Indication anthropogenous Dynamics of a Top-Soil on the Basis of Digital Processing of aerial Photographs

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Abstract. *In this article the outcomes of investigations on learning dynamics of a top-soil with application of the automated data-processing system of remote sensing are described.*

Keywords**:** automated decoding, aerial photographs, digital processing, top-soil.

1. INTRODUCTION

The learning of dynamics of a top-soil with the purpose of monitoring is one of perspective directions of application of methods of digital processing of snapshots. The microstructures and their components - elementary soil areals - are main objects of research of dynamics of a top-soil, as the processes of transformation of a top-soil appear first of all at this level of its organization [1].

The different methods of person influence on soil can be divided into two groups pursuant to consequences [2]:

The undirected - anthropogenous group promotes amplification of contrast and is connected to negative consequences of development of erosion and amplification of salinity and bogging waterlogging. The derivation of complexes and combinations increases at that. Such modification of top-soil structure results from incorrect implementation of receptions processing, of melioration etc.

The second group embodies scientifically justified and purposeful methods eliminating unfavorable properties of soils of separate components of structure of a top-soil, results in equalization and increase of fertility by all soil, lowering of contrast of a top-soil. For example, to elimination salinity - by washdown, redundant humidifying - by drainage melioration, equalization of fertility - by liming and gypsuming etc.

The consequences of the given of the person influence on soils can be rated on the basis of digital processing of snapshots taking place at different times [3,4].

Materials of air photography of a key site "Makarichi" (Petrikov's region of Gomel area) were compared with the purpose of learning influence of a drainage melioration on modification of a top-soil structure. The materials obtained before and after realization of the land reclamation, with an interval 20 years were researched. In researches the aerial photographs of optimum (vernal) terms of visitation were used.

2. EXPERIMENTAL RESULTS

The digital processing of aerial photographs includes following fundamental stages[5]: scanning of original images; transformation of snapshots in a projection of a map; the automated decoding of the digital images of snapshots; obtaining of quantitative parameters of structure of a top-soil (factors of partition, contrast range and non-uniformity).

By results of digital processing of snapshots taking place at different times, the maps of clusters were obtained and the quantitative parameters of structure of a top-soil are calculated.

The comparison of aerial photographs taking place at different times and reduced to one scale (1:10000) has shown a similarity as a whole of soil varieties and incongruity of their boundaries. As it is visible from figures 1(a) and 2(a), the top-soil of investigated territory has undergone considerable changes, which can be evaluated on change of tone of the photo image and change of geometry of soil space. As was shown earlier, the darkening of tone of the photo-image of soils on aerial photographs is connected to increase of the contents in them of moisture and humus, i.e. on aerial photographs finds reflection, first of all, degree of humidifying of soils. Therefore on change of tone of the photo-image it is possible to judge change of a degree of a hydromorphism of soils.

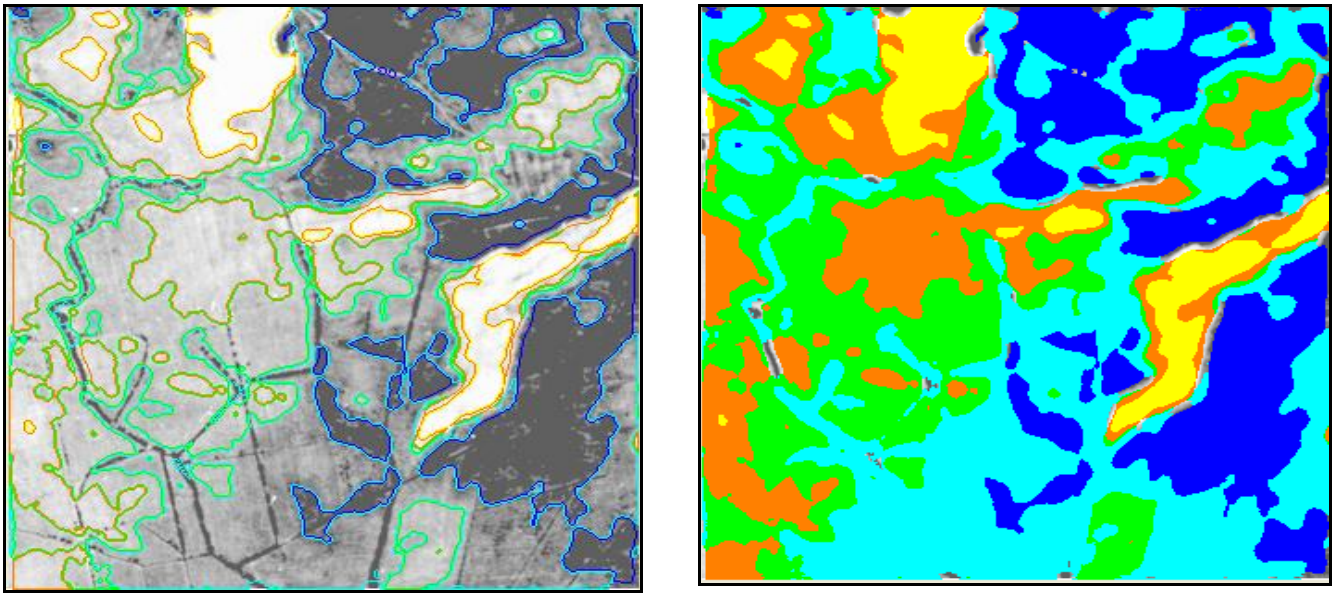
Quantitatively to evaluate the changes, which have occurred in a top-soil of the given territory, it is possible through the analysis of parameters of a top-soil structure. The comparative quantitative analysis of a top-soil structure was executed for cropland of the same territory of a key site. The obtained cluster maps are visible in figures 1(b) and 2(b). Statistics of a cluster map and the balls of contrast of cropland soils up to melioration are listed in table 1, after melioration - in the table 2.

Quantitative parameters of a top-soil structure up to melioration:

$$К_к = 100,3 : 20 = 5,02$$
$$К_р = 67,5 : 42,3 = 1,60.$$
$$К_н = К_к \cdot К_р = 5,02 \cdot 1,60 = 8,03$$

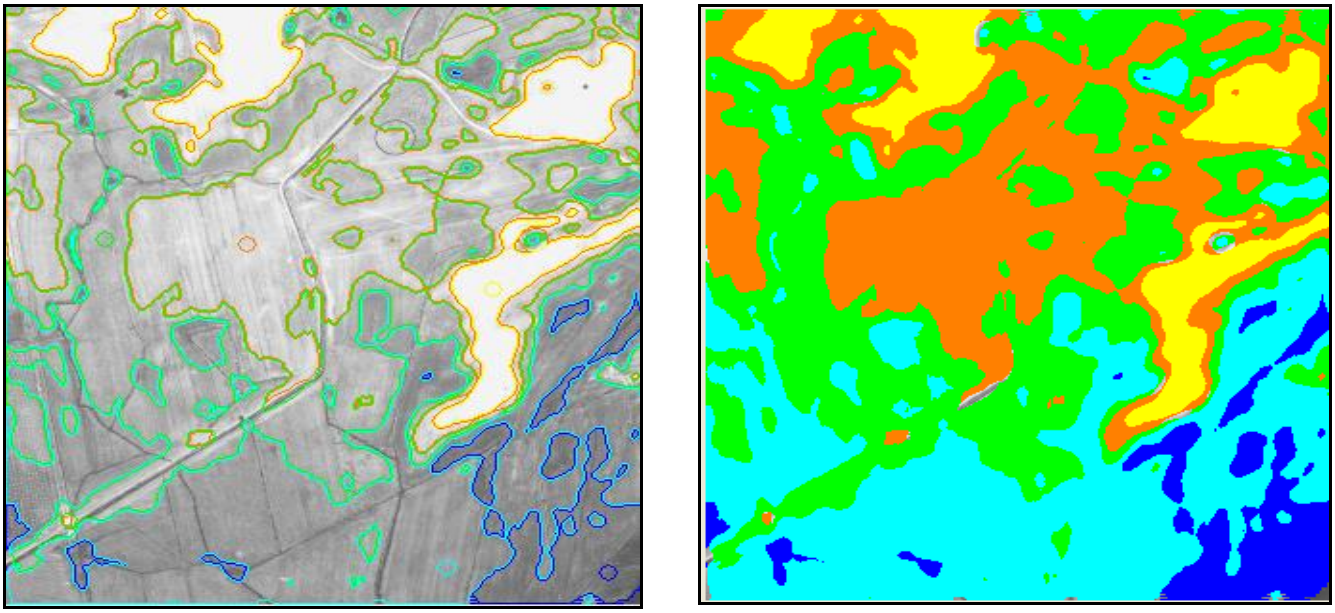
Quantitative parameters of a top-soil structure after melioration:

$$К_к = 91,2 : 20 = 4,56$$
$$К_р = 58,56 : 41,59 = 1,41$$
$$К_н = К_к \cdot К_р = 4,56 \cdot 1,41 = 6,43$$



a) **b)**

Fig. 1. A fragment of an aerial photograph of a key site "Makarichi" up to melioration: a) with demonstration of boundaries of soil contours; b) the cluster map



a) **b)**

Fig. 2. A fragment of an aerial photograph of the same region after melioration: a) with demonstration of boundaries of soil contours; b) the cluster map

If up to melioration the dominant area was occupied by sod-podzol gley by soils (34 %), after melioration the sod-podzol gleyey soils were become dominant (31 %). The areas of sod gleyey soils were reduced with 20 % up to 6 %, the area of sod-podzol gleyey have increased with 22 % up to 31 %. There was also increase of the areas poor sandy sod-podzol of soils (with 7 % up to 9 %).

Up to melioration a dominant soil combination was composite of sod-podzol gley, sod-podzol gleyey soils and sod gleyey soils (ДПБ334 + ДПБ222 + ДБ220), after melioration combinations of sod-podzol gleyey, sod-podzol gley and sod-podzol temporarily over wetted soils were become by a dominant soil composite (ДПБ231 + ДПБ329 + ДПБ125).

Table 1. Statistics of a cluster map and balls of contrast of soils up to melioration

List of clusters	The area on a cluster (hectare)	The area (in % from general)	The perimeter on a cluster (kilometre)	Balls of contrast			Product of a ballon the area (КхS)
				Main ball on " to a Scale of visibility "	With the correction on the acidity	Total ball	
К1 – ДПБ0	2,8	7	3,6	3,0	0,3	3,3	23,1
К2 – ДПБ1	7,4	18	13,3	2,0	0	2,0	36,0
К3 – ДПБ2	9,4	22	18,8	1,0	0,6	1,6	35,2
К4 – ДПБ3	14,4	34	21,9	There are prevail			
К5 – ДБ2	8,3	20	9,9	0,0	0,3	0,3	6,0
	42,3	100	67,5				100,3

Table 2. Statistics of a cluster map and balls of contrast of soils afte melioration

List of clusters	The area on a cluster (hectare)	The area (in % from general)	The perimeter on a cluster (kilometre)	Balls of contrast			Product of a ball on the area (КхS)
				Main ball on " to a Scale of visibility "	With the correction on the acidity	Total ball	
К1 - ДПБ0	3,6	9	4	2,0	0,3	2,3	20,7
К2 - ДПБ1	10,6	25	15,8	1,0	-	1,0	25
К3 - ДПБ2	12,8	31	20,6	There are prevail			
К4 - ДПБ3	12,1	29	13,8	1,0	0,3	1,3	37,7
К5 - ДБ2	2,4	6	4,4	1,8	1,0	1,3	7,8
	41,5	100	58,6	1,4			91,2

Indexes of the names of soils to the tables 1 and 2:
ДПБ0 - sod-podzol gley from below;
ДПБ1 - sod-podzol temporarily over wetted;
ДПБ2 - sod-podzol gleyey;
ДПБ3 - sod-podzol gley;
ДБ2 - sod gleyey.

The analysis of quantitative parameters of structure of a top-soil on non-simultaneous aerial photographs showed decreasing of a factor of visibility (with 5,02 up to 4, 56), factor of ruggedness (with 1,60 up to 1,41) and factor of a non-uniformity (with 8,03 up to 6,43).

As a whole, if up to melioration the top-soil of the given territory could be described as average-contrast (Кк=5,02), average-multipartite (Кр=1,60), weak-heterogeneous (Кн=8,03), after melioration as weak-contrast (Кк=4,56), average-multipartite (Кр=1,41), weak-heterogeneous (Кн=6,43).

By main reason of dynamics of top-soil exhibited in change of the areas and boundaries of soils, in this case was lowering a ground-water level as a result of realization of drainage melioration. The effect of the person on soil on consequences in modification of top-soil structure has resulted in lowering of top-soil contrast and elimination of unfavorable properties of soils (overwetting).

3.CONCLUSION

Thus, as a result of researches, conducted by us, on digital processing of non-simultaneous snapshots the capability of learning of dynamics of top-soil through its structure is shown, on the basis of which it is possible to judge happening changes in top-soil.

Starting from the concept about soil, as about « a mirror of a landscape», dynamics of geometry of soil space determined by changes of the factors of spatial differentiation, can serve by the indicator of changes and condition of an environment as a whole.

4. REFERENCES

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