Tropentag, September 18-21, 2016, Vienna, Austria

"Solidarity in a competing world — fair use of resources"

Spatial Variability of Soil Properties in the Floodplain of a River Oasis in the Mongolian Altay Mountains

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Abstract

Owing to the fertility of alluvial soils, the leveled topography and the easy access to water, floodplains are favored areas for agricultural activities. These factors allow small-scaled cultivation of crops and hay even under the arid climate conditions in the floodplain of the river oasis Bulgan sum center located in the foothills of the Altay Mountains, Western Mongolia. Previous studies in the river oasis suggested a negative impact of agricultural land use on soil quality indicated by soil biological parameters which, however, were characterized by a high spatial heterogeneity. This study aims at a further characterization of the spatial variability of major soil properties within the floodplain of Bulgan sum center and the determination of factors responsible for the variation of soil biological properties.

In the framework of the IFAD-funded project WATERCOPE (grant I-R-1284), topsoil samples were taken every 20 m according to a grid sampling approach, covering a floodplain area of 4 ha. Samples were analyzed for physico-chemical (electrical conductivity (EC), inorganic carbon (C), pH, texture, total C) and biological properties (basal respiration, ergosterol, microbial biomass C). The coefficient of variation (CV in %) was calculated as a measure of spatial variability. Spearman correlations were computed between soil biological and physico-chemical properties.

While pH values were almost homogenous within the 4 ha (CV = 12 %), biological soil parameters were characterized by a relatively high variability (basal respiration: CV = 46 %, ergosterol: CV = 63 %, microbial biomass C: CV = 41 %). EC and inorganic C, however, were extremely variable within the area (CV = 86 % and 163 %, respectively). The variation of the biological parameters primarily depends on the spatial distribution of organic C (average $r^2 = 0.62$, $p < 0.01$), while for ergosterol and for microbial biomass C a positive relationship with EC ($r^2 = 0.57$, $p < 0.01$) and with the clay content ($r^2 = 0.43$, $p < 0.01$), respectively, was additionally observed.

In summary, presented variabilities confirm previous observations and are comparable to further floodplain studies. Results underline the significance of organic carbon to preserve the scarce and susceptible agroecological resources of river oases.

Keywords: Kriging, soil organic carbon, soil respiration, soil salinity

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