regimes that spatial-temporal variability is determined by mesorelief and land-use conditions.