PEDOLOGICAL CHARACTERIZATION OF PASTURES FROM ILIA AREA, HUNEDOARA COUNTY

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Abstract. *The purpose of the work is the accumulation of knowledge regarding the characteristics of the natural environment and its zonal peculiarities, as elements that define the structure of the land fund and the state of soil quality, in order to establish the ecological specificity of land productivity and the possible pressures on them. The importance of the research theme derives from the fact that the properties of the land are extremely differentiated in the territory, due to the variation of environmental factors and conditions. Meadows are an essential element of sustainable agriculture systems represented by: providing fodder, animal welfare, soil quality and optimal use of poorly productive land, especially for the production of biomass, a renewable energy source. Due to the fact that meadows are located in very varied seasonal conditions occupying, as a rule, surfaces unsuitable for other crops, either due to the deficient physico-chemical properties of the soil, or due to the orography of the land or other causes, their productivity is closely related to both environmental conditions in which they are found, as well as human and animal activities. The knowledge of the natural conditions and especially of the ecological potential of the land for the main categories of use and crops is of particular importance in carrying out the qualitative evaluation of the land, based on the assessment notes and the analysis of the limiting factors, being able to constitute an effective tool for the choice the set of ameliorative measures that favor an efficient use of land resources within the researched space.*

Keywords: *soil. pasture, favorability, limiting factor*

INTRODUCTION

The soil is has an particular importance not only in agriculture but in general, it is one of the resources necessary for the existence and productive activities of mankind.

As a means of production in agriculture, the soil differs from other means of production, being limited in the geographical space and requiring a rational use.

Of course, the soil cover, once formed, behaves as an autonomous entity, a system withpown personality, capable of self-development, but through its multiple reactions of energy-material exchange with the other shells, it still remains largely dependent on manifestation and the evolution of environmental factors, that the soil system is integrated as a subsystem in the geosystemic ensemble of the geographical environment.

Sustainable development is a complex process that takes place through and under human intervention, aimed at the development of society. In this sense, the sustainable development of agriculture is a part of this process, agriculture being its indispensable component.

The animal husbandry, especially of cows and sheep, has a important role in the achieving a sustainable agriculture. Meadows are an essential element of sustainable agriculture systems represented by: providing fodder, animal welfare, soil quality and optimal use of poorly productive land, especially for the production of biomass, a renewable energy source.

The plants in the meadows have a role in maintaining the humus content, in the maintaining soil microfauna, on ensuring the fodder requirement for at least 60% of the cows herd and 80% of the sheep herd.

Within agricultural ecosystems affected by soil erosion, the contribution of meadows is essential in protecting the soil, I fightând those phenomena that lead to triggering and acceleration of erosion process.

Due to the fact that the meadows are located in very varied seasonal conditions, occupy, as a rule, surfaces unsuitable for other crops, either due to the deficient physico-chemical properties of the soil, or due to the orography of the land or other causes, their productivity is strongly linked of environmental conditions in which they are found, and by human and animal activities.

MATERIALS AND METHODS

To achieve the proposed objectives, the territorial administrative unit (UAT) was identified and characterized from an ecopedological point of view; relief conditions, hydrography and hydrology, vegetation elements (biodiversity) were studied; the cosmic-atmospheric offer specific to the researched area was studied; soil types and subtypes and their morphological, chemical, physical and hydrophysical properties were identified.

The present work was carried out according to specific methodologies, falling within the pedological norms in force and aims to update the problem of the soil cover with all its aspects (pedogenetic peculiarities, morphological, physical-chemical, fertility and quality indices, protection or improvement measures).

The object of study is the land occupied by pastures in the locality of Ilia, the main focus of our research being the detailed highlighting of the morpho-physico-chemical properties of the soil cover and the correlation of these elements with the local biochemical peculiarities, respectively the quality for the category arable, pasture and hayfiel use categories.

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

Within the soil profile, the samples were collected on pedogenetic horizons, both in natural (unmodified) and modified settlement.

RESULTS AND DISCUSSION

From a physical-geographical point of view, the studied territory is located in the Mures Corridor, the Ilia basin, as well as partially in the northern sector of the Poiana Rusca mountains and the southern sector of the Metaliferi mountains.

The cadastral territory of the Ilia commune includes the following villages: Ilia, Bretea Muresana, Braznic, Sacamas, Dumbravita, Sarbi, Bacea, Cuies and Valea Lunga.

The studied territory is located in the eastern extremity of the county, bordering the Vorta commune to the north, Gurasada commune to the west, Dobra commune to the southwest, Vetel commune to the southeast and Branisca commune to the east.

From a physical-geographic point of view, the territory of Ilia commune can be divided into two large units:The Mures Corridor and the Western Carpathians.

The meadow area represents the most recent form of relief and is the result of the uneven alluviation processes of the Mures River, combined with the proluviation processes of the streams and alluvial valleys.

Characterized by absolute altitudes between 170-175 m and by a general slope of 2-3 gr. oriented east-west, the Mures meadow follows the meandering course of the Mures on both banks, developing unevenly within these meanders.

The terrace area appears only on the right side of the Mures river and has an accumulative character and makes the transition from the meadow to the slopes, in the Bacea-Bretea Muresana sector.

In contact with the slope, the terrace is made up of colluvial deposits, as a result of the slope processes, materials that give it a greater inclination of 5-7 gr. compared to the rest of the land.The front of the terrace is steep and mechanized in the south of the Bretea Muresana intravillage and disappears on both sides of the Batrana valley, where the transition from the high meadow to the 5-8 m level is lost due to the deepening of the valley bed in the deposits of the terrace.

The Poiana Rusca Mountains represent the northern sector of the Banat Mountains and represent a "typical karst" located between three large crystalline geomorphological units: Tarcu-Retezat, Cibin and Semenic. In the researched territory, the Poiana Rusca mountains are characterized from a sculptural point of view by a series of lower relief steps located between 300 and 600 m, as well as by the presence of internal depressions of differential erosion found within the base levels.

The region of the Metaliferi Mountains has a mountainous-hilly aspect and includes the entire complex of massifs and depressions that stretch along the Mures, between the Dumbravita Depression (west) and the Ampoi Valley (east). They represent a special subgroup of the Apuseni Mountains, respectively their northern subgroup and are characterized by a great geomorphological complexity, due to neotectonic collapses, marine and lacustrine transpositions of upper Miocene and Pliocene age and a late (Neogene) effusive magmatism.

From a geological point of view, the researched territory is characterized by the presence of a crystalline foundation of Mesozoic age over which lies a sedimentary blanket of Tortonian age, represented by marls and clays. Quaternary formations of Pleistocene and Holocene age were deposited on top of them, represented by the deposits in the first level of the terrace, represented by gravels, sands, red clays and sandy clays, respectively the deposits in the meadow, represented by gravels, sands, fine sands.

The geology of the Poiana Rusca Mountains is generally quite complex and is made up of crystalline and sedimentary formations.

Within the Metaliferi mountains we meet the eruptive formations which are of Neogene age and are represented by the two small basalt cones, one located near the railway line (Branisca Quarry), and the other in the north of the village of Bretea Muresana (Bretea Quarry).

From a hydrographic point of view, the studied territory belongs to the Mureș river basin, which flows approximately through the middle of the territory, for a length of approx. 13 km.After crossing the narrow corridor from Brănișca, the Mureș Corridor gradually widens, in the Ilia-Lăpugiu basin, arriving downstream of Ilia to have an opening of approx. 10 km.

Generally characterized by an average flow rate of 106 m^3/sec. and with an average slope of 2-4%, the Mureș river is very meandering, with numerous bends, islands and a small minor bed.

In the years with more abundant precipitation (spring and rarely autumn), the lands located on the low meadow are periodically flooded. These floods occur on both banks - the left bank being affected up to the contact with the slopes and the right bank up to the railway line.By periodically meandering, in the lower areas, the Mureș brings recent sandy alluvium of different thicknesses that it deposits over the older soils.

Among the main tributaries of Mureș on the right bank, we mention Valea Batrâna, Valea Bacea and Valea Cuieș, and on the left bank Săcămașului Stream and Brâznicului Stream, both torrential streams, which drain the northern edge of the Poiana Rusca mountains .

The depth of the ground water varies depending on the shape of the relief, within the non-flooded low meadow, the ground water is found at depths between 1.5 - 2.5 m, within the floodable low meadow, it is found at depths between 0.60 - 1, 00 m, on the depression areas within the high meadow, the ground water is found at depths between 0.60 - 1.50 m, on the three levels of the terrace, the ground water varies between 3.00 - 6.00 m, and on the slopes , groundwater is found at depths greater than 10 m.

The Ilia area belongs to the moderate continental climate, at the interference between the climatic province sector with oceanic influence and the climatic province sector.

The multiannual average temperature is 9.2˚C for the terrace and meadow area and for the hill area, the annual average temperature is 8.6^0C.

The average annual amount of precipitation is 660.2 mm.

However, it is necessary to take into account the fact that in some years there are deviations from the multiannual average of temperatures and precipitation, but especially in terms of their distribution during the vegetation period (a fact mirrored as faithfully as possible by the levels the harvests of those years).

Also, some deviations from the precipitation averages appear due to some local conditions: the shape of the meso and microrelief, the granulometric composition, the degree of vegetation cover.

The commune of Ilia is part of the area of deciduous forests - the oak sub-zone, the woody vegetation being represented by oak forests with all its varieties, hornbeam, ash, sky hazel, garnet, brumary oak, downy oak.In the low areas of the narrow meadows, in the Batrana, Bacea, Braznic and Sacamas valleys, as well as in the Mures Valley, we find woody essences of sedges represented by Salix and Populus.

The grassy vegetation is very different, depending on the geology and lithology, respectively the inclination and exposure of the slopes, the absolute altitude of the land and the soil moisture regime.

The main meadow formations found within the mapped territory are Agrostis tenuis meadows, Festuca Pseudovina and Festuca sulcata meadows and Batriochloa ischaemum meadows.

On the lands covered with meadows on the Ilia cadastral territory, 48 soil units were delimited and characterized, according to the "Roman Soil Taxonomy System", Bucharest, 2012 edition, being grouped into 5 soil classes: Protisols, Cambisols, Luvisols, Hidrisols , Antisols (Fig. 1).

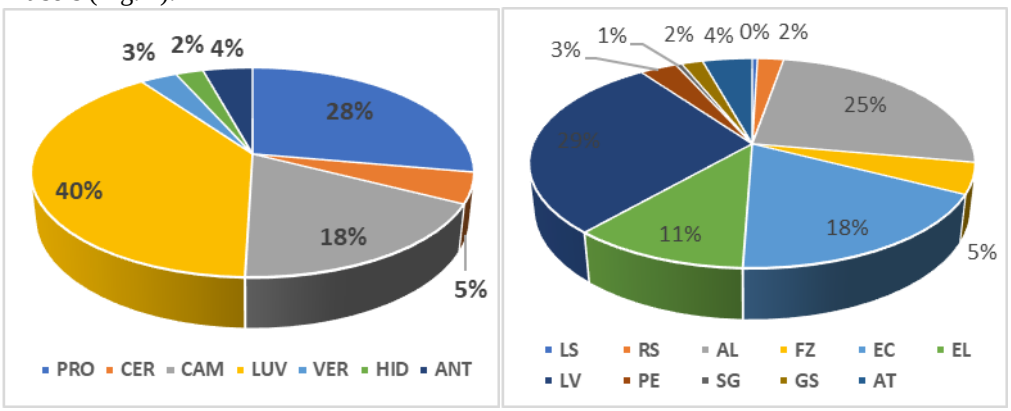

Figure 1. Classes and types of soil in the locality of Ilia

The objective of credit rating is to establish the productive potential, respectively the establishment of quality and favorability classes by ways of use and crops depending on the credit rating grades.

The classification into suitability classes was made according to: soil properties (texture, pH, useful edaphic volume, degree of subsidence, surface erosion and depth, skeletal content, bearing capacity), climatic conditions (temperature, precipitation), relief.

The grouping of land into suitability classes is done in relation to the nature and intensity of the restrictive factors for production (Fig. 2).

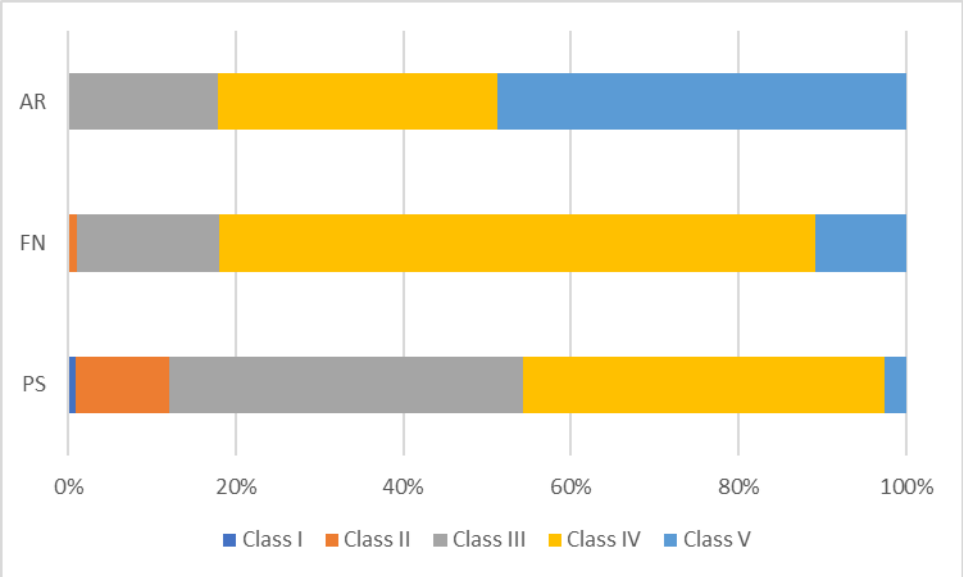

Figure 2. Quality classes for the use categories pasture, hayfield, arable

The production capacity of the pastures belonging to UAT Ilia are affected by the following limiting factors:

a) Surface erosion it affects 517.06 Ha - 82.67% of the perimeter, being determined by the slope. Moderate surface erosion by water occupies an area of 404.03 Ha - 64.60%, the strong 47.54 Ha - 7.60% and the very strong 65.49 Ha - 10.47%.

The amelioration works that are required are differentiated according to the intensity of the degradation process as follows:

- *Agrotechnical anti-erosion works*- for the prevention and stabilization of the erosion process, which are recommended on moderately and strongly eroded soils.
- *Complex anti-erosion works*- which is recommended for lands very strongly affected by erosion, as well as on poorly developed young soils.
- *Planting with forest essences*- it is recommended on lands with excessively eroded soils.

b) Deep erosion- represented by ravines and torrents. The lands affected by this degradation process are recommended to be planted with forest essences, and consolidation works, thresholds and dams will be carried out on the bottom of the torrential bodies.

c) Excess humidity- affects 289.38 Ha – 46.27% of the studied perimeter. Depending on the origin of excess moisture, they were differentiated:

- *Soils with excess moisture from precipitation and lateral runoff*

Excess moisture from precipitation and side runoff affects 283.48 Ha - 45.33%. Water stagnation is favored by the microdepression relief.

The lands affected by weak stagnation occupy an area of 226.78 Ha - 36.26%, the moderate stagnation affects 51.33 Ha representing 8.21% and the strong one affects 5.37 Ha representing 0.86% of the studied perimeters.

The agrotechnical works to prevent the advancement of the stagnation process are required on the surface of 278.11 Ha - 44.47%, the soil cover is affected by weak and moderate stagnation processes.

The lands with soils strongly affected by the stagnation processes, which require drainage works, occupy an area of 5.37 Ha - 0.86 %.

- *Soils with excess moisture of phreatic nature*

The excess of phreatic moisture affects 5.90 Ha - 0.94 %.

The lands affected by strong gleyc processes occupy an area of 0.82 Ha - 0.13% and excessive gleyc processes affects 5.08 Ha, representing 0.81% of the studied perimeter. The lands with soils strongly and excessively affected by gleyc processes, which require drainage works, occupy an area of 5.90 Ha - 0.94 %.

d) Soil reaction

Within the studied territory, the area occupied by soils with an acid reaction, which requires works to correct the acid reaction, is 277.96 Ha - 44.44 %.

The use of fertilizers with an alkaline physiological reaction, in order not to favor the acidification process, is required on an area of 255.21 Ha - 40.80% which has a soil cover with a slightly acidic reaction.

e) Landslides affects 9.98 Ha – 1.60% of the studied perimeter.

Depending on the type of landslide, old landslides stabilized in waves associated with moderate surface erosion were differentiated, and the excess moisture in depth from precipitation and lateral runoff affects 9.98 Ha - 1.60%.

The works that are imposed on these lands are differentiated according to the type of landslide, they are represented by the elimination of excess moisture, leveling, establishment of forest plantations on lands with active and semi-active landslides.

f) Reduced thickness of the useful physiological layer

Small useful soil volume occupies an area of 65.21 Ha - 10.43%.

g) The slope of the land- it affects the quality of the soils located in the area of the hills and on the fronts of the terrace.

The agrochemical characterization of the soils in the studied perimeter was performed based on the analyzes regarding the reaction (pH), the humus content, as well as the supply of fertilizing elements (nitrogen, phosphorus and potassium). The provision of soil with nitrogen was assessed based on the IN (nitrogen index).

Acidic lands that require works to correct the reaction represent 44.44%, of the territory being made up of moderately acidic soils (tab. 1).

Table 1

The reaction of the soils on the meadows of Ilia

Specification	Moderately acidic pH 5.1-5.8	Weakly acidic pH 5.9-6.8	Neutral pH 6.9 – 7.2	Weak alkaline pH 7.3 – 8.4
Area Ha	277.96	255.21	9.30	82.97
%	44.44	40.80	1.49	13.27

Soils with weak acid reaction, with acidification potential, represent 40.80%. In order to prevent acidification, it is recommended to avoid fertilizing with chemical fertilizers that have an acidic reaction.

The classification of soils into humus content classes was differentiated, depending on the value of the analysis and the texture (tab. 2). According to the data in the table, it appears that all studied territory is poor in humus, a fact that affects the physical-chemical properties, respectively the production capacity of the soils.

Table 2

Humus and nitrogen content on the lands occupied with meadows in the town of Ilia

Content	Humus			Nitrogen index	
	Very small	Little	Middle	Weak	Middle
Area Ha	114.44	511.00	-	611.05	14.39
%	18.30	81.70	-	97.70	2.30

The nitrogen supply of the soils within the studied perimeter was calculated according to the humus content (%) and the degree of saturation in bases (V %). The IN values show that the nitrogen provision of the soils in the studied perimeters is weak on 97.70%.

The normal development of meadows requires fertilization with high doses of fertilizers with a high nitrogen content.

Regarding the content of phosphorus and potassium on the soils covered with meadows in Ilia, the situation is presented in table 3.

Table 3

The content of phosphorus and potassium on the soils covered with meadows in the locality of Ilia

Content	Phosphorus			Potassium			
	Very small	Little	Middle	Extremely small	Very small	Little	Middle
Area Ha	83.23	521.79	20.42	13,21	143.07	448.74	20.42
%	13.31	83.43	3.26	2.11	22.88	71.75	3.26

According to the data in the table, it appears that 3.26% of the studied soils are moderately supplied with phosphorus and potassium and 96.74% of the studied perimeter has a very low - low content of phosphorus and potassium, a fact that affects the productions obtained. To restore the optimal content, fertilization with large doses of phosphorus and potassium fertilizers is required.

CONCLUSIONS

The natural conditions of the researched area are generally favorable for the development of the agri-food sector, in all aspects, there is an old tradition of cultivating cereals and their exploitation, especially through raising animals.

On the lands covered with meadows in the Ilia cadastral territory, 48 soil units, 11 soil types, were demarcated and characterized, being grouped into 5 soil classes, namely Protisols, Cambisols, Luvisols, Hidrisols, Antrisols.

The limiting factors that affect the production capacity of the pastures belonging to UAT Ilia are represented by soil reaction, excess of surface and phreatic moisture, surface and depth erosion, landslides, the slope of the land and the thickness of the soil layer.

From an agrochemical point of view, the lands occupied by meadows have a weak to moderately acidic pH, the humus content is low, and the degree of supply with nutrients (N, P, K) is low.

The work offers practical solutions in the sustainable management of edaphic resources, to avoid extreme climatic events that lead to a decrease in the productivity of meadows, by choosing methods adapted to the new edaphic-climatic conditions.

In this sense, the knowledge of the natural conditions and especially of the ecological potential of the land for the main categories of use and crops is of particular importance in carrying out the qualitative assessment of the land.

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