Analele Universităţii din Craiova, seria Agricultură – Montanologie – Cadastru (Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series) Vol. 55/1/2025

EVOLUTION OF SOILS LOCATED ON SLOPE IN THE VALEA CU DRUM HYDROGRAPHIC BASIN IN BUZĂU COUNTY UNDER THE INFLUENCE OF EROSION AND ANTHROPOGENIC INTERVENTION, UNDER CURRENT CLIMATE CHANGE CONDITIONS

Alexandra Teodora RADU[1], Mircea MIHALACHE[1], Leonard ILIE[1], Nicoleta SÎRBU[2], Valentina Mihaela VASILE[1]

[1]Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, Bucharest, Romania
[2]Faculty Faculty of Land Reclamation and Environmental Engineering, University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, Bucharest, Romania

author email: radualex563@gmail.com

Abstract

The paper aims to present the evolution of soils located on slope over 24 years by comparing data obtained through successive mapping in 2000 and 2024.The research aimed to characterize the soils in the upper third of the Valea cu Drum hydrographic basin, located on the right slope of the Slănic stream in Buzău county. Two successive pedological mappings were carried out in this area in 2000 and 2024. The soils in the studied area fall into two classes according to the Romanian Soil Taxonomy System: Chernozems (luvic Chernozems and haplic Phaeozems) and Anthrosols (calcareous Anthrosols). These three soil types have the highest share in the hilly area of Buzău County. In the upper third of the left slope of the studied watershed, wide terraces were built between 1993 and 1996, with the following dimensions: platform height of 12 m, height of embankment and cut-off of 2.3 m, platform slope ip=10%, excavation volume (Vfill) was equal to that of filling (Vfill) of 10 m3/ ml with the aim of reducing soil losses through erosion. Through the pedological mapping carried out in 2024, the three main profiles were opened, in which the pedogenetic horizons were delimited through morphological analysis carried out in the field and soil samples were collected from each pedogenetic horizon for laboratory analysis: granulometric analysis, reaction, carbonate and humus content.

The June-September 2024 interval is characterized by higher temperatures and lower precipitation, which characterizes a dry year from a climatic point of view. The air temperature values during the vegetation period recorded in 2024 are higher by 1oC in June, by 2.4oC in July, by 3oC in August and by 5.4oC in September compared to those recorded in 2000. Lower air temperature values in 2024 compared to those in 2000 were recorded in April by 1.4oC and in May by 3.6oC. The total amount of precipitation that fell during the vegetation period in 2000 is 321.6 mm compared to 247.3 mm in 2004, a difference of 74.3 mm showing a deficit of precipitation in 2024.

The calcareous Anthrosols profile was located in the upper third of the terraced left slope, on the platform of the T2 terrace in the clearing, and has the profile: Aho-Ck. The haplic Phaeozems profile was located on the right slope of the watershed with hay use, having the profile: Amtk-ACk-Ck1-Ck2. The soil is slightly eroded. The luvic Chernozems profile was located on the left slope of the watershed and has the profile: Aom-AB-Bt1-Bt2-C, the soil is moderately eroded.

***Key words**: watershed, soil profile, erosion, land improvement works*

INTRODUCTION

Common purslane The study of soils over long time intervals brings into question their physical and biochemical changes, in order to understand their evolution under different climatic, vegetation and relief conditions (Amunsdon Roland, et al. 2015).
The influence of the relief specific to hilly areas, in particular the shape of the slopes, their length and slope, as well as anthropogenic intervention, shows the direction of evolution of the soils in these areas (Zang, Zonqq, et al. 2011, Rășca, S., et al. 2020).
The intrinsic properties of soils in hilly areas, especially the organic matter content and vegetation cover, are key aspects for understanding the influence of erosion processes and choosing, in a conscious manner, measures to reduce these processes (Galindo, Victor et al. 2022). De Alba, S. et al. (2004) showed the influence of agricultural uses and soil tillage methods on the intensity of soil cover degradation in hilly areas. In this regard, Quinton Jon N. Lena K. Ottl and Peter Fiener in 2022 state that plowing on slopes thins soils, reduces their productivity and influences the intensity of erosive processes. Long-term research (Radu, 1998; Radu et al., 2010) shows that, with the soil washed from agricultural lands, significant amounts of humus (9.6-31.4 t ha-1) are lost and the reaction changes towards soil acidification. Akhtaruzzaman, Md, Md Enamul Haque and Khan Towhid Osman 2014 show that arable soils in hilly areas are facing severe degradation through acidification and loss of carbonates from the soil profile.
Terracing slopes is a way to reduce soil erosion. This method aims to intercept surface runoff and increase the amount of water infiltrated into the soil (Dumbrovský, M., Sobotková, V., Šarapatka, B., Chlubna, L., & Váchalová, R 2024). Wei, Wei, et al. (2019) show that terracing can increase soil moisture by 0.87% (±0.82%) to 37.71% (±9.01%), which brings benefits to the soil. On terrace platforms, 3.69% organic matter can accumulate in the soil, compared to 2.24% in unpreserved soil (Damene, Shimeles, Lulseged Tamene, and Paul LG Vlek 2012).
The different systems of use of sloping soils under long periods of perennial natural vegetation have led to positive changes in the physical and chemical properties of the soil (Somasundaram, J., et al. 2013). In this regard, research undertaken in the hilly area of Buzău County on cernisols located on slopes of 15% under grassy vegetation, showed a reduction in erosion below the allowed limit and an increase in humus content by 2.2% (Radu Alexandra Teodora, and Burcea Mariana 2024). The results provide a reference point for land management from the perspective of soil and water conservation (Yan, Yue, et al. 2023). It is necessary to intensify research on the evolution of soils located on slopes both under the influence of erosion processes and under anthropogenic influence (Somadam, J. et al. 2013).
This paper presents the evolution over a period of 24 years of Chernozems and Anthrosols in the hilly area of Buzău County, their profile composition and main physical and biochemical properties, under current climate change conditions.

MATERIALS AND METHODS

The experiments Pedological research carried out in the upper third of the Valea cu Drum watershed, located on the right slope of the Slănic stream in Buzău county (fig. 1), followed the evolution of the soils in the upper third of this perimeter affected by surface erosion processes over 24 years.
The surface of the Valea cu Drum river basin is 82.87 ha and falls into the category of small torrential basins (under 1000 ha). The perimeter of the river basin has a length of 3475 m, and the Gravelius coefficient is 1.10, depending on which the shape of the basin is established, which is slightly elongated. The length of the basin is 1375 m, the left slope is 375 m long, the right slope is 450 m long, the average length of the slopes is 167 m with an average slope of 11.3%.

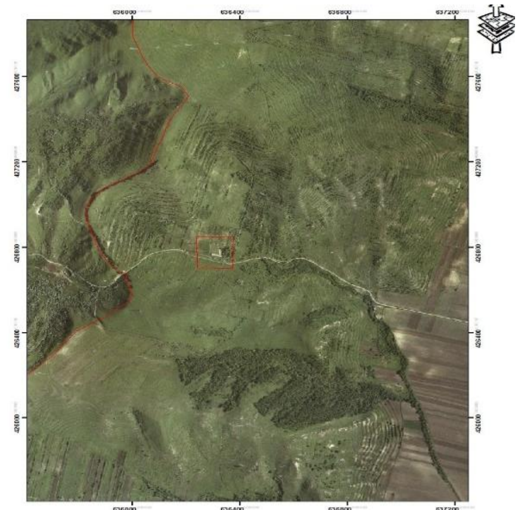

Fig.1 Site plan scale 1:5000

The first soil mapping was carried out in 2000. At that time, five main soil profiles were opened from which samples were collected for physical and chemical analyses to identify soil types. Based on the data obtained, a soil map of the studied watershed was drawn up (fig. 2).

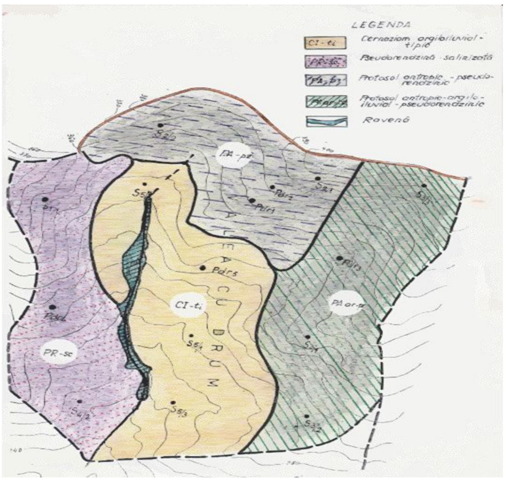

Fig. 2 Soil map of the Valea cu Drum watershed from 2000 scale 1:5000

The soils in the studied area fall into two classes according to the Romanian Soil Taxonomy System: Chernozems (luvic Chernozems and halpic Phaeozems) and Anthrosols (Anthrosol-calcareous). These three soil types have the highest share in the hilly area of Buzău County. It is worth mentioning that in the upper third of the left slope of the studied watershed, wide terraces were built in the period 1993-1996, with the following dimensions: platform height of 12 m, height of embankment and clearing of 2.3 m, platform slope ip=10%, excavation volume (Vfill) was equal to that of filling (Vfill) of 10 m3/ ml, (figure 3) with the aim of reducing soil losses through erosion. Apple saplings were planted on the platforms of these terraces and 80% of them have taken root. Currently, some of the trees have dried up and the platforms of the terraces and the slopes are overgrown with grass.

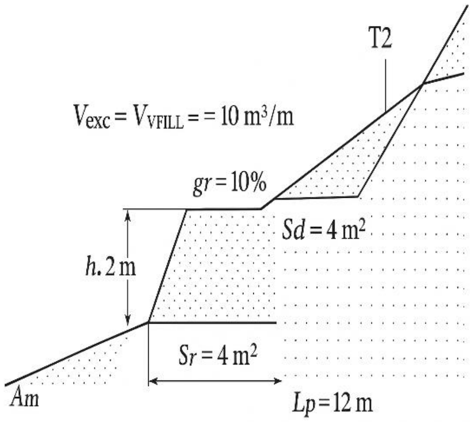

Fig.3 Longitudinal profile through the left slope of the Valea cu Drum watershed arranged with wide terraces in 1996

Soil research methods. Through the pedological mapping carried out in 2024, the three main profiles were opened, in which the pedogenetic horizons were delimited by morphological analysis carried out in the field and soil samples were collected from each pedogenetic horizon for laboratory analyses.

Granulometric analysis was carried out on the fine soil (< 2 mm) and consisted in the determination by sieving and pipetting, after the dispersion pretreatment of the soil sample, of the fractions: coarse sand (2-02 mm), fine sand (02—0.02 mm), dust (0.02-0.002 mm) and clay (< 0.002 mm). The results are expressed in percentages (mass), the sum of the fractions always being 100. The granulometric composition of the soil serves to classify it into textural classes.

The determination of the total content of alkaline earth carbonates was carried out by the gasovolumetric method (Scheibler method).

The determination of the soil pH was carried out in aqueous suspensions with a soil:water ratio of 1:2.5 by the potentiometric method, the pH value represents the logarithm with changed sign of the concentration of hydrogen ions in the soil solution.

The determination of the soil organic matter content was carried out by the wet oxidation method and tritimetric dosing according to the Walkley-Black method, in the Gogoașa modification. The results are expressed in % organic carbon or in % humus = % organic carbon x 1.724. Values of humus content in sevesc when calculating the reserve expressed in t ha-1, at a depth of 40 cm.

The interpretation of the results obtained from the physical and chemical analyses on the harvested soil samples was done using the tables of values contained in "Methodology of the elaboration of pedological studies - I.C.P.A Bucharest 1987" volume III.

Soil erosion estimation. The factors with a determining role in triggering or intensifying the erosion process are: climate, soil, relief, vegetation and agricultural use.

The estimation of surface erosion, by indirect methods, is used in the quantitative assessment of erosion through different models of estimating the amount of soil washed away annually by torrential rains. Such a model was adapted, for the conditions of Romania, by Moțoc M. from the universal erosion formula.

$$E = Ka \times S \times Lm \times In \times C \times Cs \ (t\ ha^{-1}\ year^{-1}) \quad [1]$$

where:

E=average surface erosion.

Ka=climate aggressiveness coefficient determined according to the pluvial erosivity and the amount of soil washed from the standard plot.

Lm= correction coefficient according to the length of runoff measured in the direction of the highest slope.

In=correction coefficient according to the slope of the land in the direction of runoff.

S=correction coefficient for soil erodibility.

C=correction coefficient for crop use and structure.

Cs=correction coefficient for soil erosion control measures and works.

m, n= constants, which for Romanian conditions have values of: m=0.3 and n=1.5

The estimation of surface erosion was carried out for the three soil types analyzed from the upper third of the Valea cu Drum watershed.

RESULTS AND DISCUSSIONS

Analyzing the dynamics of air temperature during the vegetation period and presented in Figure 4, it is found that the values recorded in 2004 are higher by 1°C in June, by 2.4°C in July, by 3°C in August and by 5.4oC in September compared to those recorded in 2000.

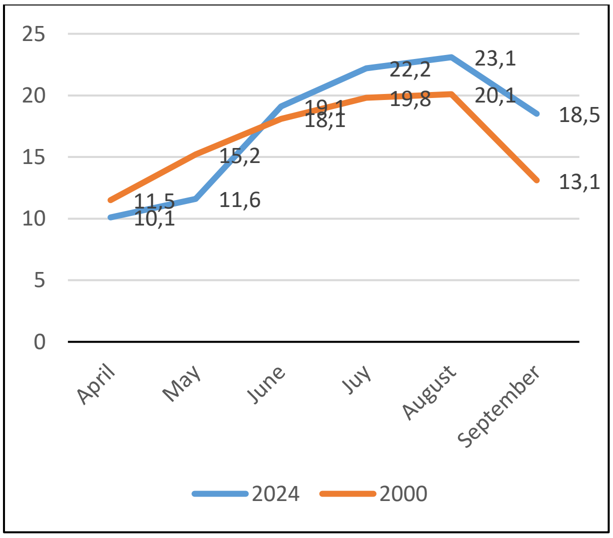

Fig.4 Air temperature dynamics during the vegetation period (April-September) in 2000 and 2024 (recorded data)

Lower air temperature values in 2004 compared to those in 2000 were recorded in April by 1.4°C and in May by 3.6°C.
The dynamics of precipitation during the months of the vegetation period (April–September) are presented in Figure 5. The values recorded in 2004 are lower than those in 2000, thus the largest differences (34.5 mm) are in June followed by those in September (23.8 mm). Smaller differences were recorded in April (11.6 mm) and August (14.3 mm).

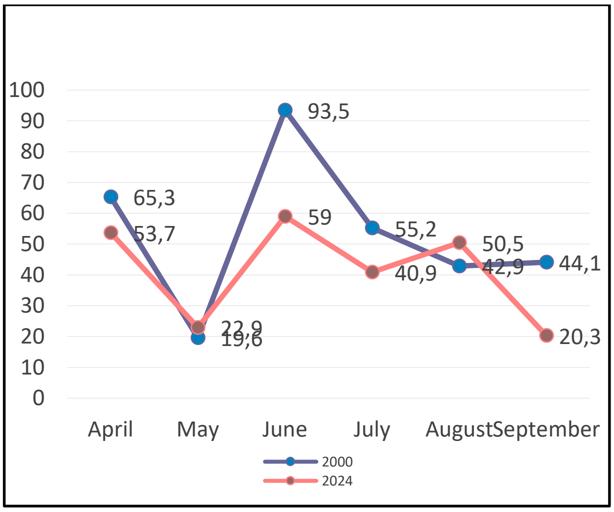

Fig.5 Precipitation dynamics during the vegetation period (April-September) in 2000 and 2024 (recorded data)

The climatic parameters of 2024, such as precipitation and air temperatures, present numerous peculiarities, radically differing from those of 2000, which were considered normal. The total amount of precipitation during the vegetation period in 2000 was 321.6 mm compared to 247.3 mm in 2004, a difference of 74.3 mm showing a deficit of precipitation in 2024. The June-September 2004 interval is characterized by higher temperatures and lower precipitation, which characterizes a dry year from a climatic point of view.
The herbaceous vegetation is composed of two associations: Botriochloa ischaemum and Festucetum valesiacae, the latter being dominant in the upper third of the studied watershed. The areas occupied by these associations are currently used as pastures or hayfields, the previous use was orchard.
The rocks on which the soils of the Valea cu Drum watershed evolved come from Levantine-Quaternary deposits composed of marls, clayey marls, sandstones and sandy marls.
The groundwater is located at about 20-25 m depth.

Morphological description of the soils in the upper third of the watershed

The analyzed soil types are: Anthrosols-calcareous, haplic Phaeozems and luvic Chernozems

Anthrosols-calcareous (AT-ka) Profile P1 was located on the platform of terrace T2 in the clearing (figure 6). The morphological description is presented in table 1.


Fig.6 Location of profile P1

Table 1. Morphological description of the anthrosols –calcareous

Marly parent material; relief: grassy terraced slope; slope: 10%; groundwater depth: over 10 m	
Morphological description of the P1 profile	
(Anthropogenic material) Aho (0-60 cm)	Clayey clay, uneven color 10YR2/3 when wet and 10YR4/4 when dry with spots of color 10YR5/2 when wet and 10YR6/6 when dry, unstructured, friable when wet, cohesive when dry, moderately plastic and adhesive, strong effervescence, straight gradual transition
Ck (> 60 cm)	Clayey clay, color 10YR3/2 in wet state and 10YR6/6 in dry state, structureless, friable in wet state, weakly cohesive in dry state, moderately plastic and adhesive, weakly compact, strong effervescence, frequent CaCO3 stains.

The haplic Phaeozems (FZ-ha). Profile P2 was located on the right slope of the watershed used as a hayfield (figure 7). The morphological description is presented in table 2.

Fig.7 Location of profile P2

Table 2. Morphological description of the haplic Phaeozems

Marly parent material; relief: straight slope; slope category 15.1-20%; groundwater depth: over 10 m, use: hayfield	
Morphological description of the P2 profile	
Amtk (0-15 cm)	Loamy clay, color 10YR2/2 in wet state and 10YR3/2 in dry state, moderately developed glomerular structure, moderately plastic, adhesive and compact, strong effervescence, frequent thin roots, net straight passage.
ACk (15-57 cm)	Loamy clay, color 10YR3/3 in wet state and 10YR4/4 in dry state, moderately developed grain structure, moderately plastic, adhesive and compact, strong effervescence, net straight passage.
Ck1(54-100 cm)	Clay, color 10YR5/4 in wet state and 10YR5/6 in dry state, unstructured, moist, moderately plastic, adhesive and compact, very strong effervescence, CaCO3 spots, clear straight transition.
Ck2 (> 100 cm)	Clay, color 10YR6/4 when wet and 10YR6/6 when dry, unstructured, moist, weakly cohesive, moderately plastic, adhesive and compact, very strong effervescence, frequent CaCO3 stains.

Chernozems luvic (CH-lv). The soil occupies the left slope of the watershed, in the continuation of the terraced area, where profile P3 was located (figure 8). The morphological description is presented in table 3.

Fig.8 Location of the P3 profile

Table 3. Morphological description of luvic Chernozems

Parent material: clay shales, relief: left slope; slope category 15.1-20%; groundwater depth: over 10 m; use: arable.	
Morphological description of the P3 profile	
Aom (0-10 cm)	Clayey clay, color 10YR2/3 in wet state and 10YR3/3, granular structure with friable aggregates, moderately plastic, adhesive and compact, shows cracks, rare traces of roots, clear straight passage.
AB (10-30 cm)	Clayey clay, color 10YR3/3 when wet and 10YR4/3 when dry, poorly developed prismatic columnoid structure, moderately cohesive when dry, moderately plastic, adhesive and compact, the material is slightly mealy, rare traces of roots.
Bt1(30-100 cm)	Clayey clay, color 10YR3/3 in wet state and 10YR4/4 in dry state, prismatic columnoid structure with large and small aggregates, continuous clay films, hard in wet state and hard in dry state, moderately plastic, adhesive and compact, frequent fine cracks.
Bt2 (100-120cm)	Clayey clay, color 10YR3/4 in wet state and 10YR4/6 in dry state, well-developed prismatic columnoid structure, continuous clay films, hard in wet state and hard in dry state, moderately plastic, adhesive and compact, frequent cracks.

Surface erosion estimation. To assess the soil resistance to erosion, the amount of soil washed away by torrential rains was calculated using the universal erosion formula [1] for the three soil types analyzed (Figure 9). The luvic-Chernozems (thallus 3) is moderately eroded, the amount of washed soil exceeds the allowed amount by 5.4 t ha-1 and year-1, which means a loss of 7.9 m3 ha-1 and year-1 soil. The haplic Phaeozems is poorly eroded, the amount of washed soil exceeds the allowed amount by 0.3 ha-1 and year-1. The calcareous anthrosols is noteworthy, where erosion is negligible, soil losses are insignificant.

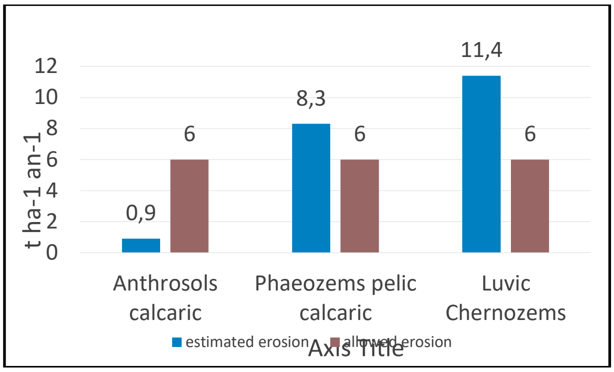

Fig.9 Values of the quantities of washed soil in Antosol-calcareous, Phaeosol-pelic-calcareous and Chernozom-argic

Soil characterization. For the three soil types analyzed, the following were followed by comparison in 2000 and 2024: granulometric composition, reaction, carbonate and humus content.

In the case of the calcareous antrosol, the granulometric composition did not undergo significant changes during the studied period (figure 10). The clay content in the first 20 cm of the analyzed profile in 2000 is 33.8% and 32.5% in 2024, so the textural class does not change. The trend line of the calcium carbonate content (figure 11) indicates a slight decrease at a depth of 40-60cm. The reaction in the first 20 cm is weakly alkaline in both studied profiles. The humus content (figure 12) has an increasing trend from 1.1% in the first 20 cm of the analyzed profile in 2000, to 1.68% in 2024.

The conclusion is that anti-erosion protection of the slope by constructing wide terraces and maintaining grassy platforms causes the accumulation of organic matter in the upper part of the soil, soil losses through erosion are insignificant and the soil profile is protected, even in dry climate conditions.

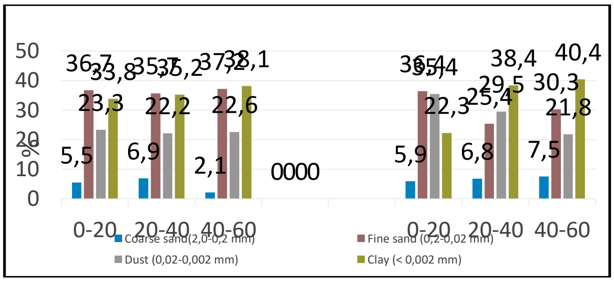

Fig.10 Granulometric composition of the calcareous antrosol in the years 2000 and 2024

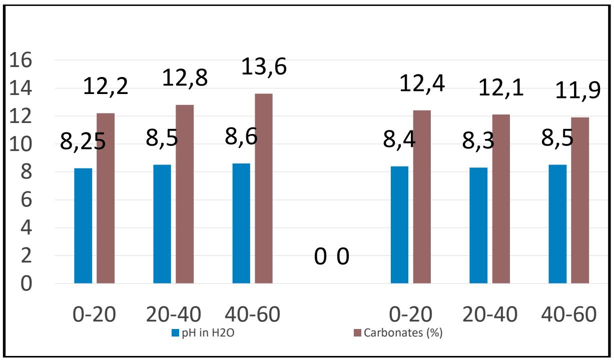

Fig. 11 Carbonate content and soil reaction in anthrosol-calcareous in the years 2000 and 2024

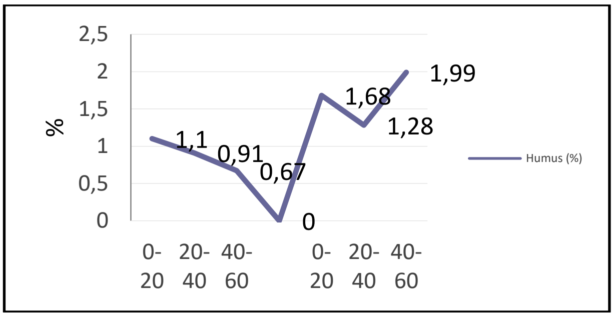

Fig.12 Humus content in calcareous antrosol in 2000 and 2024

In the case of the pellic-calcareous phaezioma, the textural class is loamy clay in the first 80 cm of the soil profiles analyzed in 2000 and 2024, the soil falls into the pellic subtype. It is found that clay has a slightly decreasing trend (figure 13) from 50.8% in the first 20 cm of the 2000 profile, to 49.9% at the same depth of the 2024 profile. Also, the percentage of sand increased by 12.1% in the first 20 cm of the profile analyzed in 2000 compared to that of 2024, by 11.8% in the next 20 cm in both profiles.

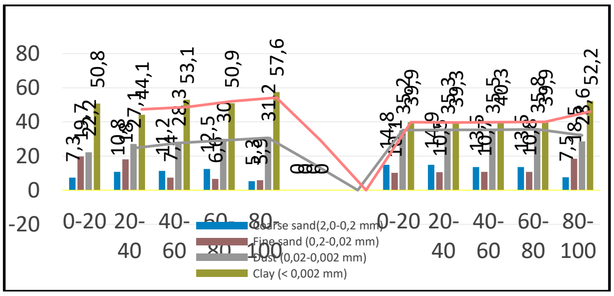

Fig.13 Granulometric composition of the pellic-calcareous phaeozems in the years 2000 and 2024

The weakly alkaline reaction was maintained throughout the soil profile analyzed in both 2000 and 2024 (Figure 14). The carbonate content values have a slightly decreasing trend, from 13.5% in the first 20 years of the profile analyzed in 2000 to 12.2% in 2024. It can be said that the decrease in carbonate content is approximately 3% in both analyzed profiles.

Regarding the humus content (figure 15), it decreases from 3.97% in the first 20 cm of the profile analyzed in 2000, to 2.3% in the profile analyzed in 2024, a value that is maintained in the next 40 cm of this profile. If the values of this content decrease from 20 cm of the profile analyzed in 2000, in the one analyzed in 2024 the decrease occurs from 60 cm of this profile.

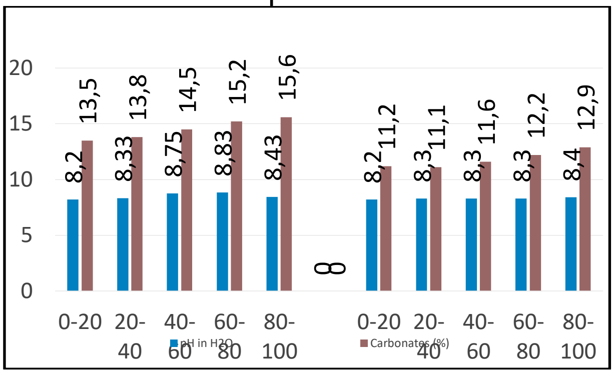

Fig. 14 Carbonate content and reaction to the pellic-calcareous phaeozems in the years 2000 and 2024

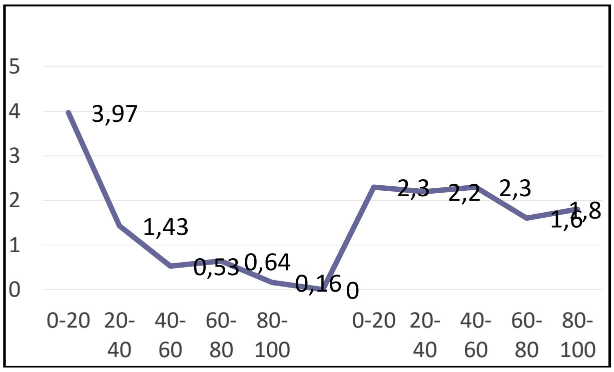

Fig.15 Humus content in the pellic-calcareous phaeozems in the years 2000 and 2024

The analysis of the presented data highlights the role of agricultural use, in the case of the pellic-calcareous phaeozems it is hayfield, in the conservation of the soil profile and its main properties even in the dry periods we are going through.

In the case of the luvic chernozems, significant changes in the granulometric composition are observed (figure 16). Thus, the clay content in the first 20 cm of the profile analyzed in 2004 of 33.2% is approximately the same as that at a depth of 60-80 cm of the profile analyzed in 2000.

This change can be explained by the fact that the soil is susceptible to water erosion through which 7.9 m3 ha-1 year-1 soil is lost.

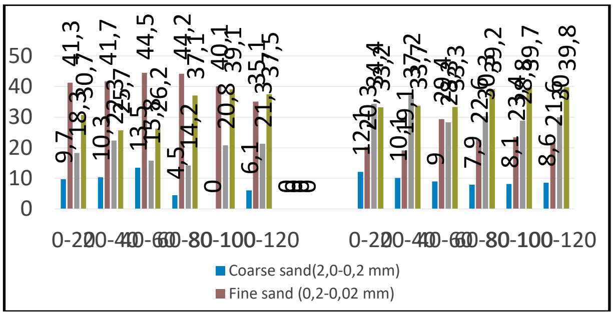

Fig.16 Granulometric composition of argic chernozem in the years 2000 and 2024

The soil reaction (figure 17) is slightly alkaline throughout the profile analyzed in 2000 and slightly acidic in the first 100 cm of the profile analyzed in 2024, the pH values indicate an acidification of the soil at that depth. Regarding the carbonate content, it can be observed that the value of 0.2% corresponding to the 40 cm depth of the profile analyzed in 2000 corresponds to that recorded in the first 20 cm of the profile analyzed in 2024.

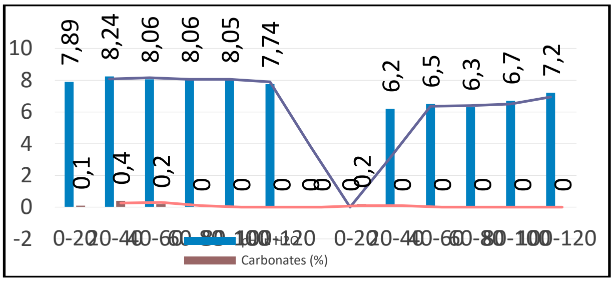

Fig. 17 Carbonate content and reaction to chernozion-argic in the years 2000 and 2024

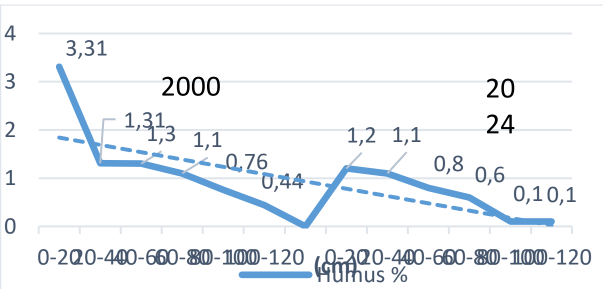

Fig.18 Humus content in argic chernozem in 2000 and 2024

The humus content has a decreasing trend (figure 18) and is 2.1% lower in the first 20 cm of the profile analyzed in 2024 compared to the profile analyzed in 2000. In this case too, a similarity can be observed between the values recorded at a depth of 60 cm of the 2000 profile with those recorded in the first 20 cm of the 2024 profile.

In the case of soils located on slopes, a criterion for assessing the influence of erosion on the profile is the average humus content. If we follow the humus reserve (table 4) at a depth of 40 cm, for the three soil types analyzed in 2000 and 2024, we find that in the anthrosol-calcareous and in the phaeosol-pellic-calcareous, the humus reserve increases by 18 t ha-1 in the analyzed interval, and in the chernozom-argic it decreases by 67 t ha-1.

Table 4. Humus reserves (t ha-1) at a depth of 0 - 40 cm

Soil type and subtype	Humus reserves (t ha-1)		
	2000	2024	Difference
Antrosol-calcaric	55	73	+ 18
Faeoziom-pelic-calcaric	107	125	+ 18
Cernoziom-argic	133	66	-67

The anthrosol-calcareous resulted from the execution of terracing works, when the initial soil profile was modified. Over time, the terraces were naturally grassed, surface erosion was reduced, favoring the accumulation of humus in the first 40 cm.

The phaeosium-pelic-calcareous located on the right slope of the watershed was like hayfield before 2000. In this case, the grassy vegetation that covered the soil throughout the vegetation period, protected it against erosion and produced an increase in humus content.

The argic chernozem, located on the left slope of the watershed, used as arable and not protected against erosion during the studied period. In this case, a significant amount of humus is lost, along with the 7.9 m3 ha-1 year-1 soil.

In conclusion, in soils located on slopes, naturally or anthropogenically grassed, they preserve their profile and main properties (or are modified in a positive sense), the bioaccumulation processes proceed in the sense of accumulating organic matter in the upper part of the profile, although the last years have been dry from a climatic point of view.

CONCLUSIONS

The pedological studies were carried out in the Valea cu Drum hydrographic basin located on the right slope of the Slănic stream in Buzău County.

- Three soil types were studied: anthrosol-calcareous, phaeosiom-pelic-calcareous and chernozem-argic.
- The data obtained in 2024 were compared with the data from 2000.
- The climatic parameters in 2024, such as precipitation and air temperatures, present numerous particularities: the total amount of precipitation falling during the vegetation period in 2024 is 74.3 mm lower than that in 2000, values that characterize a dry year from a climatic point of view.
- For the three types of soil analyzed, the following were followed, by comparison in 2000 and 2024: granulometric composition, reaction, carbonate and humus content.

-The anthrosol-calcareous profile was located in the upper third of the terraced left slope, on the platform of the T2 terrace in the clearing, and has the profile: Aho-Ck.

- The phaeosium-pelic-calcareous profile was located on the right slope of the watershed with hay use, having the profile: Amtk-ACk-Ck1-Ck2. The soil is slightly eroded.
- The chernozem-argic profile was located on the left slope of the watershed and has the profile: Aom-AB-Bt1-Bt2-C. the soil is moderately eroded.
- The texture of the anthrosol-calcareous is clayey loam, the clay content in the first 20 cm of the profile analyzed in 2000 is 33.8% and 32.5% in 2024, so the textural class does not change, the reaction is weakly alkaline in the first 20 cm, the humus content increases from 1.1% in the first 20 cm of the profile analyzed in 2000, to 1.68% in 2024.
- The texture of the phaeozem-pelic-calcareous is loamy clay in the first 80 cm of the soil profiles analyzed in 2000 and 2024, clay has a slightly decreasing trend from 50.8% in the first 20 cm of the 2000 profile, to 49.9% at the same depth of the 2024 profile, the reaction is weakly alkaline, the carbonate content decreases by 3%, the humus content decreases by 1.6% in the 2000 and 2004 profiles.
- In the argic chernozem, significant changes in the granulometric composition are observed, the clay content in the first 20 cm of the profile analyzed in 2004 is 33.2%, it is approximately the same as that at a depth of 60-80 cm of the profile analyzed in 2000, the reaction is weakly alkaline throughout the entire profile analyzed in 2000 and weakly acidic in the first 100 cm of the profile analyzed in 2024, pH values indicate soil acidification at that depth, the humus content is 2.1% lower in the first 20 cm of the profile analyzed in 2024 compared to the profile analyzed in 2000.

-The humus reserve at a depth of 40 cm, in the anthrosol-calcareous and in the phaeosol-pelic-calcareous, increases by 18 t ha-1 in the analyzed interval, and in the chernozom-argic it decreases by 67 t ha-1.

- In soils located on slopes, naturally or anthropogenically grassed, they preserve their profile and main properties (or are modified in a positive sense), the bioaccumulation processes proceed in the sense of accumulating organic matter in the upper part of the profile, although the last years have been dry from a climatic point of view.

REFERENCES

Akhtaruzzaman, Md, Md Enamul Haque și Khan Towhid Osman. (2014). „Morphological, physical and chemical characteristics of hill forest soils at Chittagong University, Bangladesh”. *Open Journal of Soil Science*. https://scholar.google.com

Amundson, Ronald, et al. (2015"Soil and human security in the 21st century." *Science* 348.6235): 1261071. . https://scholar.google.com

Damene, Shimeles, Lulseged Tamene, and Paul LG Vlek. (2012): "Performance of farmland terraces in maintaining soil fertility: A case of Lake Maybar watershed in Wello, northern highlands of Ethiopia." *Journal of Life Sciences* 6.11 1251. https://scholar.google.com

Dumbrovský, M., Sobotková, V., Šarapatka, B., Chlubna, L., & Váchalová, R. (2014). Cost-effectiveness evaluation of model design variants of broad-base terrace in soil erosion control. *Ecological engineering*, *68*, 260-269. https://scholar.google.com

Ene Alexandru, Radu Alexandra-Teodora, *(2000) Impactul lucrărilor antierozionale asupra solurilor din zona colinară a bazinului hidrografic Slănic-Buzău, Editura Bren.*

Galindo, Víctor, et al. (2022) "Land use conversion to agriculture impacts biodiversity, erosion control, and key soil properties in an Andean watershed." *Ecosphere* 13.3: e3979. https://scholar.google.com

Micu, M. M., Dinu, T. A., Fîntîneru, G., Tudor, V. C., Stoian, E., Dumitru, E. A., ... & Iorga, A. (2022). *Schimbările climatice - Între „mit și adevăr" în percepția fermierilor români. Sustenabilitate, 14, 8689.* https://agronomyjournal.usamv.ro/index.php/scientific-papers/guide.

Panagos, Panos, et al. „New assessment of soil loss through water erosion in Europe(2015)". *Environmental science & policy* 54: 438-447. . https://scholar.google.com

Papiernik, SK și colab. (2007) „Caracterizarea profilelor de sol într-un peisaj afectat de aratul pe termen lung." *Soil and Tillage Research* 93.2: 335-345. https://scholar.google.com

Podhrazska, J. et al. (2022). The Effects of Long-Acting Water Erosion on the Hydro-Pedological Characteristics of Chernozems. *Agronomy,* 12.10: 2574. https://scholar.google.com

Quinton, John N., Lena K. Öttl și Peter Fiener. (2022) „Ararea terenului exacerbează vulnerabilitatea culturilor de cereale la secetă." *Nature Food* 3.6: 472-479. https://scholar.google.com

Radu, A. T. (1998). *Changes in the properties of the soil as a result of the application of works to combat soil erosion on the agricultural lands in the Slănic-Buzău hydrographic basin, PhD Thesis, USAMV Bucharest*

Radu, A. T. et al. (2009). The phizsical and hidrophisical properties of the erodes and the subtype of erodes soil from the Slănic hidrographic basin, Buzău county. *Analele Universității din Craiova-Agricultură, Montanologie, Seria Cadastru,* 39.1: 460-464. https://scholar.google.com.

Radu, A. T. et al. (2010). Studies on the modifications of physico-chemical attributes of arable lands from the water catchment area Valea Harboca, located on the left slope of Slanicul de Buzau, compared with the standard profile. *Scientific Papers-University of Agronomic Sciences and Veterinary Medicine Bucharest. Series A, Agronomy,* 53: 67-72. https://agronomyjournal.usamv.ro/index.php/scientific-papers/guide

Radu, A. T. et al. (2010). Studies on the modifications of physico-chemical attributes of arable lands from the water catchment area Valea Harboca, located on the left slope of Slanicul de Buzau, compared with the standard profile. *Scientific Papers-University of Agronomic Sciences and Veterinary Medicine Bucharest. Series A, Agronomy,* 53: 67-72. https://agronomyjournal.usamv.ro/index.php/scientific-papers/guide

Radu, A. T., & Burcea, M. (2023). The study of erosion processes in the hilly area of Buzău County (Romania) in the specific climatic conditions of year 2022. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 23*, Issue 3, 756-767. https://scholar.google.com

Radu, Alexandra Teodora, and Mariana Burcea. (2024)" Losses of soil thirough erosion to the cernozem subtype argic from the perimeter of the stațion for study of soil erosion located in the hill area of Buzău county, Romania în 2023". *Scientific Papers. Series A. Agronomy* 67.1. https://scholar.google.com

Somasundaram, J., et al. "Soil properties under different land use systems in parts of Chambal region of Rajasthan." *Journal of Agricultural Physics* 13.2 (2013): 139-147. https://scholar.google.com

Somasundaram, J., et al. (2013"Soil properties under different land use systems in parts of Chambal region of Rajasthan." *Journal of Agricultural Physics* 13.2): 139-147. https://scholar.google.com

Wei, Wei, et al. (2019): "The effects of terracing and vegetation on soil moisture retention in a dry hilly catchment in China." *Science of the Total Environment* 647 1323-1332. https://scholar.google.com

Yan, Yue, et al. "Effects of grain-forage crop type and natural rainfall regime on sloped runoff and soil erosion in the Mollisols region of Northeast China." *Catena* 222 (2023): 106888. https://scholar.google.com

Zhang, Zhongqi, et al. (2011) "Effects of prediction methods for detecting the temporal evolution of soil organic carbon in the Hilly Red Soil Region, China." *Environmental Earth Sciences* 64: 319-328. https://scholar.google.com