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The influence of biotic and abiotic factors on carbon dioxide production of the artificial soils in Moscow Botanical Garden (Russia)

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Soil respiration is the second largest carbon efflux in most ecosystems (after photosynthesis), and can account for 60–90% of total ecosystem respiration. Soil respiration is one of main indicators of the biological activity of soils. It depends on many biotic factors (such as heterotrophic and autotrophic respiration) and abiotic factors (such as moisture and temperature). The efflux of carbon dioxide in artificial urban soils differs significantly from the CO_2 efflux in natural soils. Microbial community of urban soils is also very different from natural soil microbial communities. The influence of the biotic and abiotic factors on the components of soil respiration in the artificial soils is poorly understood.

The research took place in Moscow State University Botanical Garden Arboretum (southern taiga). Investigations were carried out at 2 sites: the areas planted with Picea obovata and Carpinus betulus. Three plots were established on each site: plot of "trenching" method (plot without root), plot without litter and control plot .The study was conducted with 1-2 weeks intervals between October 2015 and October 2017. Emission measurement were carried out by closed chamber technique.

The "trenching" method showed the following results: contribution of microbial respiration the area planted with Picea obovata was 10-60%, with Carpinus betulus - 10-70% during a year. Thus, methods gave positive result and are suitable for using in artificial soils. Carbon dioxide soil surface efflux during the year ranged from 0 to 1100 $mgCO_2/(m^2*hr)$. The functioning of soils on plots without roots and plots without litter is very different from the functioning of control plots. In winter period, the plots without litter froze faster and deeper, however, they thawed more quickly (the litter plays the role of a heat insulator). Plots without roots are characterized by higher moisture during the vegetation period. Plots without litter during snowless periods have less moisture, but in the first days after rains they are most moistened, due to the ability the litter to retains a large amount of water on the surface of the soil.