GEOGRAPHICAL DISTRIBUTION OF SOILS FROM BRAILA PLAIN (NORTHERN BARAGAN) THEIR USE AND MANAGEMENT PROBLEMS

DISTRIBUȚIA GEOGRAFICĂ A SOLURILOR DIN CÂMPIA BRĂILEI (BĂRĂGANUL NORDIC), PROBLEME DE MANAGEMENT ŞI FOLOSIREA LOR

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Abstract: *Natural soil bodies are the result of climate and living organisms acting on parent material with topography or local relief exerting a modifying influence and with time required for soil forming processes to act. One of the main characteristic of the soils is their ability to support growing of living plant out-of-door. Therefore, a good knowledge of soil resources is a prerequisite condition for any good management of agricultural lands. This paper refers to an important part of the Romanian Lower Danube Plain, known as the Braila Plain or Northern Baragan. Its main goal is that to emphasize the geographical distribution of soils according to different geomorphological subunits and pedogeoclimatic microzones. For describing the studied area the Geografic Information System of the Pedogeoclimatic Microzones (GIS-MZP) was used, each microzone being characterized according to specific climate, relief and dominant soil conditions. This operation involved overlapping of soil map with that of microzones one. The use of soil cover data improved the information comprised by former microzones. So, the material elaborated earlier has been revised and up dated with new pedological and climatic information. The main limiting factor for agricultural use of soils from Braila Plain results from the persistent climatic moisture deficit that affects the whole area. Locally, risks of soil salinisation as well as wind erosion also occur. The results of this research, unequivocally underline the necessity of adequate measures for a better soil management, as well as for an improved soil and environment protection.*

***Rezumat*:** *Solurile naturale sunt rezultatele activității climatului şi organismelor vii asupra materialului parental, a influenței topografiei şi reliefului local în procesele de pedoformare, şi în decursul timpului. Una din principalele caracteristici ale solului este abilitatea acestuia de a fi un suport de creştere a plantelor. Cunoaşterea resurselor de sol ajută la o mai bună gospodărire a terenurilor pretabile pentru agricultură ținând cont de factorii de risc, de nivelul apei freatice precum şi de potențialul de producție a solului. Principalul obiectiv al acestei lucrări este de a evidenția distribuția solurilor din Câmpia Brăilei pe subunități de relief şi microzone pedoclimatice. Pentru descrierea zonei studiate s-a folosit şi Sistemul Informatic Geografic al MicroZonelor Pedogeoclimatice SIG-MZP, fiecare microzonă a fost caracterizată în parte (definirea microzonei ținând cont de condițiile specifice de climă, relief şi sol dominant). În acest scop, a fost realizată suprapunerea stratului de soluri al Câmpiei Brăilei cu stratul de microzone. Materialele anterior elaborate au fost revizuite, completate şi aduse la zi cu informație pedologică, climatică şi informatică. Restricțiile principale în legătură cu valorificarea agricolă a solurilor din Câmpia Brăilei sunt determinate de deficitul de umiditate climatic care afectează întreaga suprafață, la care se adaugă în anumite areale sărăturarea solului şi pericolul de sărăturare sau cel de deflație. Rezultatele cercetării subliniază fără echivoc necesitatea luării de măsuri adecvate eficiente pentru protecția resurselor de sol şi implicit a mediului.*

Key words: *pedogeoclimatic microzones, Braila Plain, soil management*
Cuvinte cheie: *microzone pedogeoclimatice, Câmpia Brăilei, managementul solului*

INTRODUCTION

Natural soil bodies are the results of climate and living organisms acting on parent material with topography or local relief exerting a modifying influence and with time required for soil forming processes to act. One of the main characteristic of the soils is their ability to support growing of living plant out-of-door. Therefore, a good knowledge of soil resources is a prerequisite condition for any good management of agricultural lands.

This paper refers to an important part of the Romanian Lower Danube Plain, known as the Braila Plain or Northern Baragan. Its main goal is that to emphasize the geographical distribution of soils according to different geomorphological subunits and pedogeoclimatic microzones. For describing the studied area, the Geografic Information System of the Pedogeoclimatic Microzones (GIS-MZP) was used.

MATERIAL AND METHODS

The microzonation of Romanian territory was accomplished in two succesive issues (FLOREA et al., 1989, 1999). In both cases, the separation of microzones as distinct cartographic units has been done according to 3 characteristics: climate, relief, and soil. In the framework of an AGRAL project, between 2002 and 2004, the SIG-MZP was developed, resulting the digital microzonation database (DUMITRU et al, 2006).

In order to characterize the climatic conditions, 3 climatic zones have been used (BERBECEL et al., 1984), namely warm-dry climate, moderately warm - semihumid and cool - humid. In addition, 2 areas have been included: an area with cold - very humid climate, corresponding to the mountainous (nonagricultural) one and an area with very cold - very humid climate, corresponding to the alpine one. Climatic zones are characterized by annual mean temperature, solar radiation, annual precipitations, evapotranspiration deficit in the growing season and other indices.

For the relief characterization, 6 main categories have been established: river plain, plain, wavy, slightly slopy, moderately slopy and strongly slopy. Relief categories are characterized by slope, fragmentation density and relief energy. It has to highlight that these characteristics refer to the prevailing conditions in the respective microzones, the variations inside them not being taken into account, even though they are important. In the relatively often cases in which the same microzone/area is situated in more relief units, it is subdivided in different subareas.

Regarding soil conditions, the first approach found 27 taxonomic units, while the second one 28 taxonomic units, mainly soil types. Not all the soil types from the Romanian classification are found in the final map, some of them being not so widely spread. sometimes, taxonomic subdivision of the soil types are also given. The soils mentioned in the description of the microzone, as well as their characterization, are those prevailing in the respective microzones.

The surface covered by Braila Plain was cropped from the pedogeoclimatic microzones map using techniques specific to GIS, fromArcView 3.1. The information held by the SIG-MZP database has been analysed for the studied territory.

RESULTS AND DISCUSSIONS

Taking into account the functionality, the status and the stability of the soil cover in relation to the natural factors or conditions, Braila Plain was divided in 3 pedogeoclimatic microzones, differentiated by climate, relief, lithology and hydrogeology, as well as soil conditions; the entirety of these conditions obviously also characterize the ways to set up the layout of the territory and to improve soils, at the same time being units of pedoameliorative zonation. They are I-s-CZ(k,f); I-s-CZ(f); I-o-PS.

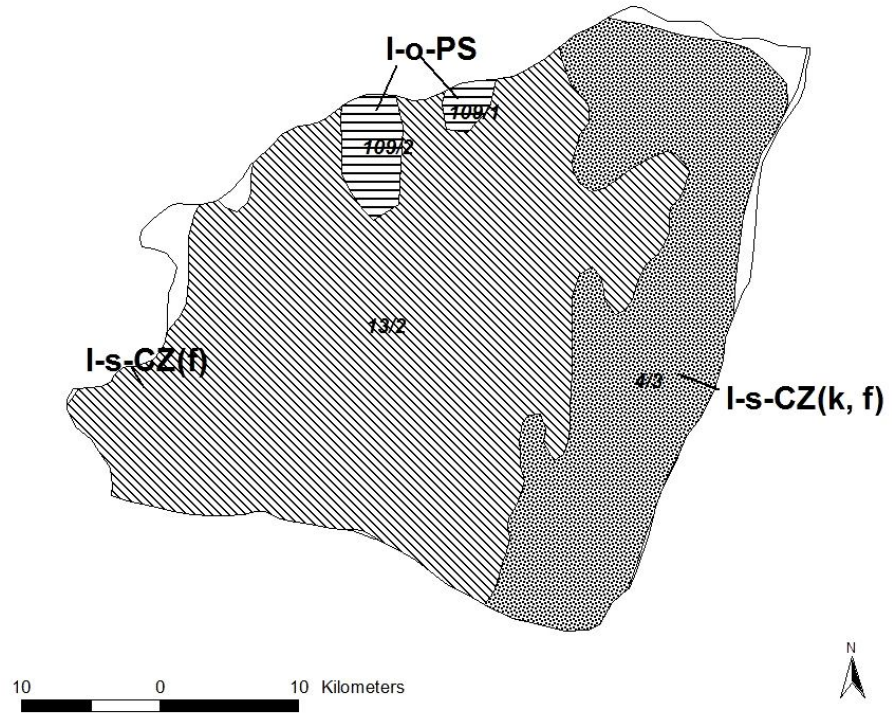

Figure 1. Braila Plain (northern Baragan) – microzone map

The differences between the 3 territorial units are actually determined only to a small extent by the climate (rather similar in the interfluve); the differentiating factors are the relief, the parent material and the hydrogeologic conditions.

The **I-s-CZ(k,f) microzone** localized in the East of the interfluve, with loess deposits and then sands to the base, is better drained, at least in the North and in the East, due to the neighbouring Buzau river plain and the Danube (which have a draining influence due to their subsidence compared to the interfluve). Thus, there is a less affected land by secondary salinization.

The **I-s-CZ(f) microzone**, localized in the center of the interfluve, with loess deposits followed by sands, is the least drained area in the whole Calmatui-Buzau influve and it has an endoreic area with lakes where the hydrogeological balance (equilibrium) is reached by the water level in lakes. It receives a flow of ground water from North and West, which slows down in this area. This is the microzone with the highest likelihood of moisture excess and secondary salinization occurrence.

The **I-o-PS microzone** localized in the Northeastern Braila Plain clearly differs from the other microzones by the wavy relief (dunes), the parent material: sands and the good drainage (except for the souther part of the microzone where groundwaters are at low depth or there is even the lake).

Table 1

Microzones distribution in Northern Baragan

Microzone cod	Microzone symbol	Microzone surface	The MZP surface belonging to Braila Plain	
		ha	ha	%
4/3	I-s-CZ(k,f)	44426.04	43380.78	97.65
13/2	I-s-CZ(f)	106631.52	90511.86	84.88
109/1	I-o-PS	1765.34	1040.60	58.95
109/2	I-o-PS	3405.36	3301.36	96.95

Regarding soil distribution, there can be seen a zonal differentiation on the East-West line. Vermic calcaric chernozems, characteristic of the Danube terrace in the east, change into typical vermic chernozems in the West and finally in cambic chernozems. Salsodisoils occur locally in low and poorly drained areas in the interfluve.

According to the information in the Romanian soils map 1:200.000 (Braila page), the Braila Plain (Northern Baragan), where loess deposits prevail, is covered by chernozems with middle texture on 87.8% of the land, out of which 25.6% are vermic, 18.2% calcaric vermic, 31.7% with ground waters and 11.3% calcaric vermic with ground waters, out of which salinic 4.2%. Cambic chernozems cover 5.1% of the land and mainly have coarse texture, occuring in dunes or valley areas where they have middle texture. Salsodisoils, which are soils with a very strong salinization and/or alkalization cover 5.0% of the land, and alluvial soils only 1.7%. The wide spread of both soils with ground waters, usually slightly salinized in the depth, and salty soils draws attention on the high risk of salinization in this plain (table 2).

The morphogenetic and analytical data referring to the soils in the Braila Plain Interfluve shows that the prevailing soils – chernozemic soils with middle texture – have a large soil volume (over 100%), are poorly loosened (hard setting degree -5 to -1%) but sometimes poorly to moderately hardset (hard setting degree 8-14%), have a good porosity, air porosity being middle to high (16-24%) and only locally very low (2-9%). The useful water capacity is usually moderate – high (100-210 mm/m) or low (70-150 mm/m), permeability is mainly moderate - high (1.1-22 mm/h), but it becomes high – very high (30-600 mm/h) in sandy soils or very low – excessively low (0.1-1,3 mm/h) in some alkali soils.

The humus content is between 3 and 4.6% in middle soils, but it decreases below 1 - 2% in sandy soils. The content in nitrogen is frequently 0.15 – 0.25%, but it goes below 0.08% in sandy soils. The C:N ratio varies between 10 and 14 showing a high mineralization degree of organic matter. The content in total phosphorus is of 0.10 – 0.20% and somewhat lower in sandy soils.

Most soils have calcium carbonate at the surface or close to the surface, that's why their reaction is alkaline (pH = 8 – 8,3); in the depth the reaction becomes moderately alkaline and even strongly alkaline in chernozems with ground waters.

Soils with washed off carbonates have a neutral reaction and solonets have a strong alkaline reaction.

The cationic exchange capacity (T) varies between 20 and 38 me/100 g soil, sandy soils having values below 10 me/100 g soil. The base saturation degree is mainly 100%, not going below 85 - 90%.

The territory of Braila Plain requires a setup of land or soil improvement for each microzone. It can be seen that the main problems are irrigation and drainage together with stopping the going up of ground water table and the improvement of the existing salty soils. The other measures to loosen clayey soils or to control deflation or to fixate sands are necessary on much smaller areas.

Table 2

Soil distribution in Northern Baragan in different pedoclimatic units (microzones) (% of units)

Soil		Texture	Northern Baragan Microzones*			Total
			I-s-CZ (k,f)*	I-s-CZ (f)	I-o-PS	
Chernozems (CZ)			98.2	86.0	-	87.8
Typical chernozems (Czti)		coarse to middle	-	1.4	-	1.0
Vermic chernozems (CZvm)		mijlocie	13.5	32.0	-	25.6
Typical chernozems (Czti) a		fine	-	-	-	-
Vermic/with ground waters chernozems (CZti/f)		middle	-	47.4	-	31.7
Vermic/ carbonatic chernozems (CZvm/k)		middle	58.2	0,4	-	18.2
Vermic/carbonatic/with ground waters chernozems (CZvm/k/f)		middle	7.7	-	-	7.1
Salinized chernozems (CZsc)		middle	18.8	4.8	-	4.2
Cambic chernozems(CC)			-	4.4	91.8	5.1
Typical cambic chernozems (CCti)		coarse	-	1.8	91.8	3.3
Typical cambic chernozems (CCti)		middle	2.6	-	1.8	4.4
Valley cambic chernozems (CC-d)		middle	+	+		+
Soloncheaks (SC)		middle	1.8	5.4	-	4.2
Solonets (SN)		middle to fine	-	1.1	4.1	0.8
Psamosoils (PS)		coarse	-	-	4.1	0.1
Alluvial soils (SAti)		middle to fine	-	2.6	-	1.7
Lakes			-	0.5	-	0.3
Total percentage			100.0	100.0	100.0	100.0
Unit surface	ha		46850	102100	3550	152500
	%		26.5	57.6	2.0	86.1

*) I – Warm-dry climate; S – plain relief (plain including terrace); O – wavy relief

Irrigation is necessary for the entire land in order to control soil water regime and to fight against drought. The water source, well used, offers at the same time the opportunity to apply intensive technologies to improve salty soils.

It is necessary to associate irrigation with a drainage network in the territory, providing the low natural drainage capacity of the whole interfluve (except for the northern part of Vizirului Field). The functionality of the existing drainage network needs to be examined in order to increase its efficiency to control soil salinization.

In order to prevent soil salinization, very likely in the hollow areas with ground waters at low depths, the network of drains plays an important role by absorbing and eliminating the water from the acviferous layer and thus preventing it going up. Any other measure taken to stop water loss from the adduction network or from the irrigated field is important too, by rationally using water according to soil hydrophysical indices and to the plant needs. The drainage network also needs to be kept in a good function by a periodical cleaning.

Well drained or sandy soils are mainly used for agriculture as arable land (there is a local occurence of vineyards, orchards) around inhabited areas and meadows cover the salty fields.

CONCLUSIONS

Braila Plain has been divided in 3 pedogeoclimatic microzones: I-s-CZ(k,f); I-s-CZ(f); I-o-PS, the differentiating factors being the relief, the parent material and the hydrogeological conditions.

For a sustainable land use and in order to obtain steady yields, the territory of the Braila Plain requires the setup of land or soil improvements for each microzone:

- in the I-s-CZ(k,f) microzone, with carbonatic chernozems and ground waters, it has to associate irrigation with a drainage network in the territory;
- in the I-s-CZ(f) microzone, chernozems with ground waters prevail, but their main problem is the occurrence of moisture excess and the risk of secondary salinization, drainage being necessary;
- in the I-o-PS microzone, which covers the least of the Braila Plain, measures need to be taken to control sand deflation and fixate sands.

Regarding soil distribution, there can be seen a zonal differentiation on the East-West line. Vermic calcaric chernozems, characteristic of the Danube terrace in the east, change into typical vermic chernozems in the West and finally in cambic chernozems. Salsodisoils occur locally in low and poorly drained areas in the interfluve.

Soils are mainly used for agriculture as arable land (there is a local occurence of vineyards, orchards and meadows on the salty fields).

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