THE USE OF ARCHIVAL MAPS FOR THE MONITORING OF AGRICULTURAL LAND

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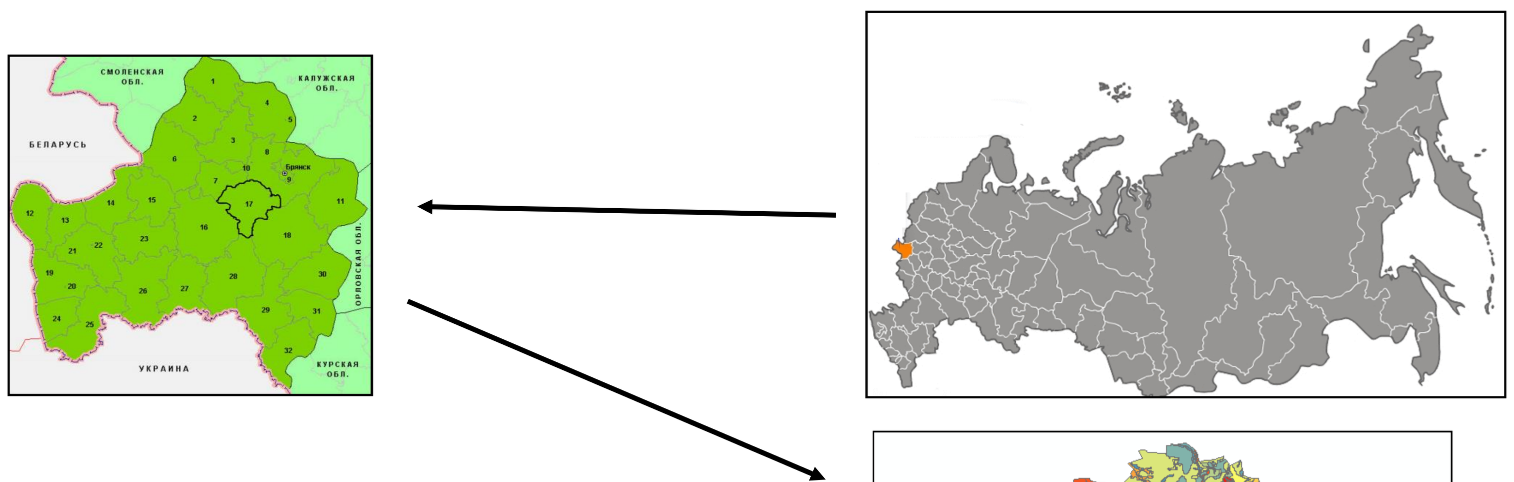
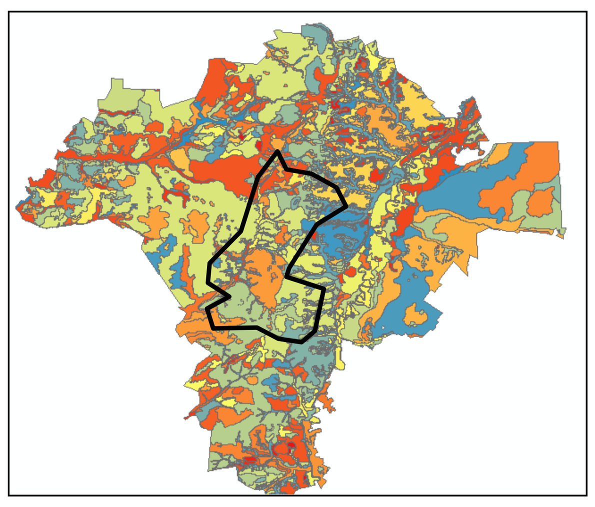
I. Considered matters

There are a large number of soil surveys data that were collected in the Soviet Union in the late 20th-century. They were generalized in the form of large-scale soil maps of farms, districts and a whole region. The accompanying descriptions contain a large amount of information about morphological properties, granulometric composition, organic matter content and basic agrochemical properties of soil profiles on the basis of which was allocated to the soil contours. These data can serve as a point of reference in assessing changes in land cover that have occurred over the last 25-30 years. The soil profiles locations were pointed on soil maps with the scale 1:10 000.

II. Material and Methods

The study was performed on the Bryansk region landscapes, which are the part of the Opolje- Polesye landscape zone of the Russian Plain.





The study area was equal to 73,547 ha. The basic classification was the classification of soils of USSR, 1977. The soil cover is dominated by Albeluvisol Umbric and Phaeozems Albic, which are almost completely under cultivation. Phaeozems Gleyic were associate to depressions. Fluvisols Umbric were marked as part of the territory.

Fig.1. Soil map 1983 and study area 2016

We compare the soil properties (pH, soil organic matter (SOC), soluble P2O5 and K2O) of the top 0-20 cm horizon obtained in 2016 survey on the part of Vygonichsky district of the Bryansk region (Russia) with the data from archive soil map of 1983 (scale 1:50,000). There were 39 individual samples in 1983 and 564 composed samples in 2016 (fig.2).

n=39 n=564

Fig.2.Soil sampling in 1983 and 2016 years

Ordinary kriging technique was used to construct soil property maps for 2016 data. Than values in points of 1983 sampling were interpolated and compared with the initial data.

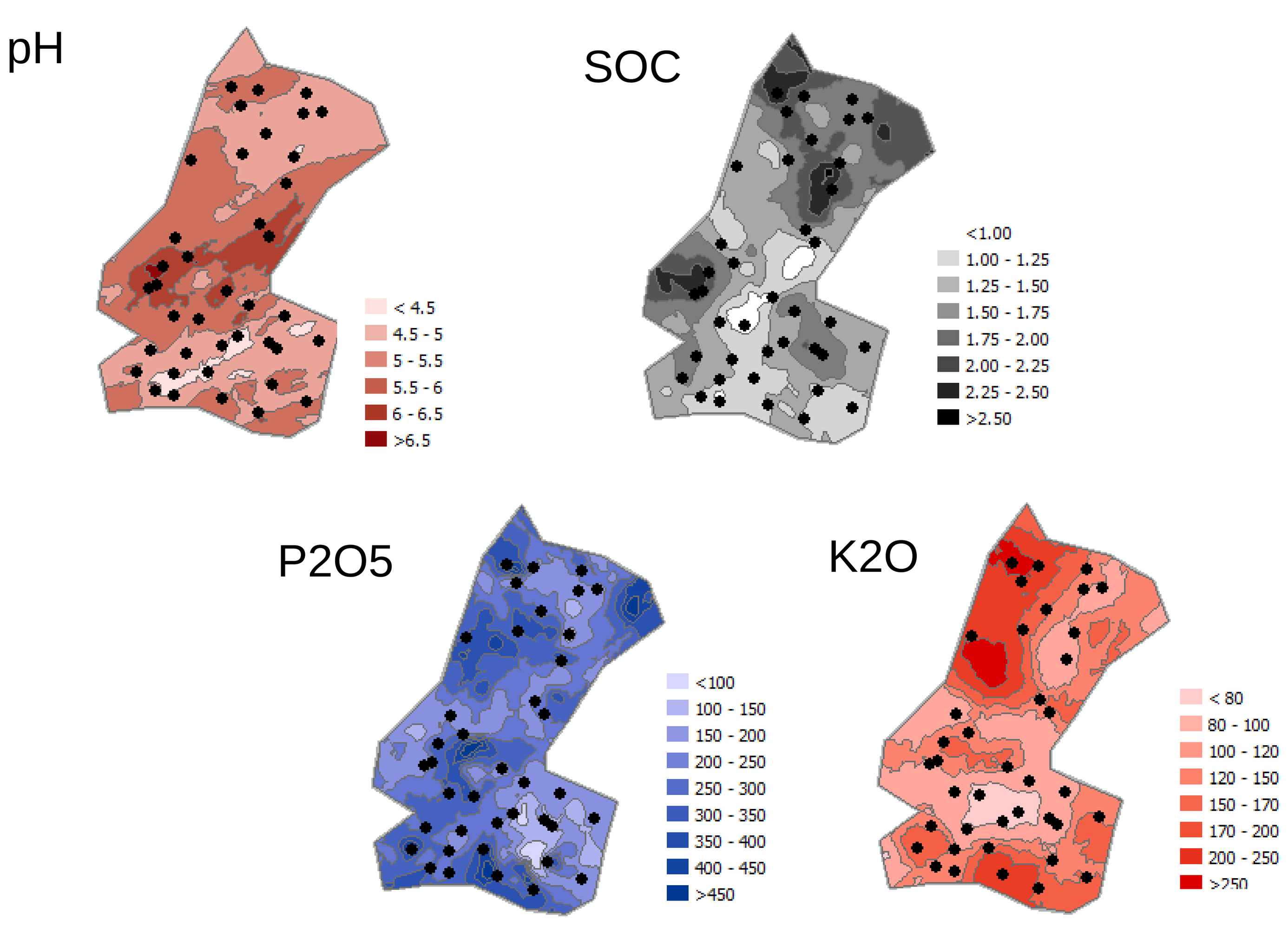


Fig.3. Maps of soil properties (2016 with points 1983)

Table1
Statistics of soil properties

	pH	SOC, %	P2O5, mg/kg	K2O, mg/kg
1983, n=39				
Mean	5.33	1.56	74	133
St.dev.	0.61	0.50	65	58
Min	4	0.3	12	20
1-quartile	4.9	1.3	27	100
Median	5.2	1.5	50	123
3-quartile	5.7	1.8	94	170
Max	6.7	2.7	250	316
2016, n=564				
Mean	5.59	1.67	239	189
St.dev.	0.57	0.43	101	90
Min	4.43	0.75	49	52
1-quartile	5.15	1.37	166	132
Median	5.51	1.61	231	170
3-quartile	5.99	1.89	293	219
Max	7.26	2.76	1005	813

Table 2
Correlation between predicted (2016) and independent (1983) values

pH	0.014
SOC	**0.600**
P2O5	0.268
K2O	0.007

(marked value is statistically significant at the 0.05 level)

III. Conclusions

Comparison of the statistical characteristics shows that in 33 years the acid-alkaline properties and SOC of the arable horizon within the surveyed territory did not change, and the content of mobile phosphorus and potassium increased statistically significantly (Table 1).

At the same time, the structure of the spatial variability of properties varied with time in time. Thus, if there is no correlation between individual time points for the pH and the content of mobile potassium (the correlation coefficients are close to zero), then for the content of organic matter and mobile phosphorus, the relationship between the values at different instants of time is statistically significant (Table 2).

The most stable is the spatial distribution of the SOC , which, on the one hand, may be due to the slow variability of this index over time, and on the other hand, to insufficient application of organic matter. .

The increase in the average content of mobile phosphorus and potassium is due to the massive application of fertilizers in the territories exposed to radioactive contamination as a result of the Chernobyl accident. The different temporal stability of the spatial structures of these indicators correlates well with the different mobility of the elements in the soil.

Spatial structures of agrochemical properties primarily depend on the history of the site and to a small extent on the classification of the soil (Fig. 4).

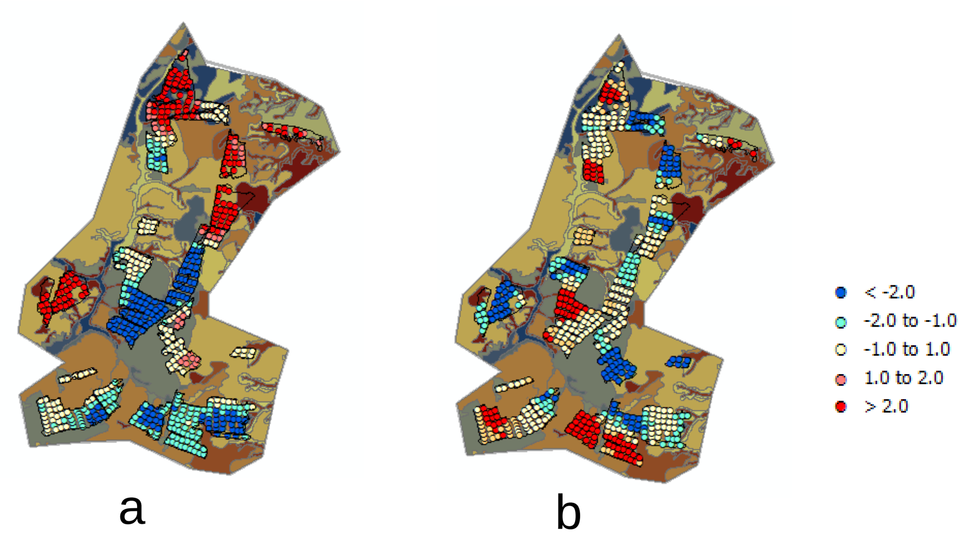


Fig.4. Hot points (clusters of normal scores) for SOC(a) and P2O5 (b)

The study was supported by RFBR grant №16-44-320069