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Analyzing spatial variability of soil properties in the urban park before and after reconstruction to support decision-making in landscaping

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On-going urbanization stresses a necessity for structural and aesthetically organized urban landscapes to improve citizen's life quality. Urban soils and vegetation are the main components of urban ecosystems. Urban greenery regulates the climate, controls and air quality and supports biodiversity in urban areas. Soils play a key role in supporting urban greenery. However, soils of urban parks also perform other important environmental functions. Urban soils are influenced by a variety of environmental and anthropogenic factors and, in the result, are highly heterogeneous and dynamic. Reconstructions of green zones and urban parks, usually occurring in cities, alter soil properties. Analyzing spatial variability and dynamics of soil properties is important to support decision-making in landscaping. Therefore, the research aimed to analyze the spatial distribution of the key soil properties (acidity, soil organic carbon (SOC) and nutrient contents) in the urban park before and after reconstruction to support decision-making in selecting ornamental plants for landscaping.

The research was conducted in the urban park named after Artyom Borovik in Moscow before (2012) and after (2014) the reconstruction. Urban soil's properties maps for both periods were created by interpolation of the field data. The observed urban soils included recreazems, urbanozems and constuctozems. Before the reconstruction soils were sampled using the uniform design (the net with 100 m side and key plots with 50m size). After the reconstructions the additional samples were collected at locations, where the land cover and functional zones changed in a result of the reconstruction.We sample from the depths 0-30, 30-50 and 50-100 cm. The following soil properties were measured: pH, SOC, K2O and P2O5. The maps of the analyzed properties were developed using open QGIS2.4 software by IDW. The vegetation in the park was examined using the scale of the visual assessment. The results of the visual assessment were processed using QGIS2.4 and the maps of the vegetation condition were created.

High spatial variability was shown for observed soil properties with the highest variance reported for nutrient concentrations. High heterogeneity in P2O5 and K2O was obtained both in topsoil and subsoil, before and after reconstruction. We showed that average concentrations of P2O5 and K2O were correspondingly above and below legal threshold taken for the Moscow city. In result of the reconstruction the pH has changed from slightly acid and acidic to neutral and slightly alkaline. The topsoil SOC content has increased in the result of reconstruction but still was below threshold, recommended by municipal regulations. The potassium content and acidity were the main factors, influencing the vegetation condition. The 'weakened' condition of wood vegetation was reported with the lowest values obtained for the Pinus sylvestris, Thuja occidentals and, Sorbus aucuparia. References have developed for planting vegetation.

The spatial heterogeneity and high dynamics of urban soils constraints the quantitative assessment of their properties and functions and the use of this information in landscaping. The successful experience of digital soil mapping techniques in urban park allowed solving this problem and highlighted the importance of soil data for creating urban green infrastructure.