The Role of Ecopedological Parameters in Management Sustainability of Banat Lands

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The issue addressed relates to an area of 1891694 ha of which 1183343 ha are agricultural land (62, 56) located in the south-west of Romania and refer to the use of soil chemical and physical properties as an acceptor for certain crop systems, with minimal undesirable effects both for plants to be grown, as well as soil characteristics and groundwater surface quality. It is therefore necessary on a case-by-case basis, measure stoc or rect the acidic reaction by periodic or alkaline calculations, the improvement of plant nutrition conditions through ameliorative fertilization and the application of measures to improve the physical state, sufficient justification for the need to develop short and long term strategies for the protection and conservation of edifying factors and the need to respect the frequency of field and laboratory investigations at all 8x8 km grids of the National Soil-Grounds Monitoring System (organized by I.C.P.A.) and completing it with the relevant pedological and agrochemical studies.

Keywords: resource, Banat, soil, agriculture

As a means of production, as an objectand in part as a product of human activity, the earth (the soil) respectively all conditions and environmental factors that manifest on the terrestrial surface, isdefined by a wide range of features and economic and social characteristics, which distinguish it from other means of production [1], its quality varying in time and space.

In F.A.O. terminology, *land quality* is defined as a complex of factors influencing land sustainability for the proposed purposes, the term *land* referring to: soils, landscape, climate, hydrology, vegetationand fauna, also including land improvements and other forms of management etc. [2,3].

The quality of the land (soil) in the sense of the pedology school in Romania, represents the totality of the basic features and characteristics (defined topographically, geologically, agrochemically etc.) through which a part of terrain differs from the others, being better or worse [1].

If in the first part of the 20th century the soil agro-chemical parameters were indissolubly linked to plant nutrition requirements, taking into account physical characteristics, the mechanisms and the processes involved in defining the soil fertility status and the generalization of some agricultural works that solve in most regards the chemical order aspects:fertilization, finishing herbicides etc[1,4,5],which today is unanimously acknowledged that it is no longer practiced or can not promote agricultural systems without knowing the local specificity, including the physical state of the soil [1,6-8].

Based on these considerations, the authors attempt to present in this paper, based on the data extracted from scientific research topics developed over several years, as well as on the basis of an impressive amount of data accumulated in the O.S.P.A. archive (Timisoara and Arad) mostly on classical support, but also on the SPED 1 computer system (used at O.S.P.A. Timisoara since 1988 and O.S.P.A. Arad in 2001) and the BDUST-B system implemented in the territory by I.C.P.A. Bucharest, several aspects regarding the quality of the soil and the evolution of th main factors, in order to promote the most appropriate measures for the production of the vegetal biomass.

Experimental part

Materials and methods

The issue addressed concerns as an area of 1891694 ha (table 1) out of which 1183343 ha are agricultural lands (62.56%), located in the south-west of Romania, which from the administrative point of view belong to the counties of: Timis (the largest county in Romania), Caras-Severin (the 3rd place in size between the counties of Romania, being the county where forestslie on almost half of its surface), partly Arad county (only south of the river Mures) and Mehedinti (several localities located west of Orsova and of course the city in mention Mehedinti), together constituting the largest part of The historic territory of Banat.

The research of the ecopedological conditions was done in accordance with the *Methodology of Pedological Education* (vol. I, II, III) elaborated by I.C.P.A. Bucharest in 1987, supplemented with specific elements of the Romanian Soil Taxonomy Systems (SRTS-2003/2012) and other normative act supdated by MAAP Order 223/2003, respectively Order MADR 278/2011, based on the pedological information accumulated in the O.S.P.A Timisoara and Arad archives (over 65 years), information-processed with the SPED1system in the period 1987-2016.

The analysis and other determinations were carried out in the physico-chemical analysis laboratory O.S.P.A-U.S.A.M.V.B.T, Faculty of Agriculture, USAMVB Timisoara, Calea Aradului, no. 119, accredited RENAR according to STAS SR EN ISO/CEI 17025, through the accreditation certificate no. LI 1001/2013.

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Table 1
THE SURFACE STRUCTURE FOR THE MAIN CATEGORIES OF LAND USE

Specification	*Arable*	*Pasture*	*Hayfield*	*Wineyard*	*Orchad*	*Agricultural*	*Forest*	*Other*	*Total*
Timiş	*528242*	*123552*	*28535*	*4695*	*8393*	*693417**	*109465*	*66783*	*869665*
%	**60.74**	**14.21**	**3.28**	**0.54**	**0.96**	**79.73**	**12.59**	**7.68**	**100**
Caraş-Severin	*126873*	*183341*	*74562*	*771*	*11452*	*396999**	*411276*	*43701*	*851976*
%	**14.89**	**21.52**	**8.75**	**0.09**	**1.35**	**46.60**	**48.27**	**5.13**	**100**
Arad	*64620*	*15500*	*4573*	*222*	*1605*	*86520*	*26168*	*6257*	*118945*
Mehedinţi	*1315*	*2577*	*2418*	*22*	*75*	*6407*	*25558*	*19143*	*51108*
Total ha	*721050*	*324970*	*110088*	*5710*	*21525*	*1183343*	*572467*	*135884*	*1891694*
%	**38.12**	**17.18**	**5.82**	**0.30**	**1.14**	**62.56**	**30.26**	**7.18**	**100**
%	*60,94*	*27,46*	*9,30*	*0,48*	*1,82*	*100*			

** Order MADR 278/2011, Anex 1*

Results and discussions

Due to its geographical position the territory of Banat is situated between 44°27' - 46°48' Nordic latitude and 20°15' - 22°52' Eastern longitude and presents a great diversity of ecopedological conditions, determined by the great variability of all factors (cosmic-atmospheric and technical-edificial) which strive to achieve the environment in which plants grow and harvest.

The landscape of Banat, as a whole, is characterized by a great complexity of morphological forms, from the meadows and the old deltas (with altitudes of about 70-80m), the piedmont plains, and piedmont, high hills, depressions under and above the mountain, as well as mountains with altitudes up to 2291m (Mt. Godeanu with Gugu peak), with geological structures and specific pedogeographical evolutions related to time and space genesis of the south-west part of the country.

From a geological point of view, the landscape of the researched perimeter rests on a rough foundation, made up of Paleozoic and Mesozoic crystalline rocks submerged in tortonian, more accentuated in the central parts and less in the peripheral, fragmented in different directions, after a system of faults that almost is intersected perpendicularly.

These fragmentations have created areas of minimal resistance and the balancing of blocks thus falsified, amplified by a series of tectonic events, have led to advantages or withdrawals of the marine domain (Thetys) or lacunar (Panonic).

The withdrawal of Panonic Lake left behind a vast, impenetrable and insubstantial area [9], which lasted until the end of the 18th century, during which they persisted [10], 877600 ha of swamps, fed regularly from the rivers that crossed the area: Mures, Bega, Timis, Barzava, Caras and their affluents.

The river network, which bases its basins south of Mures, belongs to the Danube basin, being the direct affluents of Tisa (Aranca, Bega) or the Danube (Timis, Cerna) and gathers its waters exclusively from the province's territory, by the mountainous and sub montane region by the fact that here they have the origin and here the particularities of the liquid leakage processes are defined.

The geographic position, the disposition of the landscape and the general inclination from the east to west determine that the space investigated is open to the influences of the air masses coming from the southwest, west and northwest, which imprint the major features of the climate.

Referring to the vegetation of the western region (from the Banat-Crisana area) [11], noted that it was strongly influenced by the long-standing anthropological activity, archeologically reported, from the pre-Roman era which led to the fragmentation of potential vegetation and replacement on large spaces with secondary vegetation represented by extensive grassland or technical plants and grasslands, exploited as hays or pastures.

A distinct part of Romania's territory, from a geomorphologic point of view and the soil cover, significantly modified by the aggressive agro-hydrobiological measures of the last 300 years, the researched area makes the transition between Eastern Europe, the eutrophic cambisols characteristic of Central Europe and the cromicluviosolsrodic from the south-west of the continent.

According to the Romanian Soil Taxonomy System (SRTS-2012), 23 types (table 2) and Soil Associations (fig. 1) were identified, comprising 11 of the 12 soil classes (Protisols, Chernisols, Umbrisols, Cambisols, Luvisols, Spodisols, Vertisols, Hydrisols, Salsodisols, Histisols, and Antrisols).

Under the influence of complex cosmic-atmospheric factors (light, heat, precipitation, etc.) and teluricedafic (relief, lithology, hydrology, physical, hydrophysical, chemical and biological properties of soil) modified differently in time and space Human intervention and found in the productive capacity of the land, each of the 414 soil and ground units (TEO) representing a series of subtypes and varieties within the 23 soil types identified within the investigated space were characterized according to the current Methodology Development of pedological studies using a series of scoring indicators: indicator: 3C - annual average temperature - corrected values indicator; 4C - annual average precipitation - corrected values; Indicator 14-glueing, indicator 15-pseudogleization (stagno-glization); Indicator 16 or 17 - Saliva or Alcalation (Sodizing); Indicator 23A - A-texture or the first 20 cm; Indicator 29 - pollution; Indicator 33 - slope; Indicator 38 - slides; Indicator 39 - depth of groundwater; Indicator 40 - flood; Indicator 44 - total porosity in the restrictive horizon; Indicator 61 - total $CaCO_3$ content of 0-50 cm; Indicator 69 - degree of saturation in Bases or 0-20 cm; Indicator 133 - the useful editorial volume; Indicator 144 - humus reserve in the 0-50 cm layer; Indicator 181 - excess of stagnant (surface) humidity; Indicator 271 - Improvements for Land Improvement called rating indicators.

Table 2
THE MAIN TYPES OF SOILS IN BANAT (RO)

Nr. crt	Tip/subtip SRTS-2012	Type/sub- type WRB-1998	Arable	Pasture	Hayfield	Wineigard	Orchard	Agricultural	Forest
			Ha/ %	Ha/ %	Ha/ %	Ha/ %	Ha/ %	Ha/ %	Ha/ %
1	Litosol	Leptosol	72	20668	11636	-	32	32408	1947
			0.01	6.36	10.57	-	0.15	2.74	0.34
2	Regosol	Regosol	-	44358	6121	82	1974	52535	4465
			-	13.65	5.56	1.44	9.17	4.44	0.78
3	Psamosol	Arenosol	1154	195	11	9	6	1375	687
			0.16	0.06	0.01	0.15	0.03	0.12	0.12
4	Aluviosol	Fluvisol	68500	20766	11537	67	321	101191	11220
			9.50	6.39	10.48	1.17	1.49	8.55	1.96
5	Cernoziom	Chernozem	155026	6629	1343	517	635	164150	744
			21.50	2.04	1.22	9.05	2.95	13.87	0.13
6	Faeoziom	Phaeozem	38216	650	1365	199	745	41175	573
			5.30	0.20	1.24	3.50	3.46	3.48	0.10
7	Rendzină	RendzicLeptosol	-	1820	892		258	2970	7671
			-	0.56	0.81	-	1.20	0.25	1.34
8	Nigrosol	HumicUmbrisols	-	2600				2600	973
			-	0.80	-	-	-	0.22	0.17
9	Humosiosol	Cambic Umbrisols	-	2405				2405	1030
			-	0.74	-	-	-	0.20	0.18
10	Eutricambosol	EutricCambisol	73979	39257	17460	211	1427	132334	197043
			10.26	12.08	15.86	3.69	6,63	11.18	34.42
11	Districambosol	Dystric Cambisol	54800	67853	23240		413	146306	49461
			7.60	20.88	21.11	-	1.92	12.36	8,64
12	Preluvosol	HalpicLuvisols	130654	12284	2477	1786	4566	151767	90908
			18.12	3.78	2.25	31.28	21.21	12.82	15.88
13	Luvosol	Albic Luvisols	110321	31847	9886	154	4766	156974	163668
			15.30	9.80	8.98	2.70	22.14	13.27	28.59
14	Planosol	Planosols	3605	1202	231	20	187	5245	-
			0.50	0.37	0.21	0.35	0.87	0.44	-
15	Prepodzol	Cambic Podzols	793	1754	-	-	-	2547	859
			0.11	0.54	-	-	-	0.22	0.15
16	Podzol	HalpicPodzols	2163	2210	-	-	-	4373	5667
			0.30	0.68	-	-	-	0.37	0.99
17	Vertisol	Vertisols	58117	32498	3765	23	480	94883	9675
			8.06	10.00	3.42	0.40	2.23	8.02	1.69
18	Gleiosol	Gleysols	8076	16703	15985	-	-	40764	4294
			1.12	5.14	14.52	-	-	3.45	0.75
19	Stagnosol	Stagnosols	3533	3249	2697			9479	10190
			0.49	1.00	2.45	-	-	0.80	1.78
20	Soloneț	Solonetz	7355	12772	936			21063	-
			1,02	3.93	0.85	-	-	1.78	-
21	Histosol	Histosols	-	390		-	-	390	-
			-	0.12	-	-	-	0.03	-
22	Antrosol	Anthrosols	3677	1690	121	2625	5588	13701	-
			0.51	0.52	0.11	45.97	25.96	1.16	-
23	Tehnosol	Technosols	1009	1170	385	17	127	2708	11392
			0.14	0.36	0.35	0.30	0.59	0.23	1.99
Total			721050	324970	110088	5710	21525	1183343	*572467*
			100.00	100.00	100.00	100.00	100.00	100.00	

Each indicator above, with the exception of indirect indicator 69, participates in determining the rating by a coefficient representing values between 1 (one) and 0 (zero) depending on the intensity of the limiting factor (1 = very favorable, 0 = unfavorable), for each there are tables containing the respective coefficients (both for natural conditions and for potentiated conditions (according to annexes 3-2 to 3-29, MESP, 1987).

Depending on the values of these indicators and the specific behavior, for each of the main categories of use (AR-Arable, PS-pasture, FN-meadow, Wineyard-VN, Orchard -LV) were ranked in *quality classes*, from I to V (Order MADR 278/2011), grouping the grades from 20 to 20 points as follows (table 3).

The correct knowledge and expression of the land production capacity and its limiting factors thus involves a laborious process of thinking, forming working hypotheses and modeling in all aspects, logically, mathematically, heuristically, etc., as well as validating Processes in experimental fields and reference parcels, multiple verifications (chemical, physical, economic, etc.) to find the most appropriate means of expressing notions in their entire complexity, the natural result of co-habitation between biocenosis and biotope.

In view of the above, it should be noted that, without the presence of plants, soil fertility elements can not be used, just as without the optimum existence of cosmic-atmospheric supply (heat, light, precipitation), they can not be materialized in the production Of plant biomass, the capacity to form crops, therefore, is not an exclusive and independent attribute of the soil, but a function of the

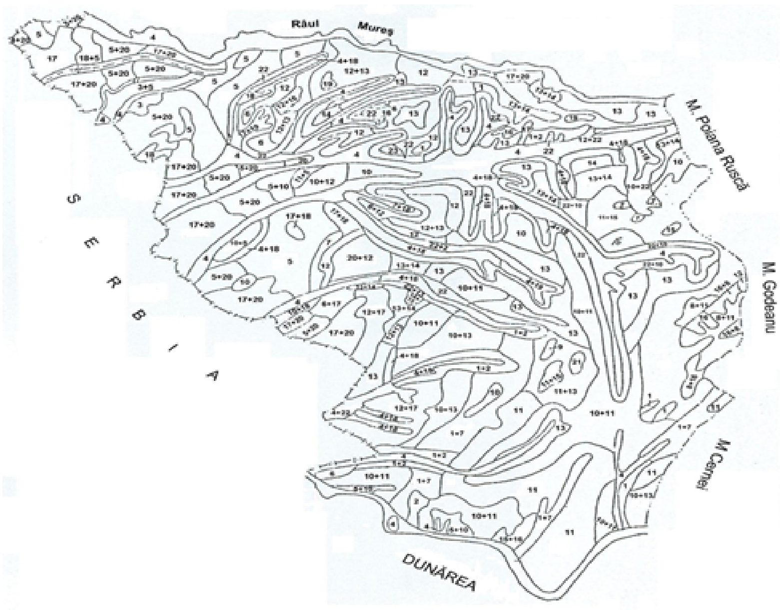

Fig. 1. The main types and associations of soil in Banat (adaptation after Tarau1998)

Table3

THE DISTRIBUTION OF AGRICULTURAL LAND BY QUALITY CLASSES FOR THE MAIN CATEGORIES OF USE

Use	Class										Agricultural (ha)	Ponderate medium mark	
	I 81-100		II 61-80		III 41-60		IV 21-40		V 1-20				
	(ha)	%	(ha)	%	(ha)	%	(ha)	%	(ha)	%		*	**
Arable	217617	18.39	169336	14.31	273234	23.09	276902	23.40	246254	20.81	1183343	51	63
Pasture	363996	30.76	297966	25.18	352755	29.81	105081	8.88	63545	5.37	1183343	68	49
Hayfield	71356	6.03	363523	30.72	416063	35.16	231344	19.55	101057	8.54	1183343	59	55
Wineyard	171821	14.52	132889	11.23	139989	11.83	307907153006	26.02	430737	36.40	1183343	43	50
Orchard	153006	12.93	192057	16.23	197618	16.70	297256	25.12	343406	29.02	1183343	47	44

** Agricultural area of 1183343 ha; ** The current area of use includes: 721050 ha (arable), 324970 ha (pasture), 110088 ha (hay meadows), 5710 ha (vii) and 21525 ha (orchards).*

ecosystem, and thus the unitary soil-plant-animal-herbivore, decaying carnivore system.

Besides, the operation of classifying agricultural lands in quality classes based on the assessment marks highlighted a series of limiting factors that influence the production capacity of agricultural land within the researched space, among which we mention: the granulometric composition (soil texture), Humus reserve, soil reaction, degree of compaction or compaction, excess humidity, which results in a series of requirements and improvement measures and / or mandatory uses as well as requirements and measures to prevent degradation and preserve soil fertility - the land.

On the basis of these restrictive elements affecting the production potential of the soil cover, it is necessary, on a case-by-case basis, measures to correct the acid reaction, by periodic calcification, the improvement of plant nutrition conditions, by ameliorative fertilization (the dose of the amendment, And the amount of fertilizer to be determined on the basis of agrochemical cartridges in relation to the use of the land and the cultivated crop), the elimination of excess moisture by prevention works and its control (leveling of the land, gullies, ditches, canals, drains, etc.) combatting soil erosion (current cultural works, crops in strips, earth waves, furrows, coastal canals, anti-erosion curtains), etc.

These works are required to be carried out in one concept, following the idea of ensuring certain conditions of excess water leakage from the plant to the channel along the entire route, if necessary complemented by trench grooves.

With regard to amelioration fertilization, particular attention must be paid to the use of semi-liquid and liquid slurry on poorly drained, frozen land on land near water courses or by the application of excessive quantities and the wrong choice of the time of administration as agricultural practices to be avoided.

Particular attention should be paid to nitrogen fertilization due to the complexity of the behavior of this nutrient in the soil and the ease with which it can be lost in the form of nitrates by entrainment within filtration waters and surface leakage.

The amount of organic and mineral fertilizer applied per unit area shall not exceed 170 - 210 kgN / ha / year for holdings in areas vulnerable to nitrate pollution and shall not exceed these quantities.

Also considering that a large part of the soils of the researched perimeter are affected successively within the same period of over-vegetation and moisture deficiency both factors with limiting effects on the agricultural production special attention should be paid to the measures for improving the physical condition of the soils degraded, both natural and artificial, specific technologies aimed both at increasing aeration porosity and permeability for water, both by deep-lying work (underlaying, scouring, scarification), especially by applying agrotechnical measures comprising: Long-lasting crops with protective and improving plants (mixtures of leguminous and perennial grasses), alternation of deep soil work (with scormonitor), without the turning of the furrow, for annual crops with a superficial work (usually made with disc, etc.), for grain cereals, or by a restructuring, as the case may be, of agricultural and forestry areas.

Conclusions

If the 20th century constituted a period in which soil science focused on obtaining information on natural soil formation factors and their influence on the genesis, properties and geographical diversity of edaphic media, essential information for maintaining soil functions and improving fertility, the problem The main stream of the current century is the sustainability of agricultural production at the level required by the explosive growth of the planet's population through a set of sustainable ameliorative or cultural measures.

In this context, the use of land in a certain way requires the determination of the soil and other soil, relief, climate, hydrological factors determining the agricultural or forestry capacity and the vocation of the land to be used for other activities with precision. Can be achieved only by conducting ground-based soil studies and laboratory analyzes to establish homogeneous soil maps or homogeneous ecological territories (TEO), characterized by bonuses for all uses and most cultures, the establishment of bonuses and Technological features for each homogeneous piece of land, from 1000 to 2000 sqm, to plots, land plots, administrative territories, counties and country according to a unitary methodology.

In thisregard, themethodology for the development of pedological studies, ICPA (1987), integrates organically, unitarily, the mapping of soils and other environmental conditions with multiple applicative aspects of interpretation of the soil map for differentpurposes, in various fields, not only of agriculture, forestry or land improvement, but also of natural sciences, of engineering geology or of the environment and of the protection of natural resources, trying to solve, in order to connect to the European system, in full harmony and consistency, the following connotations specific to the earth: Ecological, economic, social, technical and legal.

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