QUALITATIVE ASSESSMENT OF SOILS FROM BOZOVICI AREA, CARAS SEVERIN COUNTY

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Abstract: *The work provides information and elements related to the classification and evaluation of soil resources, thus integrating into the field of complex studies of natural resource identification, from the perspective of the land's vocation for the most suitable utility and the establishment of protection and conservation measures for the lands in the area. The objectives of the work are represented by the collection, processing and accumulation of scientific data related to environmental factors, the geographical characteristics of the area, soil resources, data related to the nature and intensity of the limiting factors, the qualitative evaluation of the lands. The territory of the commune has an area of 19579 ha, of which 7314 ha (37.36%) is agricultural land, and 11484 ha (58.65%) is occupied by forests. In order to establish the quality of the land, both the characteristics of the soil and the other factors of vegetation, relief, climate, hydrology, which determine the capacity for agricultural or forestry production, as well as the vocation of the land to be used for various activities, must be precisely determined. Soil properties can exert a decisive influence on the development of the root system, mineral nutrition, providing air, weather and climate for the main physiological processes from plants, acting on fertility (quality) status of soil. Systematic mapping and agrochemical studies of soil provide valuable data on the state of soil quality, establish and implement differentiated culture technologies and determining the suitability of land for various crops, substantiation of land improvement works and improvement technology, organization and systematization of land.*

Keywords: *land, quality, favorability, limiting factor*

INTRODUCTION

As a means of production, as an object and partially as a product of human activity the soil, formed over a period of thousands of years by the interference of the four layers of our planet, has been an element since ancient times that was evaluated, valued and classified, according to the scientific knowledge of the time.

Among environmental resources,water, air and soil are the most vulnerable but also most frequently subjected to the aggression of polluting factors with direct and serious consequences not only on the quality of the environment but especially on the health of people and other living things.

Being a natural body, the soil is studied in the complexity of natural conditions (climate, relief, vegetation, rock, groundwater, age) to which is added the productive activity of man.

In this sense, the eco-pedological knowledge of the lands is imposed as a necessity, increasingly demanded by modern, sustainable agriculture, which transforms both the soils (through fertilization and improvements according to well-defined methods and technologies) as well as the plants (the creation of new varieties and hybrids) .

The quality of the land represents the totality of the essential properties and particularities by which a certain portion of the land on the surface of the Earth differs from the others, being better or worse.

In FAO terminology, land quality is defined as a complex of factors that influence the sustainability of land for the intended purposes, the term "land" referring to: soils, landforms,

climate, hydrology, vegetation and fauna, also including land improvements and other forms of management etc. (M. Dumitru, 2002).

MATERIALS AND METHODS

In order to achieve the objectives proposed in this paper, the researches were carried out simultaneously in the field and in the office, being the identification and characterization from the ecopedological point of view of the territorial administrative unit Bozovici, by studying the conditions of relief, hydrography and hydrology, vegetation elements cosmic offer- atmosphere specific to this area.

From a geomorphological point of view, the territory of the commune has an area of 19579 ha, of which 7314 ha (37.36%) is agricultural land, 11484 ha (58.65%) being occupied by forests (tab.1), it includes three distinct units: the mountain area, the terraces, the Nera meadow.

Table 1

The distribution by categories of land use from Bozovici (ha)

No. crt.	Town	Arable	Grassland	Hayfield	Vineyards	Orchards	*Totall agricultural*	Forest	Whater	Other categories	*Total*
1.	Bozovici	1177	4300	1514	0	323	7314	11486	69	710	19579

The object of study is the soils belonging to the locality Bozovici, Caras-Severin county, the types and subtypes of soil being identified, their morphological, chemical, physical and hydrophysical properties were described, respectively were determined the quality classes for the category of arable, pasture and hayfield use.

The research of the ecopedological conditions was done in accordance with the "Methodology of Pedological Studies Elaboration " (vol. I, II, III) developed by ICPA Bucharest in 1987, completed with specific elements from the Romanian Soil Taxonomy System (SRTS - 2013).

RESULTS AND DISCUSSION

Bozovici commune is located in the southern part of Caraş-Severin county, approx. 75 km from Resita, being made up of the localities: Bozovici (residence) and Prilipeţ.

The first documentary attestation, according to Hungarian historiography, would be the year 1484, when the owner of locality eas an envoy of Matthew Corvin, with the name Lazăr de Bozovici. From the Daco-Roman period, we have the evidence of the Roman fortress next to the Catholic cemetery, respectively a stone with a Roman inscription.

From a geomorphological point of view, the territory of Bozovici extends over several forms of relief: mountain, piedmont (hill/terrace), depression, valley, meadow.

Mountain area borders the Bozovici Depression and is represented by the Semenic and Anina Mountains, with Bigăr nearby, where the well-known waterfall is located and the point that is marked for the passage of the 45 degree parallel.

Terraces, as a transition unit between the meadow and the mountain, they have a significant weight within the researched perimeter.

The altitudinal values of the terraces on the right side are between 250-400 m. The altitude of the system of terraces on the left side is between 250-300 m.

The valleys are 20-50 m deep, and the water troughs are narrow. Torrential elements make their presence felt in any natural or anthropogenic breach, and landslides are present where infiltrations are possible up to the impermeable bed.

Meadow represents the youngest form of relief, with the possibility of evolution every year. The areal extension and lithological structure is conditioned by the changes in the dynamics of the Nera River and its tributaries. The meadow unfolds in the NE-SW direction, especially on the left side of the river. The widest part is at the confluence with the streams Rudăria and Bănia.

The absolute altitude of the meadow decreases from NE to SW from 252 m downstream of Prilipeț to 233 m downstream of Bozovici. The lithology is varied, from the coarsest materials (sand, gravel) to the finest, all merge, stratify, without being able to define a rhythm or a rule of stratification or alluviation.

The territory of Bozovici commune, being part of Valea Almajului, falls within the geological structure of the depression, formed by metamorphic rocks - represented by crystalline shales over which sedimentary rocks were deposited.

The Almaj mountains have as their foundation crystalline schists of the autochthonous Danubian. Sedimentary rocks were deposited over the crystalline, such as the Mesozoic limestones from the Bozovici depression, then conglomerates, sandstones, clay shales, etc., which belong to the Upper Paleozoic and Neozoic.

The crystalline, together with its sedimentary, is traversed by igneous rocks (granites, gabbros), within which the Bozovici granite stands out.

The territory of Bozovici commune is part of the hydrographic basin of the Nera river. The Nera River runs long through the depression in the NE-SW direction, draining the slopes of the Semenic, Almaj and Anina Mountains. It springs from the Semenic Mountains and has a length of 131.2 km and a hydrographic basin of 1361.7 km^2. In longitudinal profile, the slope of the river is quite pronounced 2-5 m/km. However, due to the clogged riverbed, the river runs wild and floods.

In the area of Bozovici and Prilipeț localities, the Nera receives a series of permanent tributaries. On the left side, the Nera river receives tributaries Rudăria and Bănia streams and on the right side the most important tributary is the Miniș river which springs from the Anina Mountains.

Downstream of Miniș, the Bozovici stream flows into the Nera. It springs from Dealul Streneacul Mare from 667 m and presents a large drainage slope due to the short course and the lowered base level of the Nera (240 m).

The Bozovici area is under the influence of the Mediterranean climate center, which determines the sweetening of the climate and manifests itself through the activity of cyclones and warm air masses from the Mediterranean Sea and the Adriatic Sea.

The average annual temperature is between 8-10^{0}C, and the winter average is between -1 and -3^{0}C, the summer average is 21-23^{0}C.

Precipitation shows 2 maxima: May-June and November, the absolute maximum being 1000-1300 mm, and the annual average is 800-1000 mm. There are rarely dry periods that affect agricultural crops, as was the case in 1946, when it did not rain from June to November.

The relief, climate, soil and hydrographic conditions in the area of Bozovici are reflected in the configuration of the vegetation, which normally rises in altitude, starting with the soft essences that accompany the valleys, then continuing with the mixed forests of beech, elm, linden, jugastre, wild cherry, hornbeam, etc. and ending with the beech forests, with meadows or pure beech trees on the highest peaks of the Almaj mountains.

Depending on the diversity of relief forms, climate and vegetation conditions, anthropogenic interventions, the structure of the surfaces for the main categories of use, the

soils in the researched area present a great diversity. Considering the Romanian Soil Taxonomy System (SRTS-2012), 11 soil types have been identified (Fig.1).

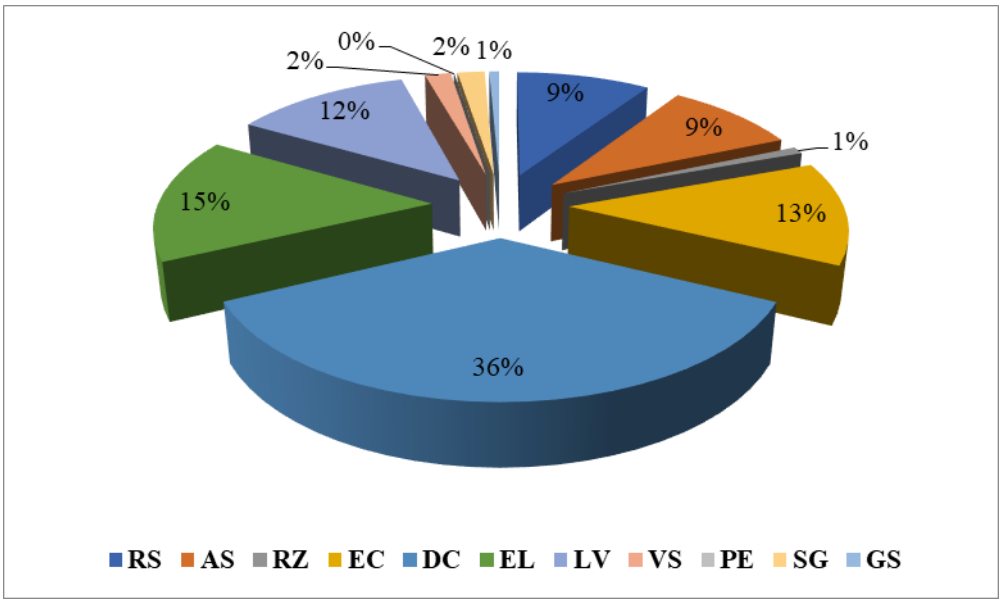

Figure 1. The soil types from Bozovici

All these soil units identified within the researched space were characterized according to the Methodology for Elaboration of Pedological Studies (MESP 1987, vol. I, II, III), using the 23 indicators of evaluation.

In the area of hills and terraces we find Haplic Luvisol (tab. 2). Haplic luvisols are soils with an ochric or molic A horizon followed by an argic B horizon, with values greater than 3.5 starting from the upper part and V over 53%. The fertility of these soils is conditioned by the rainfall regime because dry summers and springs with excess water are quite frequent, which requires measures to regulate the soil moisture regime.

In the following example we have a typical haplic luvisol, medium clay loam/medium clay loam, developed on slope alteration disaggregation materials, non-carbonate, medium-fine, weakly eroded by water.

Physical characteristics are represented by texturemedium clay loam between 0-101 cm; low apparent density between 0-8 cm, medium between 8-26 cm and high between 26-79 cm; high total porosity between 0-8 cm, low between 8-26 cm and very low between 26-79 cm; high wilting coefficient between 0-79 cm; medium field capacity between 0-79 cm;

Regarding the chemical characteristics, the soil reaction is weakly acidic between 0-101 cm; the humus reserve is small between 0-50 cm; the nitrogen index is medium between 0-8 cm and low between 8-79 cm;

Table 2

The physico-chemical characteristics of the typical haplic luvisol from Bozovici

Horizons	UM	At	AB	Btwq1	Bt	B.C
Depth	cm	8	26	46	79	101
Coarse sand (2.0 - 0.2 mm)	%	4.8	5.1	5.3	11.4	8.0
Fine sand (0.2-0.02 mm)	%	27.9	25.3	21.7	18.7	18.3
Dust (0.02 – 0.002 mm)	%	25.3	27.4	31.0	29.3	28.6
Colloidal clay (under 0.002 mm)	%	42.0	41.9	42.0	40.6	45.1
Physical clay (below 0.01 mm)	%	53.2	55.9	58.1	55.9	60.3
TEXTURE		TT	TT	TT	TT	TT
Specific density (Ds)	g/cm3	2.63	2.67	2.7	2.72	
Apparent density (Da)	g/cm3	1.20	1.49	1.6	1.62	
Total porosity (PT)	%	54.37	44.19	40.74	40,44	
Aeration porosity (PA)	%	23,29	8.14	2.50	3.51	
Degree of subsidence (GT)	%	-4.87	14.73	21.42	21.65	
Coef. of hygroscopicity (CH)	%	9.83	9.81	9.83	9.51	
Coef. of wilting (CO)	%	14.75	14.72	14.75	14.26	
Field Capacitance (CC)	%	25.9	24.2	23.9	22.8	
Total capacity (CT)	%	45.31	29.66	25,46	24.96	
Useful water capacity (CU)	%	11.15	9.49	9.15	8.54	
Hydraulic conductivity (K)	mm/h	4	0.75	0.45	0.4	
pH in water	unit.pH	6.33	6.28	6.27	6.63	
Humus	%	2.86	1.30			
Mobile phosphorus in Al	ppm	2.80				
Mobile potassium in Al	ppm	152				
Nitrogen Index (IN)		2.37	1.08	0.33	0.24	
Reserve humus	t/ha	27.46	34.87	15.36	14.43	92.12
Degree. of saturation in bases (V)	%	83.03	83.35	83.58	87.95	

In the meadow areas we find Fluvisols, soils developed on alluvial parent material (including colluvium) at least 50 cm thick and having at most horizon A. The formation of fluvisol s is conditioned by a series of specific factors, such as: meadow relief, alluvial sediments, vegetation and excess water, respectively the frequency of overflows.

In general, the alluvial soils are characterized by a fairly high degree of fertility due in particular to their favorable hydric and edaphic regime. Their fertility depends less on the stage of evolution.

In the following example, we have identified an fluvisol gleic, moderately glaucous, moderately deep soil, medium sandy loam/coarse loamy sand, developed on fluvial, non-carbonate, coarse materials (tab. 3)

The texture is medium sandy clay between 0-12 cm, coarse sandy clay between 12-50 cm, medium sandy-loam between 50-85 cm; the apparent density is very low between 0-25 cm and low between 25-50 cm; total porosity is high between 0-12 cm and medium between 12-50 cm; the wilting coefficient is small between 0-50 cm; the field capacity is small between 0-50 cm;

The soil reaction is slightly acidic between 0-28 cm, neutral between 28-85 cm; the humus reserve is moderate between 0-50 cm; the nitrogen index is medium between 0-25 cm, low between 25-50 cm;

Table 3

The physical-chemical characteristics of the fluvisol from Bozovici

Horizons	UM	Ap	Ao	AC	C	Cg	R
Depth	cm	12	25	38	50	85	
Coarse sand (2.0 - 0.2 mm)	%	27.7	30	46.5	46.2	20.6	
Fine sand (0.2-0.02 mm)	%	47.6	45	32	32.2	57.6	
Dust (0.02 – 0.002 mm)	%	9.7	9	11.2	8.1	9.8	
Colloidal clay (under 0.002 mm)	%	15	16	10.3	13.5	12	
Physical clay (below 0.01 mm)	%	17.6	20	15.3	16.8	16.2	
TEXTURE		SM	SM	UG	SG	UM	
Specific density (Ds)	g/cm3	2.6	2.63	2.66	2.69		
Apparent density (Da)	g/cm3	1.3	1.42	1.48	1.43		
Total porosity (PT)	%	50.00	46.01	44.36	46.84		
Aeration porosity (PA)	%	25.30	20.59	23,34	21.53		
Degree of subsidence (GT)	%	-5.39	3.36	4.97	0.76		
Coef. of hygroscopicity (CH)	%	3.53	3.77	2.44	3.18		
Coef. of wilting (CO)	%	5.30	5.65	3.66	4.78		
Field Capacitance (CC)	%	19	17.9	14.2	17.7		
Total capacity (CT)	%	38,46	32,40	29.97	32.76		
Useful water capacity (CU)	%	13.70	12.25	10.55	12.93		
Hydraulic conductivity (K)	mm/h	15	7	11	10		
pH in water	unit.pH	6.62	6.73	6.78	6.85	6.96	
Humus	%	3.02	2.8	2.07	1.17		
Nitrogen Index (IN)		2.63	2.44	1.80	0.70		
Reserve humus	t/ha	47.11	51.69	39.83	20.08	158.70	
Degree. of saturation in bases (V)	%	87	87	87	88		

The expression of favorability for each use and culture is done through credit ratings in natural conditions and the enhancement of credit ratings in the case of the application of land improvement works and ameliorative technologies.

As a result of the calculation of credit ratings, in natural conditions, for each unit of soil, the agricultural lands of the researched area were grouped into 5 quality classes depending on their vocation for arable, pasture and meadows uses (tab. 4).

Table 4

Quality classes for the categories of arable, pastures and meadows

Category of use	Surface Ha	Class I	Class II	Class III	Class IV	Class V	Weighted average grade
Arable	1177	0	69	502	366	240	38
Pasture	4300	59	1153	2053	1035	0	53
meadows	1514	53	422	733	245	61	52

The limiting factors influencing the soil cover mainly represented by acidity, low humus reserve, texture, high compactness (very low porosity), bearing capacity of the land, slope, landslides and unevenness of the land, erosion on the surface (including the danger of erosion), excess of moisture (phreatic, surface, through overflows or drains on the slopes), low temperature, lack of moisture.

The acidity, respectively the reaction of the soil, is a limiting factor on about 44.38% of the investigated surface due to the low pH values, in this sense the following limitations are encountered: moderate on 23.11%, reduced on 21.27%.

The humus reserve through its constitutive characteristics and through its dynamics in the soil presents the following limitations: severe for 0.85%, moderate for 59.16%, reduced for 22.17%.

The compactness presents the following limitations: severe on 0.50%, moderate on 9.40%, reduced on 0.18%.

The edaphic volume reduced with the following limitations: extremely severe on 0.38%, very severe on 33.28%, severe on 14.40%, moderate on 3.65%, reduced on 4.64%.

Landslides present the following types of limitations: extremely severe on 3.31%, moderate on 1.29%, reduced on 7.05%. Landslides favor the appearance of excess moisture on the slopes that present the following limitations within the researched space: moderate on 9.98%, reduced on 14.21%.

Excess surface moisture presents the following types of limitations: severe by 0.93%, moderate by 1.06%, reduced by 0.17%.

On these restrictive elements that affect the production potential of the soil cover, measures to correct the acid reaction by periodic calcium amendment, improving plant nutrition conditions through ameliorative fertilizations (the dose of agrochemicals, in relation with the use of the land and the cultivated plant), the elimination of excess moisture through works to prevent and combat it (leveling the land, ditches, ditches, drains, etc.), preventing and combating soil erosion (current cultural works, crops in strips, waves of soil, furrows, anti-erosion curtains).

The works to prevent and combat excess moisture and surface erosion will be carried out on the basis of complex field studies executed on the basis of situation plans suitable for the proposed purpose.

CONCLUSIONS

In order to establish the quality of the land, both the characteristics of the soil and the other factors of vegetation, relief, climate, hydrology, which determine the capacity for agricultural or forestry production, as well as the vocation of the land to be used for various activities, must be precisely determined.

This can be achieved by carrying out pedological studies and laboratory analyses, on the basis of which to draw up soil maps, more precisely representing homogeneous ecological territories (TEO), on the basis of which to establish credit rating and technological characterization grades for each portion of territory defined under this aspect.

Measures to improve the physical condition of degraded soils, both natural and artificial, are very important, both through deep loosening works (subsoil, scarification, scarification), and especially through the application of agricultural systems that include: the introduction of crop rotations long-term with protective and improving plants (mixtures of legumes and perennial grasses), alternating the deep work of the land (with the scormonitor) without turning the furrow, for annual fallow crops, with a superficial work (usually done with the disc, the combine, etc.), for grassy cereals or through a restructuring of the agricultural and forestry areas as the case may be.

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