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Soil-environmental index for assessment of forest-steppe soils on the territory of East European Plain

Iuliia Zhukova, Dmitriy Bulgakov, and Daniil Kozlov
V.V. Dokuchaev Soil Science Institute, Russian Federation (zhykss@gmail.com)

A comprehensive quantitative assessment of the lands based on their agricultural efficiency is required for successful cultivation of crops and effective land management. In order to assessment and ranking of soils, various indexes taking into account edaphic and climatic conditions are applied. One of these indicators is soil-environmental index (SEI) assessing agroecological potential of lands.
Forest-steppe soils of the East European Plain are characterized by high fertility and are used for the cultivation of winter wheat, sunflower, sugar beet, etc. However, agricultural ranking of these areas has still not been carried out. The aim of this study was to determine soil-environmental index values for the East European Plain soils within the administrative subjects of Russian Federation, and to test its applicability in agriculture.
The study was carried out for the forest-steppe area of East European Plain within the boundaries of Central Russian natural and agricultural province (18 administrative subjects of Russian Federation). SEI of lands was calculated using Karmanov's equation. This equation takes into account three constituent elements: climatic conditions (the sum of temperatures above 10 ^{0}C, humidity and continentality coefficients), agrophysical (particle size distribution, soil density) and agrochemical (total organic carbon, mobile phosphorus and potassium content) properties of soils. Agrophysical, agrochemical and climate data from the long-term observations were used. Data visualization was performed by QGIS and SAGA software.
SEI clearly reflected the changes in edaphic and climatic conditions. Moreover, SEI correlated with summer and winter wheat yields (R2 = 0.69). For the western part of province, SEI ranked by regions, ranged from 49.4 to 84.0. These significant differences can be explained by gradual increasing of averaged temperatures in southern regions compared with northern, as well as by considerable shifts in soil types distribution from Luvisols and Phaeozems to organic carbon-rich Chernozems (over 70% of the area). From west to east direction, the changes in SEI values didn't exceed 20% as the soil cover of compared regions was much more homogeneous.
In the central part of the province, SEI varied from the north to the south (45.1 - 84.0), and from west to east (variation of 30%). In the eastern part, SEI changed from north to south in the range of 20%, and from west to east with variation of 15% (49.2 - 56.9).
Thus, the analyzed averaged long-term data over a long period of observation avoid strong deviations due to certain weather periods, distracting from the overall character of the climate. Determination of soil-environmental indexes allowed us to distinguish lands which were the most suitable for agricultural use.