Soil conditions characteristics of southern part of Odessa region

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SOILS: WHERE FOOD BEGINS

Global Symposium on Soils for Nutrition | 26-29 July 2022

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Recently, scientists and practitioners of agricultural sector have noted a significant deterioration of the soil ecological condition in Ukraine, which is associated with their intensive agricultural use, primarily excessive plowing and breaking of the scientifically based crop rotation system, which lead to decrease in soil fertility and a large-scale spread of soil degradation processes.

There is an urgent need for significant changes in economic activity and nature management, which would take into account the influence of natural and anthropogenic factors on the agro-ecological state of the lands. Several approaches to the agro-ecological assessment of territories are known, which are based on general geographic, geochemical, landscape and agrotechnical principles.

Studies aimed at assessing the agro-ecological state of the land using a set of indexes characterizing the contribution of natural and anthropogenic factors are gaining considerable relevance.

The purpose of the presented research is one of the approaches to assessing the agro-ecological state of lands based on a complex of natural and anthropogenic factors as a basis for the modern optimal organization of territories on the example of the southern districts of Odessa region.

Methods of typification, classification and large-scale mapping of territories were used.

Agro-ecological differentiation of Odessa region south territory is carried out according to the following indexes:

relief elements,

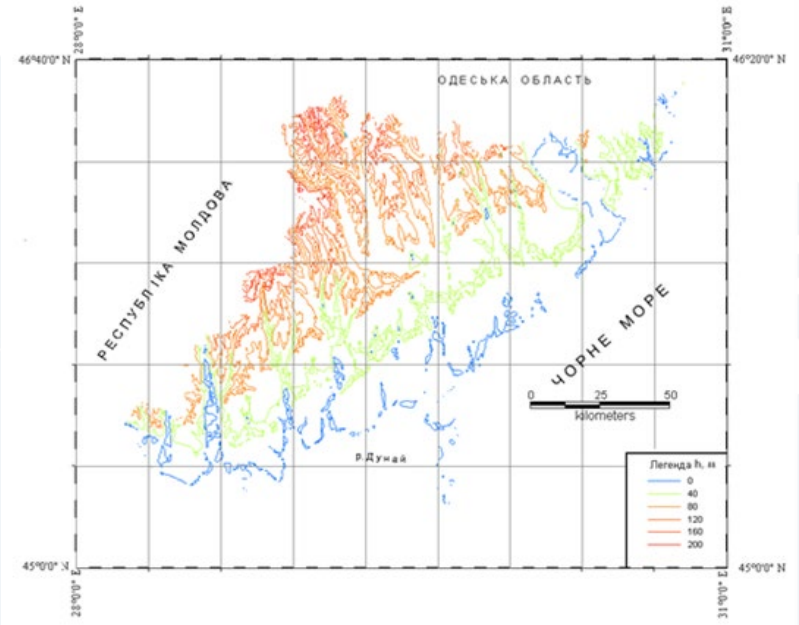
- -soil cover quality,
- -microclimatic conditions,
- -organization of different types of lands.

Differentiation of the territory according to the relief was carried out according to the following factors:

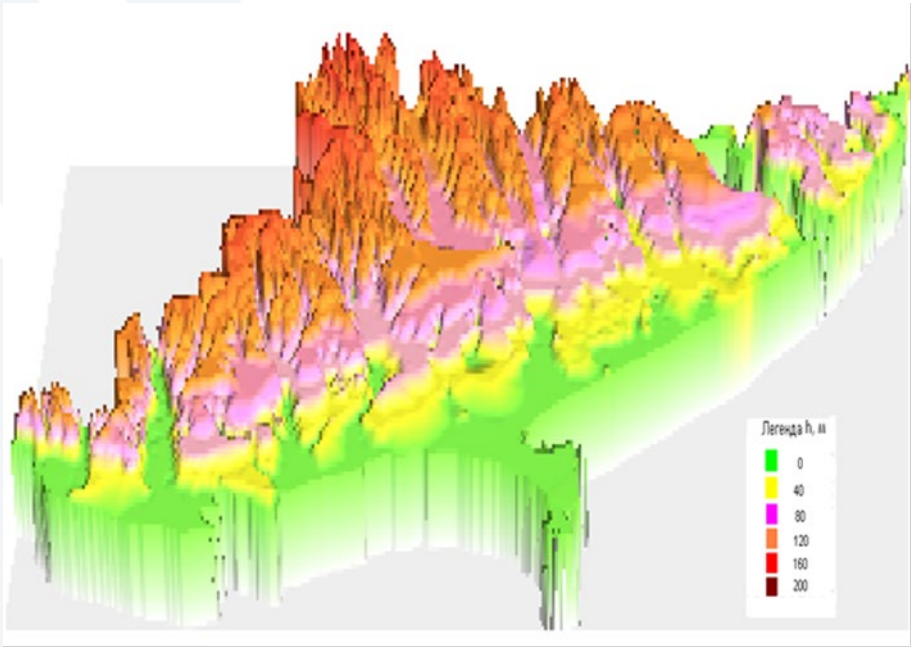
- absolute elevation marks and relative elevation (depth of vertical differentiation) By these gradations, relief types has been differentiated. On the south of Odesa region territiries, the following types of relief are distinguished, which are grouped into 4 classes:

1) < 20 m - plain; 2) 21-60 – slightly hilly; 3) 61-100 – hilly; 4) > 100 – hilly.

Drysometric map



Three-dimensional map of the relief



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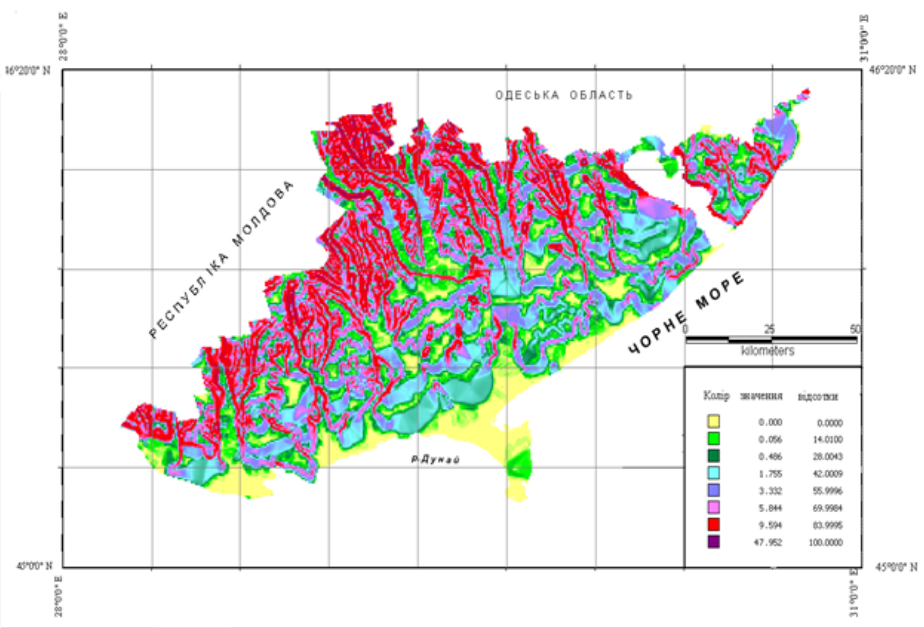
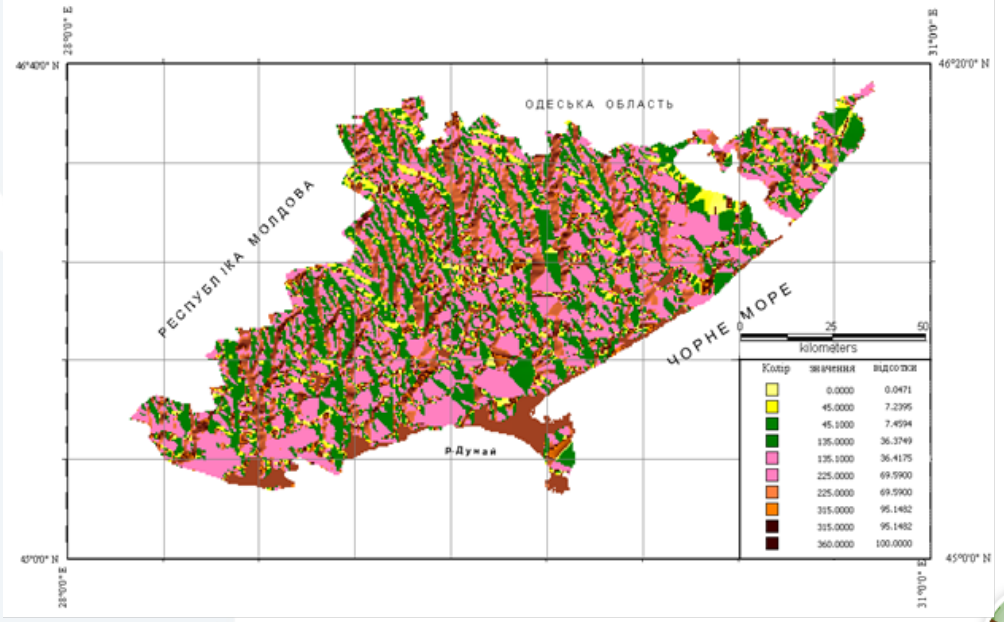
- according to exposure, slopes are divided into 8 rhumbs: north (N), north-east (NE), east (E), south-east (SE), south (S), south-west (SW), west (W), north-western (NW). In the entire territory, according to this index, lands are grouped into 3 classes: warm, moderate and cold. The 1st class includes land with exposure to the south, south-west, to the 2nd class - the south-west, east, west, north-west, and to the 3rd class - the north, north-east

- according to the steepness of the slopes south lands of Odesa region divided into 4 classes: 1) 0 - 2° – plain; 2) 2.1 – 4,0° - rolling lowland; 3) 4.1 – 6,0° - slightly hilly; 4) > 6° – hilly.

Steepness of slopes



Exposition of slopes



Evaluation of soils agroecological quality fulfilled on the basis of a detailed classification, the criteria for which is the ratio of heavy metals content and the radionuclides concentration up to MAC according to a special scale.

Four classes of quality were allocated. To the 1st class soils with heavy metals and radionuclides concentration not exceed 20% of the MAC belonged, to the 2nd class - 21-70%, to the 3rd class - 71-99% and to the 4th class - the value of MAC and higher (Table 1).

Table 1. Soil classification by individual indexes

Class	Humus content, %	pH	Radionuclide concentration, Ci/km^2		Some metals content, mg/kg						
			^{137}Cs	^{90}Sr	Pb	Cd	Mn	Zn	Cu	Co	Hg
1	≥4,1	(5,6 - 6,0) (6,1 - 7,0) (7,1 - 7,5)	<0,21	< 0,09	< 6,0	< 0,6	< 10,0	< 0,3	< 0,6	< 1,0	<0,41
2	3,1 – 4,0	(5,1 – 5,5) (7,6 – 8,0)	0,21-0,7	009-0,10	6,0-21,0	0,6-2,1	10,0-35,0	0,3-1,05	0,6-2,1	1,0-3,5	0,41-1,47
3	2,1 – 3,0	(4,6 – 5,0) (8,1 – 8,5)	0,71-0,99	0,11-0,14	21,1-29,9	2,11-2,99	35,1- 49,9	1,06 - 1,49	2,11-2,99	3,51-4,99	1,48-2,09
4	≤2,0	(<4,6) (>8,5)	≥1,0	≥0,15	≥30,0	≥3,0	≥50,0	≥1,5	≥3,0	5,0	≥2,1

Microclimatic variability detection of agroclimatic resources main components is based on the knowledge of the physical mechanisms of their formation in the conditions of a heterogeneous underlying surface, which are differ by the resources of light, heat and moisture, and the conditions of frost and spring frost danger. Lands differentiation according to microclimatic conditions is carried out on the basis of compiled large-scale microclimatic maps (M 1:50000 and 1:10000)

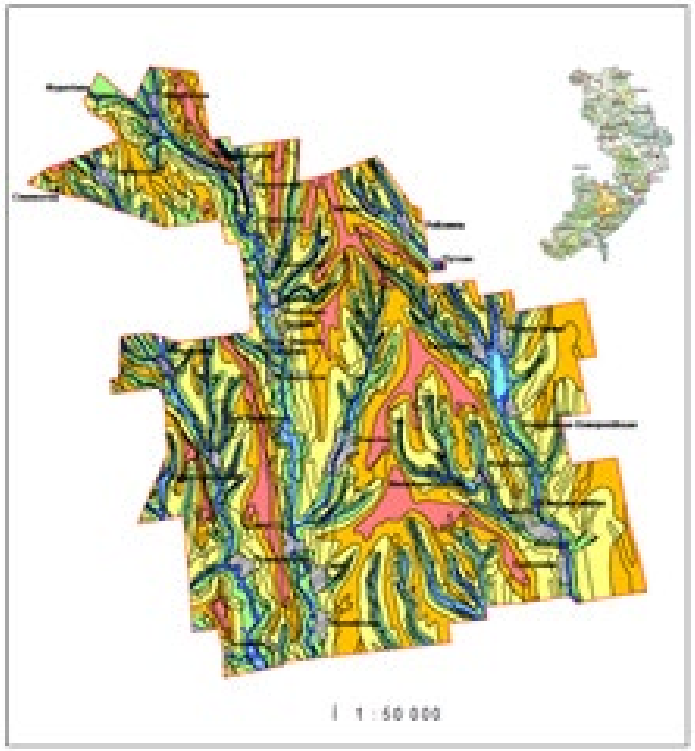


Table 2. Organization of different land types of Odessa region southern districts

Name of land	Administrative regions square, ha									
	Artsyz district	Bilhorod-Dnistrovskyi district	Bolgrad district	Izmail district	Kiliya district	Ovidiopol district	Reni district	Sarata district	Tarutino district	Tatarbunari district
Protected areas, reserves	4	7687,8	451,1	2893,4	46741,9	0	0	0	274	27865
Arable lands	99919,7	115656,8	90627,9	79576,7	64957,6	47196,8	33763	106991,8	108054,8	103614,4
Vineyards	4078,7	5275	8761,2	1936,1	2188,5	2580,5	2693,8	6077,9	7175,3	4251,9
Orchards	930,3	2204,1	1480,8	1147,6	749	1723,4	138,1	831,4	697,7	724,4
Pasture	15383,3	3361,7	12938,3	4910,1	2181,5	2401,1	4785,4	16722	32910,2	5359
Total	120312	126498	113808	87571	70077	53902	41380	130623	148838	113950
Lake	854	1664,6	966,1	1	59,19	431,3	742,4	288	772	0
Shrubs	295,1	345,3	0	5	0	89,4	28	107	101,5	0
Swamps	278	6545,7	349,2	4602,5	6167,7	1224,5	4173,1	147	1159,6	597
Ravines	405	239,4	735,6	123	33	239,4	272,3	339	1019,5	0
Farm yards	1927,8	1984,4	1495	1328,9	1225,5	1021,4	786,9	1379	1489,4	1687,7
Forest plantations and forest belts	5694,5	3292	6073,4	4825,2	2145,4	2033,6	1809,6	5480	10303,4	3406,9
Field roads	1215,1	1597,5	1894,9	1464,9	1166,6	1041,1	832,1	1678	1807,2	1432,6
Cemetry	64,55	95,4	105,4	90,6	72,8	91,1	26,4	78	100,1	84,5
Total	10734,05	15764,3	11619,6	12441,1	10870,19	6171,8	8670,8	9496	16752,7	7208,7
Sum	131050,1	149949,7	125878,9	102905	127688,7	60073,6	50051,1	140119,1	165864,7	149023,4

The classification of agro-ecological conditions of the territory according to each of the indexes and by their complex, which is based on their comparison with optimal values, has been developed.

According to the range of the indexes values variability lands were divided into 4 classes. The best agro-ecological conditions of the territory are the 1st class, and the worst - the 4th one.

An analysis of the agro-ecological conditions state in the southern part of the Odesa region was carried out by individual administrative districts, which showed its differences by the various indexes (Table 3).

Table 3. Comprehensive agroecological assessment of southern districts of Odessa region

District	By relief elements	By soil cover quality	By microcli-matic conditions	By lands organization	Points of the territory ecological state
Arsyz	3	4	4	3	3,5
Bilhorod-Dnistrovskyi	3	4	3	3	3,25
Bolgrad	3	4	4	3	3,5
Izmail	2	4	3	3	3
Kilya	2	4	2	2	2,5
Ovidiopol	3	4	3	3	3,25
Reni	3	4	4	3	3,5
Sarata	3	4	4	3	3,5
Tarutino	4	3	4	3	3,5
Tatarbunari	2	4	3	3	3

It was found that the agro-ecological conditions of the studied territory cannot be attributed to the 1st class according to none of the indexes.

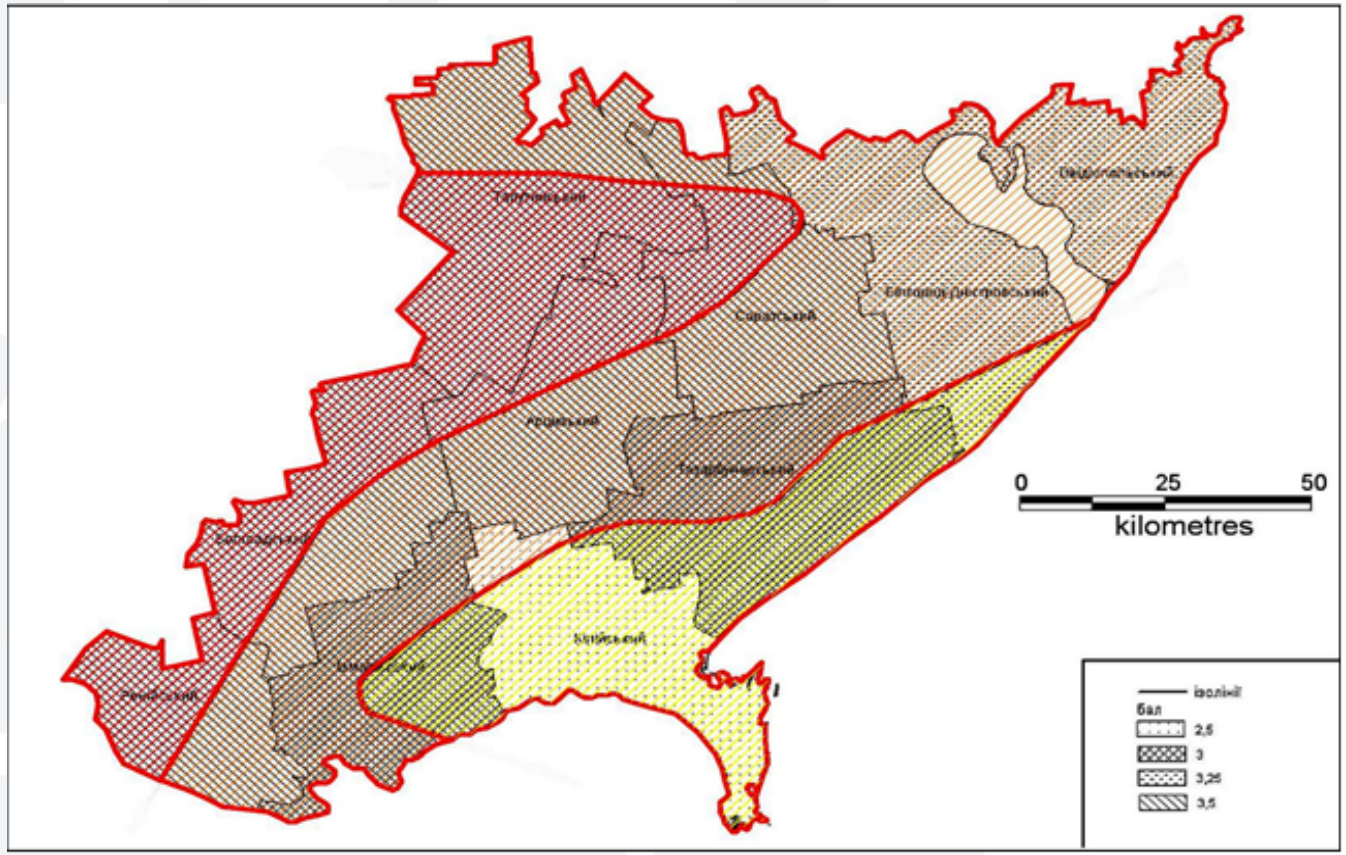
According to relief elements, good conditions are observed in the territory of Kiliya and Tatarbunari districts, and according to microclimatic conditions and land organization, good conditions have been identified only in Kiliya district.

All the districts, with the exception of Tarutino one are characterized by unsatisfactory agro-ecological conditions according to the soil cover quality.

By the relief elements, only the Tarutyno district has unsatisfactory conditions and according to microclimatic conditions, 5 of all districts has unsatisfactory conditions.

Lands differentiation according to the complex index of the agro-ecological state was carried out on the basis of large-scale mapping of the complex index of the agro-ecological state.

3 agro-ecological regions are distinguished: 1 – score of ecological condition is < 3.0, 2 – 3.0 – 3.5, 3 – >3.5.



The 1st agro-ecological district, where the best and good conditions are observed, includes 90% of the territory of the Kiliya district, about 50% of the Izmail district, Tatarbunari district, and 10% of the Bilhorod-Dnistrovsky district.

The central part of the studied territory belongs to the 2nd agro-ecological district with satisfactory conditions: about 50% of Reni, Izmail, Bolgrad, Artsyz, Sarata districts, 40% of Tarutyno, 90% of Bilhorod-Dnistrovsky and the territory of Ovidiopol district.

The 3rd agro-ecological district with unsatisfactory conditions includes half of the Reni, Bolgrad, Artsyz, Sarata and 60% of the Tarutyno districts.

CONCLUSIONS

Thus, it was established that the best agro-ecological conditions are observed only on a third of the area of Kiliya district. Unsatisfactory agro-ecological conditions are noted on the territory of 5 studied districts. The central part of the studied territory has satisfactory agro-ecological conditions.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