

# STATUS OF SOIL QUALITY IN SOUTH-WEST OF ROMANIA AND ITS ROLE IN SUSTAINABLE DEVELOPMENT OF THE RURAL SPACE

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## Summary

*Being aware of lands ecological resources' natural conditions and particularities for different uses and crops is of great importance for the big and small producers.*

*In this paper we present the main aspects regarding the quality of the ecopedological conditions. Here there are briefly presented the physico-geographic conditions and the telluric-edaphic configuration of the area. Also, the structure of the main categories of agricultural activities in the physical geographical areas (mountains, hills and plateaus, high and low plains and meadows) and main soils' types and associations are presented. Lands vocation for different use (arable, lawns, hay, orchard, vineyard*

*The paper ends with highlighting the necessary measures for a lasting administration of ecopedological resources in the studied area.*

## INTRODUCTION

Along with the systematic, modernization and development of buildings, communication routes and utilities (water, heat, electricity, sewage, gas, telephone networks, etc.), the study of rural resources for establishing priorities for its rehabilitation, through conversion and reconstruction.

In this process, natural resources and man-induced, land fund, the fund agro-forestry and their quality will determine areas of rural development: agriculture, industry, services, tourism, etc..

Quality of land (soil) in the sense of Soil school in Romania, are all essential traits and features (defined in terms of topographical, geological, geomorphological, pedological, agrochemical), whereby a certain portion of land from the Earth surface differs from the others, being better or worse (D. Teaci, 1980).

In line with the above, the sustainable management of natural and anthropogenically induced resources is a modern form of land management with the purpose of maintaining and enhancing soil fertility and long term to allow obtaining high-quality food production ( Borza et al. 2001, Coste et al. 1997, Dumitru et al. 2000, Țărău et al. 2002, 2005)

Being a well-defined condition with a high variability in space but relatively stable over time, pedological factors, through there major components are essential in characterizing of certain areas from land surface.

The problem of soil quality, with all its connotations, has been the topic of a symposium in a major international meeting (Congress of Soil Science, Montpellier)

Separate part of the Romanian territory, in terms of geomorphological and soil cover, the territory has suffered considered significant interventions over time to present and future developments, representing an area of major interest for modern pedological research, only able to substantiate the most appropriate scientific and technical practical measures plant biomass production in a dynamic and optimized rigorously correlated with environmental requirements.

To this noble purpose it serve the analysis of soil, water, plants, fertilizers, amendments, executed by OSPA (Timisoara, Arad, Bihor) and those included in the national and county monitoring organized by the ICPA Bucharest since 1975 and harmoniously integrated in other European systems since 1992.

Based on these considerations, the authors try to present based on data extracted from soil and agrochemical studies in archives of those institutions and those under research contracts with topics that are relevant risk factors in the pate of the country, coordinated SC-DA Oradea and ICPA Bucharest, some aspects regarding the status of soil quality as reflected through the prism of agro-physical important indicators for soil fertility.

## MATERIAL AND METHOD

Distinct part of Romania from the point of view of geomorphology and soil cover, the studied area which suffered very important pedo-hydro-ameliorative interventions during three centuries, represents great interest for the modern pedological research activity.

The researched area is made of 1.891.594 ha from which 194.751 ha from south-west Romania (the part of the historical region Banat) are agricultural lands from Timiș, Caraș Severin, Arad and Mehedinți counties.

The characterization of the specific ecopedological conditions of the studied area, the definition of the soil units and the analysis of limiting and restrictive factors for soil's productive capacity were conducted according to the "Methodology of Pedological Studies Elaboration" (vol.I, II, III), elaborated by ICPA Bucharest (Florea et al) in 1987 and improved with elements from the Romanian Soil Taxonomy System (SRTS-2003—Munteanu et al).

## RESULTS AND DISCUSSIONS

Through its geographic position, the studied area which is placed in the north hemisphere between  $44^{\circ}27' - 46^{\circ}48'$  north latitude and  $20^{\circ}15' - 22^{\circ}52'$  east longitude, shows a great diversity of ecopedological conditions determined by the great variability of natural factors (cosmic – atmospheric, and telluric – edaphic) that play an important role in constructing the environment where plants are growing and give crops.

Generally, the Banat relief is characterized by a great complexity of morphological forms from meadows and old delta (with altitudes around 70-80 m) to semi-drained plains (80-100m), piedmont plains and piedmonts (100-300 m), plateaus and high hills, depressions and mountains with altitudes around 2.291 m ( Gugu top from Godeanu mountain).

On this altitudinal sequence with a difference of 2.200 m from the smallest to the highest area for this region, the Banat relief looks like a great amphitheatre opened to north-west; suffering endless changes under the impact of natural factors but also under human activities impact, its' changes being more profound than those from other regions.

The geomorphological evolution of the considered space is related to the evolution of the marine area (Thetys) or lake (Pannonian) which generated the formation of soils, which during a agricultural year shows two extreme situations, namely: excessive humidity in winter and lack of moisture during the warm season, both situations resulting in a number of stress forms with negative effects on agro-ecosystem productivity and quality.

The ecopedological complexity of this territory was also determined by the geology and lithology of the surface materials, which through their various geochemical forms of soil (eruptive and crystalline rocks from the mountains area, loams, clays and sandstones from piedmonts, loess forms from plain areas, fluvial- lacustric deposits from meadows and old delta) represent essential elements for plants environment.

The hydrographic network represented by rivers, lakes, etc., which are organizing their basin in the south of Mures, belong to the Danube basin and they are the direct affluent of Tisa (Aranca, Bega) and Danube (Timis, Cerna). They collect their waters from the studied area being connected to the mountain and sub-mountain area because the rivers start from here and also because here the particularities of the specific processes for liquid flows are defined.

The macroclimatic conditions of Timis county determined by its geographical position in the European continent, movement determined by centers of termical action (Azores and the subtropical anticyclone), or seasonal thermal action centers (Siberian, Asian, or the Mediterranean anticyclone), print out this area a temperate continental climate with subtropical influences more or less pronounced in certain geographic areas.

This diversity determines the major characteristics of clime and also the local nuances, the area gaining the particularities of an area with continental and sub-Mediterranean oceanic influences (figure 1).

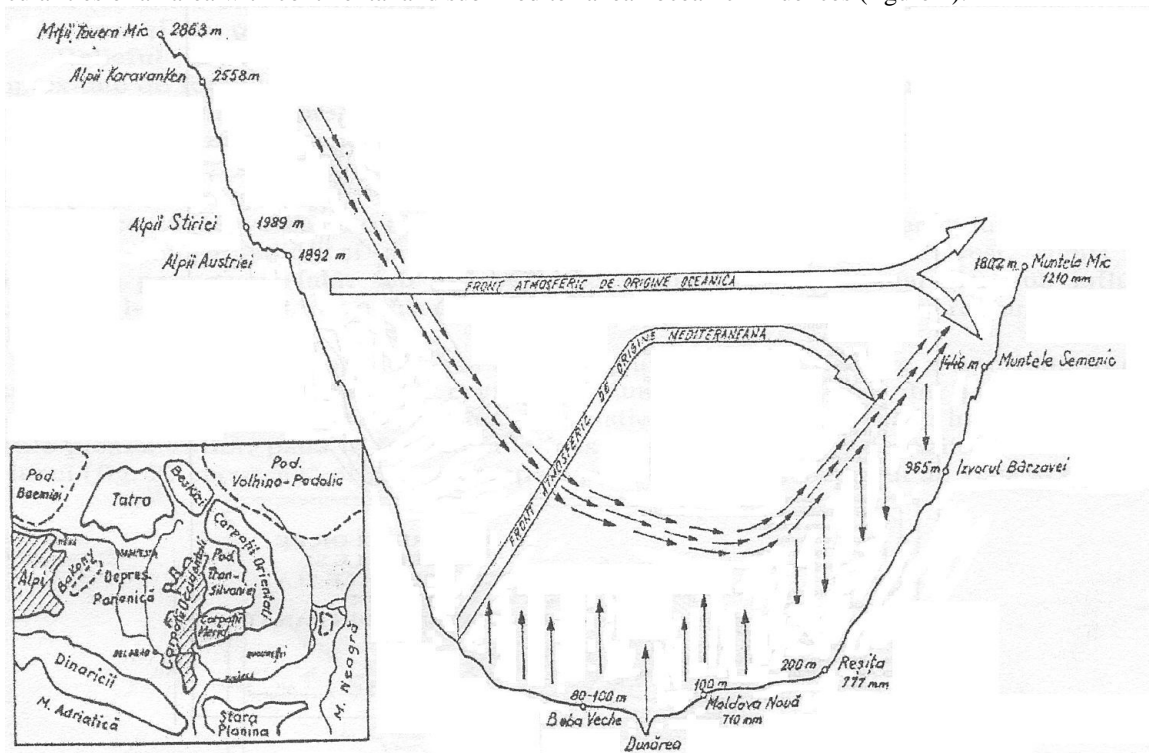


Figure 1. Geo-climatic factors contribution to the genesis of main particularities of climate from Banat

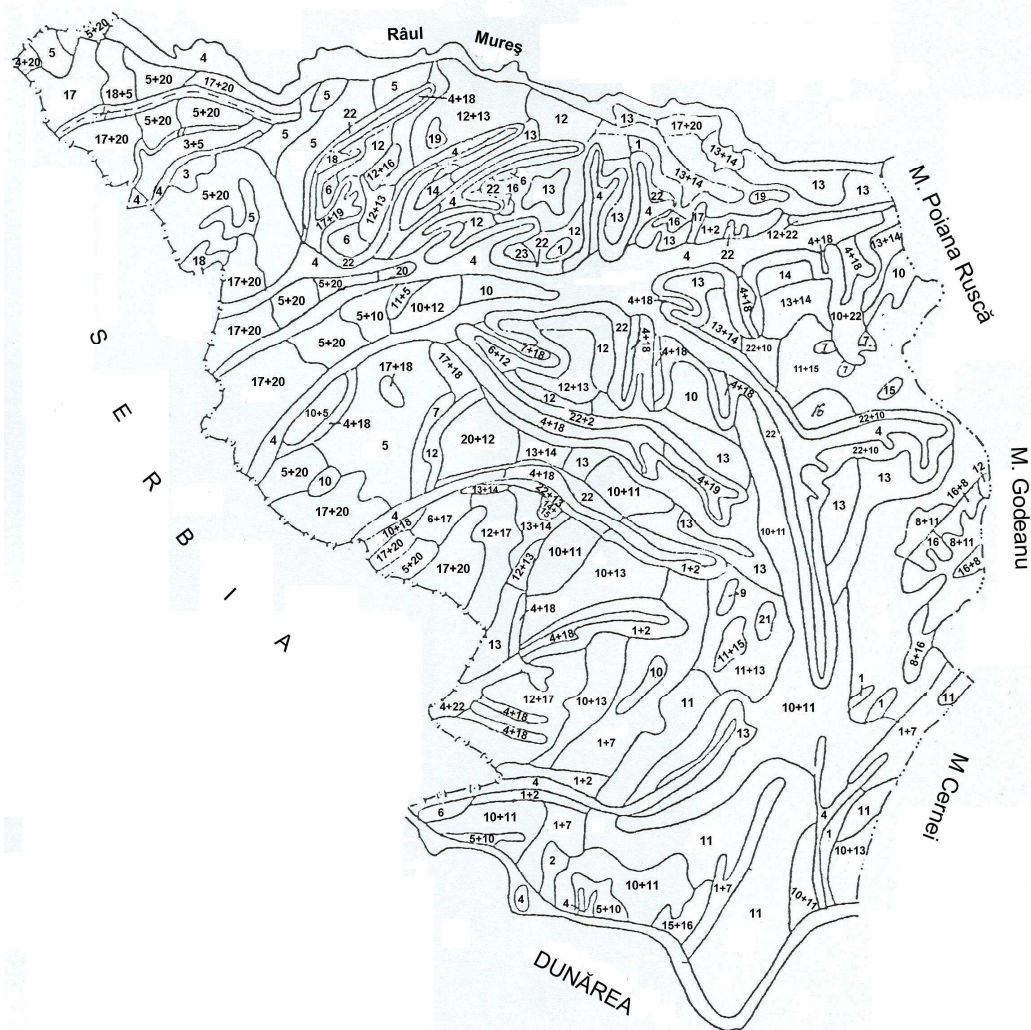


Figure 2. Map Soils Of Banat County

The large spectrum of relief forms and the interconnection of altitude factors with the morphogenetic and orographic ones have generated a great diversity of microclimatic and pedoclimatic conditions that brought to the development of people settlement on this area. The people's main occupation down here was land cultivation and animal breed. The agrarian structure of this area is the result of the area land sources (table 1).

Table 1.

**Lands structure for main land use categories**

Counties	Arable	Pasture	Hay	Vinyard	Orchard	Agricultural	Forests	Other uses	Total
Timis	530.215,00	129.231,00	29.313,00	4.313,00	9.326,00	702.398,00	109.017,00	58.25	869.665,00
Caras Severin	127.445,00	182.836,00	75.990,00	1.157,00	12.192,00	399.620,00	409.864,00	42.492,00	851.976,00
Arad	64.270,00	15.600,00	4.573,00	232,00	1.805,00	86.480,00	31.015,00	1.000,00	118.495,00
Mehedinti	1.211,00	2.277,00	2.218,00	22,00	75,00	5.803,00	43.500,00	1.705,00	51.008,00
Total-ha	723.141,00	329.944,00	112.094,00	5.724,00	23.398,00	1.194.301,00	593.396,00	45.197,00	1.832.894,00
%	39,45	18,00	6,12	0,31	1,28	65,16	32,37	2,47	100,00
%	60,55	27,63	9,39	0,48	1,96	100,00	-	-	-

According to the Romanian Soils Taxonomy System (SRTS-2003) in the researched area there are 11 soil classes with 23 soil types divided in 107 sub-types and 300 soil units, and numerous detailed units. These units are different among each other regarding their proprieties, productive capacity and the necessary measures from maintaining and increasing their fertility as defining elements for a lasting development (table 2).

**Table 2**

**Agricultural lands grouping for main relief forms**

Relief	ha % %	Arable	Pasture	Hay	Vineyard	Orchard	Agricultural land - ha, %, %
Low plains and meadows	ha	356.803,00	54.935,00	11.198,00	1.247,00	3.327,00	427.510,00
	%	49,31	16,65	9,99	21,78	14,22	35,78
	%	83,46	12,85	2,62	0,29	0,78	100,00
High plains and terraces	ha	202.316,00	37.845,00	10.514,00	1.356,00	3.667,00	255.698,00
	%	27,96	11,47	9,38	23,69	15,67	21,40
	%	79,12	14,80	4,11	0,53	1,44	100,00
Hills and terraces	ha	126.556,00	111.389,00	34.727,00	3.060,00	13.152,00	288.884,00
	%	17,49	33,76	30,98	53,47	56,21	24,18
	%	43,81	38,56	12,02	1,06	4,55	100,00
Mountains and depressions	ha	37.916,00	125.775,00	55.655,00	61,00	3.252,00	222.659,00
	%	5,24	38,12	49,65	1,06	13,90	18,64
	%	17,03	56,49	24,99	0,03	1,46	100,00
Total	ha	723.591,00	329.944,00	112.094,00	5.724,00	23.398,00	1.194.751,00
	%	100,00	100,00	100,00	100,00	100,00	100,00
	%	60,56	27,62	9,38	0,48	1,96	100,00

The great structural and socio-economical diversity induced in general by relief and ecopedological resources' particularities, gives to the Banat area a particular character which can be showed also by grouping the lands use categories in the main relief forms (table 3).

From this groups we can observe a high percentage of arable lands around 60,56% from the agricultural lands, representing 38,25% from the studied area (table1). The total arable surface of 723.591 ha finds itself in the low plains and meadows in a percentage of 49,31 %, in the high plains in percentage of 27,96%, on hills 17,49% and 5,24% on intra-mountains depressions (table 2). In the low plains and meadows the arable lands represents 83.46% from the agricultural land (table 2).

This intensity of land using situated at the maximum parameters of low plains land resources, 83,46% from the total surface, used for cereal and technical crops, is due in great part to human intervention. The human activity in this area started in 1728 with the first workings of swamps drainage and those of regularizing the rivers' bed: Bega, Timis, Barzava, Caras, etc. that continued with pedo-hydro-ameliorative tillings until nowadays.

The great diversity of natural conditions from the studied area creates at its turn a great variability of lands productive capacity for different cultivated species and for those that grow here naturally (hays, pastures).

From the data, we can see that diversity of climatic conditions and specific characteristics of the space considered had a strong influence on the structure of the land and how land use in general and particularly agricultural land (default on their current and future productivity).

In this regard, one very important issues that have concerned, and will work concerns many scientists (biologists, pedologist, agronomists, chemists, geneticists, geography, etc.) is the development and application in production of technologies capable of providing the highest returns in terms of consumption as low (energy).

Determining lands productive capacity and establishing the technologies of lands protection, conservation and amelioration requires a very detailed knowledge of ecological offer. By ecological offer we understand all energetic factors necessary for the genesis, developing and maintaining of the abiotic and biotic systems, by realizing a harmonious balance for soil and plants amelioration and protection.

In this direction, from the studied area, 300 land units (table 3, figure 2.) were identified and characterized according to the Pedological Studies Methodology Elaboration (vol. I, II, III), using 23 rating indicators that have important proprieties, are more significant, precise and easy to measure.

Din datele prezentate, se poate observa că diversitatea condițiilor pedoclimatice și însușirile specifice ale spațiului considerat au avut o influență puternică asupra structurii fondului funciar și a modului de folosință a terenurilor în general și a terenurilor agricole în special (implicit asupra productivității actuale și viitoare a acestora).

Based on the classical methodology concept in Romania (D. Teaci, 1966, 1970, 1978, 1980, partially determined also by ICPA Bucharest, 1987, I. Pușcă and D. Țărău, 1998, D. Țărău et al. 2005) and using an

conventional computer program SPD1 (D. Treta, D. Țărău, 1987) were determined the rating marks both for land use categories and for main agricultural cultivated species.

**Table 3**

**Main soil types and associations from Banat**

Nr. crt	Type/sub-type WRB-1998	Agricultural	Arable	Pastures	Hays	Vinyard	Orchard
		%	%	%	%	%	%
1	Leptosol	2,76	0,01	6,36	10,57	-	0,15
2	Regosol	4,50	0,02	13,65	5,56	3,44	9,17
3	Arenosol	0,10	0,14	0,06	0,01	0,15	0,03
4	Fluvisol	7,93	8,50	6,39	10,48	1,17	1,49
5	Chernozem	12,64	19,50	2,04	1,22	19,05	2,95
6	Phaeozem	3,46	5,30	0,20	1,24	1,50	3,46
7	Rendzic Leptosol	0,26	-	0,56	0,81	-	1,20
8	Humic Cambisol	0,22	-	0,80	-	-	-
9	Dystric Cambisol	0,20	-	0,74	-	-	-
10	Eutric Cambisol	10,91	10,26	11,08	15,86	3,69	6,63
11	Dystric Cambisol	12,66	7,60	21,88	21,11	-	1,92
12	Halpic Luvisol	12,70	18,12	3,78	2,25	11,28	21,21
13	Luvisol	13,70	15,30	9,80	8,98	12,70	42,14
14	Planosol	0,44	0,50	0,37	0,21	0,35	0,87
15	Cambic Podzol	0,22	0,11	0,54	-	-	-
16	Halpic Podzol	0,37	0,30	0,68	-	-	-
17	Vertisol	8,01	8,06	10,00	3,42	0,40	2,23
18	Gleysol	5,28	4,12	5,14	14,52	-	-
19	Stagnic Luvisol	0,80	0,49	1,00	2,45	-	-
20	Solonetz	1,78	1,02	3,93	0,85	-	-
21	Histosol	0,03	-	0,12	-	-	-
22	Erodosol	0,60	0,51	0,52	0,11	11,64	3,96
23	Anthrosol and Entiatroposol	0,43	0,14	0,36	0,35	34,63	2,59
<b>Total</b>		<b>100,00</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>

Using the rating marks obtained in this way, the lands from the researched area can be grouped, on an interval from 20 to 20 points, in the following capability classes (figure 3) .

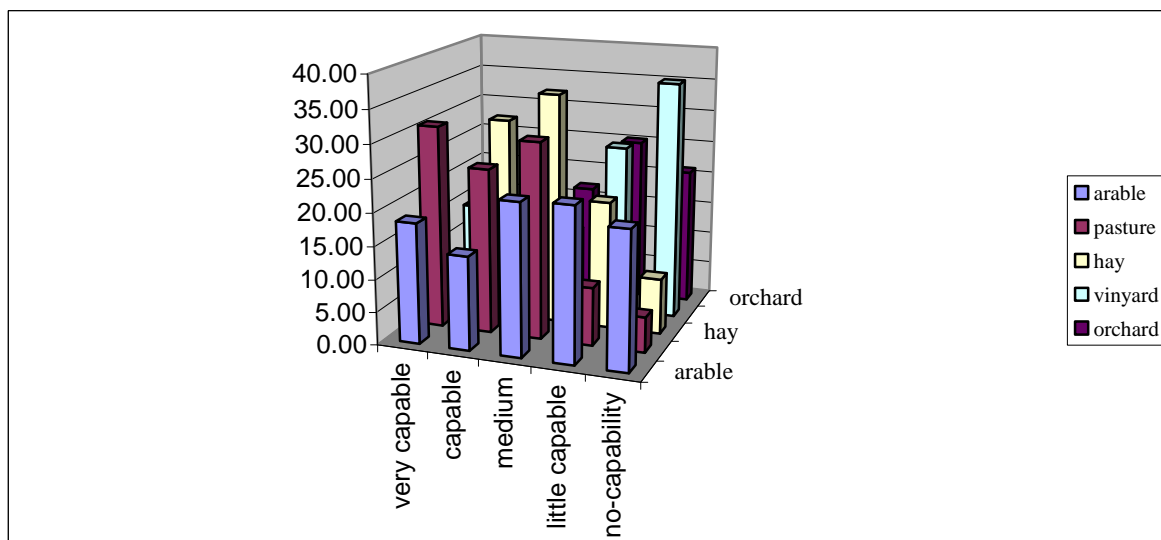


Figure 3 Agricultural lands grouping on capability areas for main use categories

The rating activity showed series of limiting factors that affects agricultural lands' productive capacity.

On lands with pastures the limiting factors are represented by: soil reaction with low values 33% and high values 15%, the loamy texture 52%, land slope 58%, low humus reserve 42%, phreatic moisture content excess 62%, the excess of stagnant moisture content of soil 25%, flooding 29% (in this statistic is not included the inundation from spring 2005), low edaphic volume 32%, etc.

The measures necessary to limit or to eliminate the restrictive factors that affect soil's productive capacity are: the correction of acid reaction through periodical liming, the correction of alkaline reaction by gyping, the improvement of plants growing condition by ameliorative fertilizations, the elimination of moisture content excess through workings of preventing and eliminating it (channels, ditches, drains etc.), the prevention and limitation of soil erosion (beds, soil waives, coast channels), the appliance of soil working technologies that should avoid its destruction and the introduction of ameliorative plants crops (mixtures of grasses with perennial legumes) etc.

Also, the pasture vegetation is not only a non-ending source of hay, which is tided with the tradition of raising the animals, it also plays an important role in preventing and fighting against soil erosion, being the safest source for soil's structure and fertility recovery.

### **CONCLUSIONS**

The physical-geographic conditions specific to the studied area allowed the formation of a diversity of soils with different characteristics: from the sandy ones (arenosols, some fluvisols), to those extremely argillic (pelosols, veritsols), or those alkaline (salsodisols) or highly acid (podzols, luvisols, dystric cambisols), from the ones poor in humus and other nutrients (arenosols, leptosols) to those equilibrated in all elements (chernozems).

Area agricultural and pedological research synthesis display a great diversity of P and K reserve levels (the same for other nutrients) produced mainly by a huge variability of implied pedogenetic processes and erroneous agricultural systems implemented during last decades. We donot know yet their linkage. That is why remains compulsory to extend this syntesis with data on environment quality status supplied by national monitoring system and with long duration experiments yielded data.

Such information avoid subjective approach and assure an unitary survey of main ecopedological characterization indicators evolution, for all cathegories of land use, no matter property nature, delivering to decident person all necessary data to establish causes that affect environment quality for proper measures election in its conservation and degrading prevention .

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