CHARACTERIZATION OF SOILS FROM DUMBRAVA, TIMIS COUNTY

Andrada VIGH, D.D. DICU, R. BERTICI

University of Life Science "King Mihai I" from Timisoara
Corresponding author:danieldicu@usvt.ro

Abstract:*The purpose of this work is the collection, processing and accumulation of scientific data related to environmental factors, the geographical characteristics of the surface, soil resources, data related to the nature and intensity of limiting factors, the qualitative assessment of land. The commune of Dumbrava in Timiș County is characterized by a diversity of soils that support a varied range of agricultural and economic activities. This area is located in a low land region with favorable agricultural climatic conditions, and the quality of the associated soils is an essential factor for agricultural productivity and ecological sustainability of the commune. The object of study is the lands belonging to the Dumbrava territorial administrative unit, Timiș county, in an area of 5667 ha, from which 4816 ha of agricultural land, respectively the soils identified in the mentioned perimeter. They are studied in relation to the environmental factors that condition their presence, together with them, forming homogeneous ecological territorial units (UT or TEO) with specific suitability/favorability for different agricultural or forestry uses/for different cultivated plants and with requirements and technologies improvement or specific cultural currents. The limiting factors influencing the quality of the land in this area are the phenomenon of acidification, which affects 23.82% of the agricultural area, the excess phreatic moisture of 8.56% and the surface on 31.34%, as well as the degree of subsidence on 64.42% of the agricultural area.*

Keywords: *soil, environmental factors, favorability, quality*

INTRODUCTION

By soil in the concept of the Romanian school of pedology is meant a natural body with its own organization, modified or not by anthropic activity, which forms and develops over time, on the surface of the earth's crust, under the action of bioclimatic factors on the material, characterized by: specific structure triphasic (solid, liquid and gaseous), porous polydisperse composition of the solid phase, vertical differentiation of composition, the presence of the living component, uninterrupted and complex dynamics, characteristic of being fertile, etc., which in addition to its characteristic of a historical-natural body, represents the environment in which food is produced for everything that lives on our planet, whether it is represented by land or is submerged.

Soil health, akathe qualityof the soil, represents the ability of the soil to function as a living ecosystem that can support organisms on the planet.

The knowledge of these particularities of the soil is of particular theoretical and practical importance. Theoretical, because it offers the specialist the opportunity to interpret the phenomena that occur in the soil and to forecast the evolution of the soil in particular and the environment in general from the point of view of present and future health, and practical because it warns the practitioner about the measures that must be taken to bring the soil in optimal conditions for the growth and development of cultivated or spontaneous plants.

MATERIALS AND METHODS

In order to achieve the objectives proposed in this study, the studies were carried out simultaneously in the field and in the office, namely, the identification and characterization of the Dumbrava Territorial Administrative Unit from an ecopedological point of view, the study of relief situations, hydrography, hydrology, vegetation elements that ensure a the unique atmosphere of this region.

From a geomorphological point of view, the municipality of Dumbrava has a total area of 5667 ha, of which 4816 ha is agricultural land, distributed as follows: arable land 3335 ha, pastures 977 ha, meadows 329 ha, vineyards 1 ha, orchards 174 ha (table 1), and 851 ha of non-agricultural land: forests 549 ha, water, bushes and thickets 39 ha, unproductive 19 ha, roads and railways151 ha, buildings 93 ha (table 2).

The object of the study is the soil surfaces in the Dumbrava area, Timis county, identifying the types and subtypes of soil, the physical, chemical and morphological properties, respectively determining the quality classes for the categories of use: arable, pastures, pastures, vineyards, orchards.

The research of ecopedological conditions was carried out in accordance with the ″METHODOLOGY FOR THE PREPARATION OF PEDOLOGICAL STUDIES' (vol. I, II, III) developed by ICPA in 1987 and the Romanian System of Soil Taxonomy (SRTS 2003,2012) developed by ICPA Bucharest in 2003 , completed by the methodological norms.

RESULTS AND DISCUSSION

Dumbrava commune is located in the eastern part of Timis county, 97 km away from Timisoara municipality and 27 km from Lugoj municipality, being made up of the villages of Bucovat, Dumbrava (residence) and Rachita.

The oldest written documents attest to the existence of the village of Rachita in 1445, of Bucovat in 1440 (when the locality belonged to the Soimos fortress), and of Dumbrava in 1450 (CJ Timis, 2013).

Genetically, the mentioned perimeter is characterized by an accumulative, piedmont relief, consisting of Pliocene fluvial deposits, the morphogenetic processes being conditioned in particular by the action of the previously existing and current hydrographic network, which generated a relief with a hilly-hilly aspect, with altitude values between 135 and 308 m.

As a whole, the relief represents a general inclination from the northeast to the southwest, which in a transverse plane descends from the north to the south, through terraces of different generations, the elements of the geographical complex being materialized through the following forms of meso-relief: mountain, hill, plain and meadow.

Erosion valleys are usually narrow, as are the ridges thus created, which present a relative parallelism created by the valleys that separate them.

The slopes generally have a complex profile with frequent slope changes, whose value is between 2 and 100%.

On small surfaces, relatively stabilized landslides were observed, which were recorded.

The plain area is constituted as a geomorphological accumulation unit, located at the junction between the Piedmont area and the meadow, representing the eastern compartment of the Western Plain, which enters in the form of a bay, along the Bega river, whose altitude does not exceed 160 m.

The meadow is a slightly undulating relief, with numerous meanders, the regularization of the Bega river allowed the gradual drainage of the meadow, which currently functions as a rarely flooded area.

The mentioned territory is part of the hydrographic basin of Bega which crosses the mentioned territory from east to west, the network of permanent waters being completed by the tributaries of the river Bega: Padureni, Saivanelor, Povernei, Droscava, Balasina, Bucovat, Priba, Livezile, Silistea, and with temporary water flow, being able to mention the secondary valleys that collect the waters from the slopes.

The pedophreatic water level is < 10 meters in the case of the Piedmont hills and 3-5-10 meters high terraces, and the low terraces are also 1-1.5-3 meters in the Begai meadow.

From a climatic point of view, the Lugoj-Faget area, in which the cadastral territory is located, is characterized by a multi-year average temperature of 10.6 degrees Celsius, and the precipitation has multi-year average values between 605.5 mm (Lugoj station) and 732.0 mm (Faget station), ensuring relatively good conditions for the development of crops.

In close correlation with the variety of geomorphological factors that determine the existence of diversified relief units, the geolithological ones, which led to a great diversity of parental materials, or the hydrological ones, as well as the various anthropic interventions within the researched space, the current edaphic cover is represented by: eutricambosols, luvosols, alluviosols, stagnosols, regosols (figure 1), which reflect, through their geobiochemical and morphological properties, the main defining and determining characteristics for the growth and fruiting of the main cultivated plants, expressed by credit notes, based on which the lands were classified in quality classes, from I to V (figure 2, 3, 4).

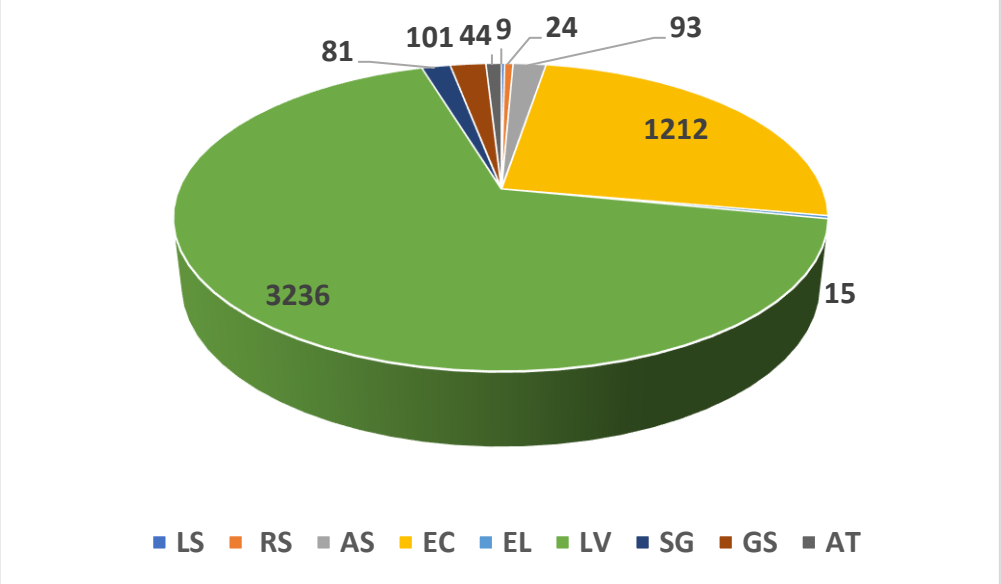

Fig. 1 Soil types from Dumbrava (ha)

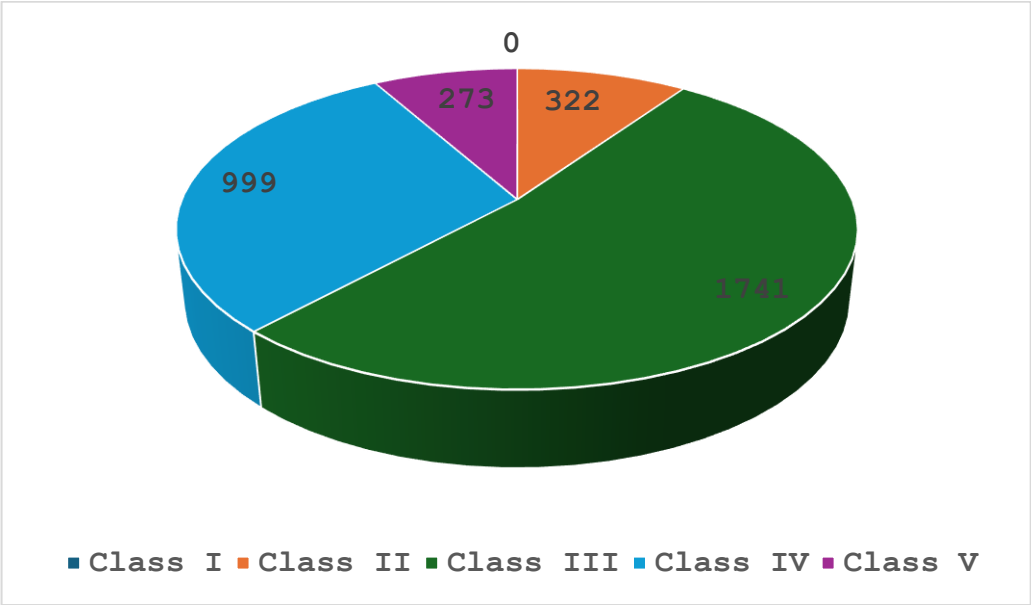

Fig. 2. Quality classes for ARABLE land from Dumbrava (ha)

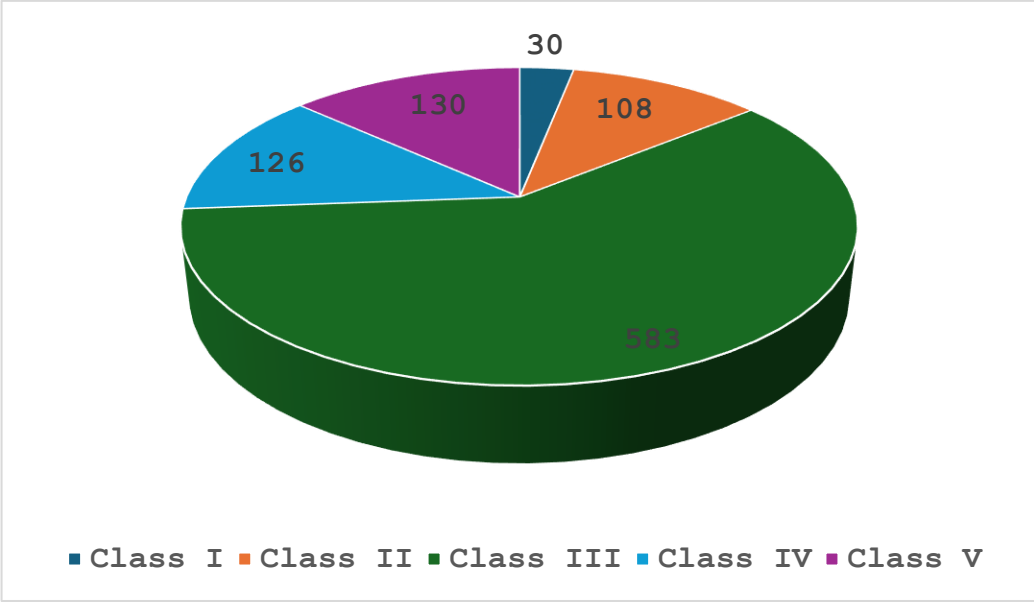

Fig. 3. Quality classes for PASTURE land from Dumbrava (ha)

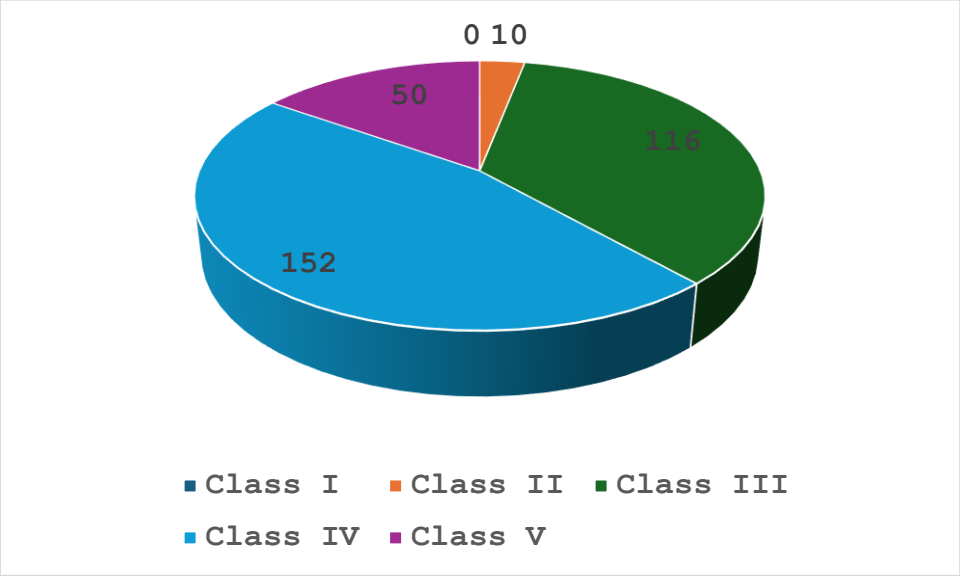

Fig. 4. Quality classes for HAYFIELD land from Dumbrava (ha)

According to WRB-SR, 1998, Luvosols are soils whose essential characteristics are textural differentiation (presence of argic diagnostic horizon), high cationic exchange capacity of clay, saturation in bases >50% and low saturation of aluminum.

Table.1

Physical, hydrophysical and chemical properties of the albic luvosol, stagnant, strongly stagnoglazed, dusty clay/ loamy clay, on very fine eluvial materials

Analytical indices	Depth (cm)								
	0-18	-28	-40	-56	-70	-92	-110	-143	-196
Soil horizon	Apw2	Atp w3	She w4	EB w4	Bt w5	Bt z w5	BCy w	CBy w	Czy
Coarse sand (2.0-0.2 mm)%	6.2	7.0	4.7	1.8	1.1	1.5	1.3	1.7	1.0
Fine sand (0.2-0.02mm) %	27.3	28.4	25.3	21.2	18.9	27.4	18.5	19.9	20.1
Dust (0.02-0.002 mm) %	39.8	38.2	37.5	32.1	20.7	15.7	29.5	28.1	27.8
Clay (below 0.002 mm) %	26.7	26.4	32.5	44.9	59.3	55.4	50.7	50.3	51.1
Physical clay (below 0.01 mm) %	45.5	44.6	50.2	59.8	70.0	67.0	64.9	63.4	64.0
Texture	LP	LP	LP	tut	of	of	of	of	of
Density (g/cm3)	2.69	2.69	2.70	2.72	2.72				
Bulk density (g/cm3)	1.55	1.70	1.54	1.59	1.59				
Total Porosity %	45.00	37.00	43.00	42.00	42.00				
Aeration porosity %	17.10	1.30	10.66	8.61	0.66				
Degree of settlement (GT)%	7.00	25.00	11.00	20.00	24.00				
Hygroscopicity coefficient %	4.76	6.20	6.20	6.20	10.00	10.00	10.00		
Coefficient of wilting (CO)%	7.13	9.30	9.30	9.30	15.00	15.00	15.00		
Field Capacitance (CC)%	18.00	21.00	21.00	21.00	26.00	26.00	26.00		
Useful water capacity (CU)%	10.87	11.70	11.70	11.70	11.00	11.00	11.00		
Total water capacity(CT)%	29.04	21.77	27.93	26.42	26.42				
pH in H2O	5.79	5.26	4.76	4.77	5.22	5.60	6.45	6.75	6.78

Carbonates (CaCO3)%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Degree of saturation in bases V %	48.09	29.86	30.13	39.45	52.37	67.77	85.65	90.96	90.96
Humus %	2.09	1.98	1.30	0.70					
Nitrogen Index (IN)	1.01	0.59	0.39	0.28					
Humus reserve t/ha	58.32	33.66	18.48	11,13	111.36				
Mobile phosphorus (ppm)	10.68	15.35	7.31	3.18	3.00	1.40	2.00	3.30	3.30
Mobile potassium (ppm)	45.00	43.00	31.00	82.00	81.20	111.60	81.20	56.60	56.60

Regarding the main physical and hydrophysical characteristics of the soilanalyzed, it presents a dusty loam texture in the upper horizons (Ap-Atp-Ea) located in the first 40 cm of the profile, clay loam in the transition horizon (EB) of about 16 cm and clay loam on the entire soil profile, from the interval 56 -196 cm (tab. 1).

The limiting factors influencing the quality of the land in this area are the phenomenon of acidification (fig. 5), which affects 23.82% of the agricultural area, the excess phreatic moisture (fig. 6) of 8.56% and the surface (fig. .7) on 31.34%, as well as the degree of subsidence (fig.8) on 64.42% of the agricultural area.

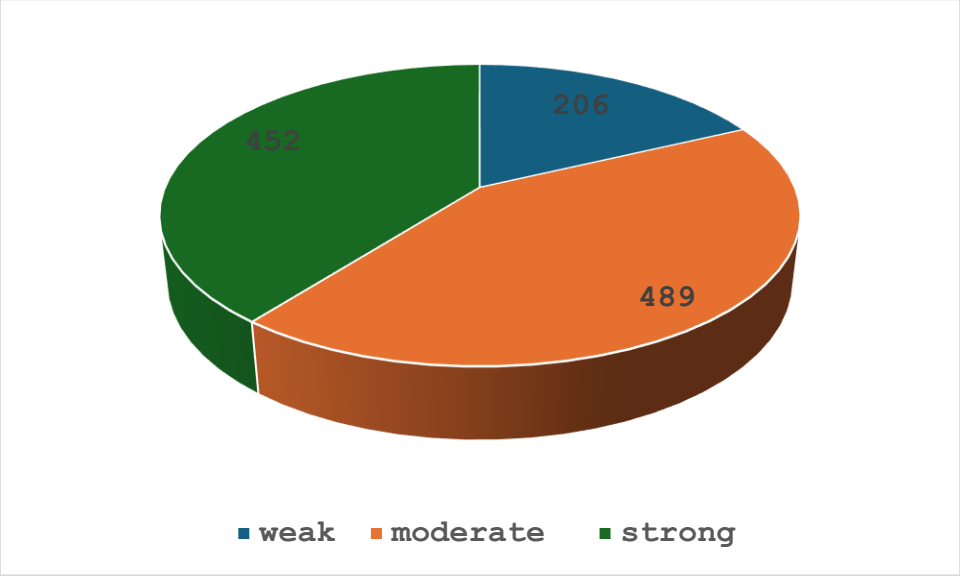

Fig. 5. Land surfaces with acidification phenomena in DUMBRAVA commune (ha)

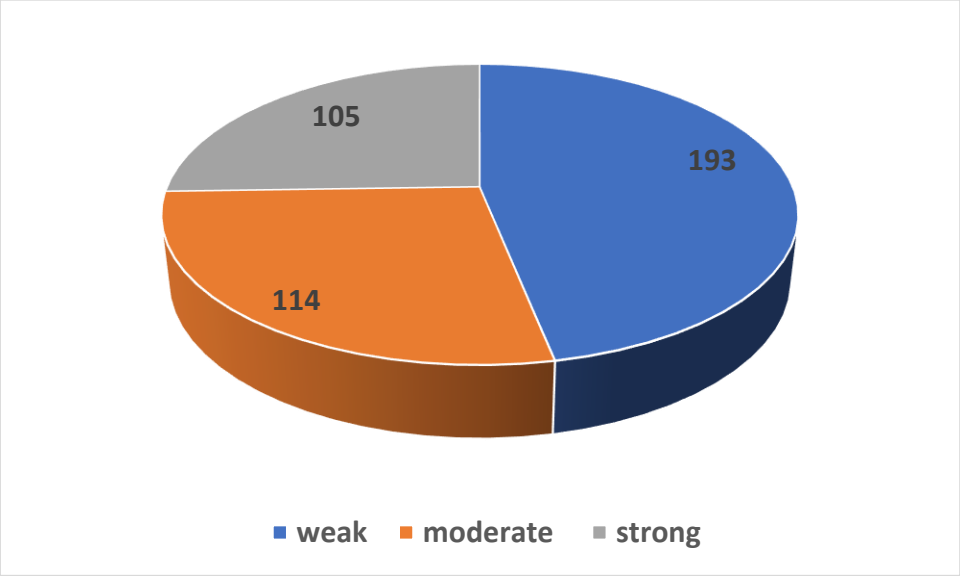

Fig. 6 Land surfaces with excess phreatic moisture in DUMBRAVA commune (ha)

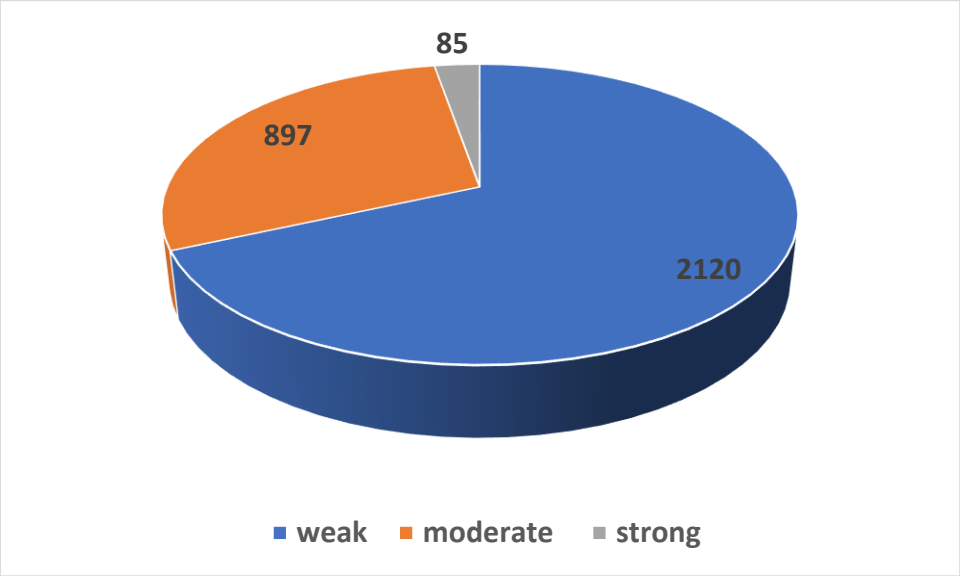

Fig. 7. Land surfaces with excess surface moisture in DUMBRAVA commune (ha)

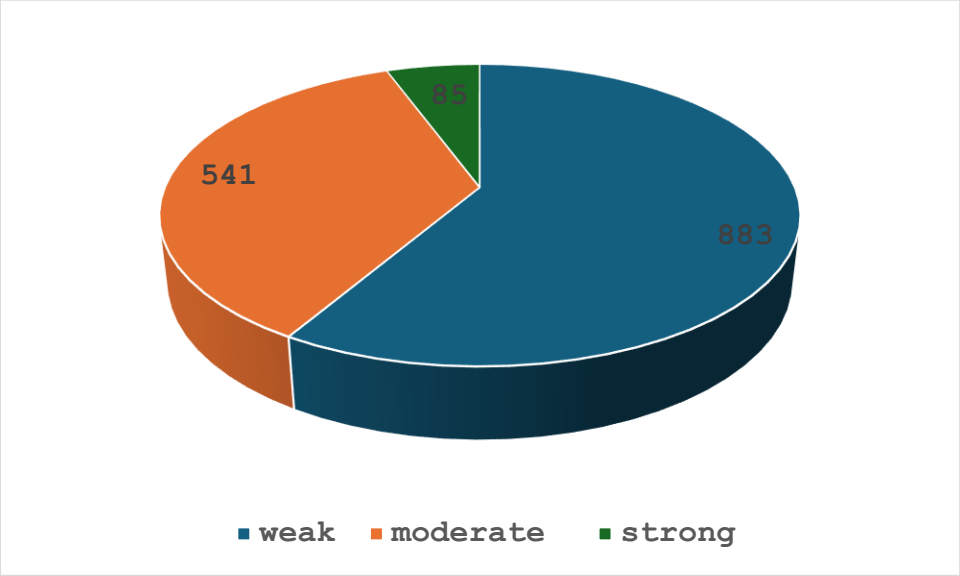

Fig. 8. Land surfaces with subsidence in DUMBRAVA commune (ha)

Work of prevention and control of excessive moisture and surface erosion shall be carried out on the basis of a complex site investigation carried out in accordance with a site plan suitable for the intended purpose.

CONCLUSIONS

Determining soil quality takes into account both soil properties and other vegetation, relief, climate and hydrology factors that determine agricultural or forestry production capacity.

This can be achieved by carrying out soil studies and laboratory analyzes on the basis of which to prepare soil maps, which more precisely represent the geographical areas, which will determine the credit evaluation and the technology of the evaluation grades for the established part of the land.

BIBLIOGRAPHY

DAVID GH., ȚĂRĂU D., ȘANDOR CI, NIȚĂ L, 2018, Soil and climate factors that define land productivity in the lower plain of Banat, Conference Proceedings Volume18, Issue: 3.2, Albena, Bulgaria,

DICU,D R BERTICI, M HERBEI, F SALA, 2024, Variability of pastures based on soil quality indices., Applied Ecology & Environmental Research, vol 21, no. 6

DORNIK A., MARINELA ADRIANA CHEȚAN, DRĂGUȚ L., DICU D., ILIUȚĂ A., 2022, Optimal scaling of predictors for digital mapping of soil properties, Geoderma, Vol. 405, Elsevier

DORNIK ANDREI, MARINELA ADRIANA CHEȚAN, LUCIAN DRĂGUȚ, ANDREI ILIUȚĂ, DANIEL DORIN DICU, 2022, Importance of the mapping unit on the land suitability assessment for agriculture, Computers and Electronics in Agriculture, vol. 201, Ed. Elsevier

DUMITRU M., ȘTEFĂNESCU SL, 2000, Agri-environmental schemes in the context of rural development, Soil Science no. 2, vol. XXXIV, Ed. Signata, Timisoara,

MIHUȚ CASIANA, LUCIAN NIȚĂ, ANIȘOARA DUMA COPCEA, ALEXANDRU RINOVETZ, 2024 - Assessment of the productive capacity of agricultural lands for their sustainable use. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural

Development, Vol. 24, Issue 1, 2024, Print ISSN 2284-7995, E-ISSN 2285-3952, pg. 619

MUNTEANU I., 2000, On some aspects regarding the relations between drought, pedogenesis and land degradation (desertification), Soil Science XXXIV, no. 2,

NITA L., TARAU D., ROGOBETE GH, NITA SIMONA, BERTICI R, TUTA SAS IOANA, SAS I, DICU D., 2018, The Role of Ecopedological Parameters in Management Sustainability of Banat Lands, Revista de Chimie, Vol. 69, no. 3

ROGOBETE GH., ȚĂRĂU D, ADIA GROZAV, BUZATU C., COVACI C., DICU DD,2021, Forest soils from Banat and southern Crișana, Ed. Eurobit Timisoara,

ROGOBETE GH., ȚĂRĂU, D., 1997 - Soils and their improvement. Banat soil map, Ed. Marineasa, Timisoara,

ȚĂRĂU D, ROGOBETE GH., NIȚĂ L., DICU D., CLARA TUDOR, RĂDUICĂ C., 2017, The role of pedologic information in defining land productivity in the mountain area of southern Banat, Soil Science.

ȚĂRĂU D., ROGOBETE GH., DICU D., 2016, Soils from western Romania, Characterization, Evaluation, Improvement, Ed., Eurobit Timisoara,

ȚĂRĂU D., ROGOBETE GH., DICU DD, ADIA GROZAV, NIȚĂ LD, ILIUȚĂ A.Ș., CLARA MAGDA TUDOR, BERTICI R., 2019, Lands and places between the Danube-Gugu-Crișu Negru Peak, Ed. Eurobit Timisoara,

TEACI D., 1980, Agricultural land reclamation, Ceres Publishing House, Bucharest,

VLAD H., M., 2009, Researches regarding the soils and the possibilities of restoring their fertility in Arad county, Doctoral Thesis, USAMVB, Timisoara.

*** OSPA Timis archive - Pedological and agrochemical studies,

*** SRTS-2012.

*** Methodology for elaborating pedological studies, vol. I, II and III, Agricultural Propaganda Editorial Office, Bucharest,