THE CLIMATIC ASPECTS IN THE NORTH OF THE CRAIULUI FOREST MOUNTAINS AND THE ASSESSMENT OF THEIR CONSEQUENCES ON SOIL CHARACTERISTICS

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RESEARCH ARTICLE

The Pădurea Craiului Mountains are a distinct branch of the Apuseni Mountains, being located in the northwestern part of this mountain massif. They are bordered by the Beiușului Depression, the Vad-Borod Depression and the Western Hills, which separate them from the main body of the Apuseni. The Pădurea Craiului Mountains represent the west part of the Western Carpathians and reach the maximum altitude of 1024 m at the top of Hodrâncușa, while the highest peak of the Apuseni is represented by the peak of Bihor, which reaches 1849 m.
The thermal changes and the level of precipitation have a particularly important role in influencing soil characteristics. During the years 2019, 2020 and 2021 we carried out a detailed analysis of the evolution of the temperature and the level of precipitation in The Pădurea Craiului Mountains area. The processed data were provided by the Banat-Crișana Regional Meteorological Center in Timișoara, the main source being the meteorological station in Borod, the closest to the studied area.
The change of temperatures and amounts of precipitation in a short period of time, in a certain region, and their impact on the basic characteristics of the soil are the subjects addressed in this study. We will not neglect the tourism-climatic potential of the area, including the underground with remarkable properties caused by climatic conditions, which transform The Pădurea Craiului Mountains into a significant tourist destination.

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INTRODUCTION

The Pădurea Craiului Mountains range is a distinct branch of the Apuseni Mountains, located in the northwestern part of this mountain massif. Surrounded by the Beiușului Depression, the Vad-Borod Depression and the Western Hills, being separated from the main body of the Apuseni. Characterized as the western part of the Western Carpathians, these mountains reach the maximum altitude of 1024 m at the top of Hodrâncușa, while the highest height of the Apuseni is the peak of Bihor, which reaches 1849 m. From an administrative point of view, this area is located in Bihor County, covering approximately 1150 square km, which represents approximately 15% of the total area of the county.

The Pădurea Craiului Mountains, together with the Plopiș, Meseș, Zărand and Codru-Moma Mountains, represent the western ends of the Apuseni Mountains, proposed by T. Rusu to be included in the so-called Peninsular Apuseni group (Ionel Novac, 2006), due to their genesis and evolution similar. The Apuseni Mountains, in turn, are a branch of the Western Carpathians. The name Carpathians comes from the Illyrian-Thracian word "karpate", which refers to the rocky features of the mountain regions. Also, this toponym is related to the population of free Dacians - the Carpi, who lived outside the territories conquered by the Romans. The term "Carpathians" was first recorded by Ptolemy, and in the 16th century it was taken over by Mercator under the name Carpathus Mons. The Pădurea Craiului mountains are delimited by the Crișul Repede and Crișul Negru rivers, being surrounded by the Vlădeasa and Bihor massifs, and extend in the north to the Oradea-Bratca depression area, and in the south they are bordered by the Beiuș Depression. To the west, it comes into contact with the Tășadului Hills. This mountain unit is characterized by a pronounced relief, mostly composed of Mesozoic limestones, with peaks rarely exceeding 1000 meters, the highest being Hodrânguşa (1027 m), descending to the west and south to approximately 400 meters.

The boundaries of The Pădurea Craiului Mountains are clearly defined, with certain

geographical elements associated with each other, with the northern limit being marked by the Vad-Borod Depression, and to the south they extend to the Tăşadului, Holodului and Beiuş Depressions. In the eastern part, they overlap tectonically with Valea Iadei through the Remeţi graben. These delimitations were established by Teodor Rusu and were accepted by B. Onac in 2002 and I. Novac in 2006.

MATERIAL AND METHOD

The unique character of these mountains in the Western Carpathian region is due to the great diversity of geological formations: crystalline rocks such as schists with granite, limestones from the Mesozoic, conglomerates and sandstones from the Triassic and Permian, andesites and pyroclastites from the Neogene, and at their edges there are even layers sedimentation from the Miocene. This peculiarity of the relief led to the appearance of the karst phenomenon, which is a distinctive feature of this region. The sinking process of the Badenian period led to the formation of some high relief forms, mainly due to the depressions in the Crişului Repede area. Sharp fragmentation and vertical erosion have resulted in average elevations of about 700-800 meters, giving them the appearance of higher hills, with higher elevations only in certain places (1027 m). The transition to the lower areas is made through Piedmont glaciations and Piedmont terraces according to the studies of Grigor P. Pop from 2000. The region is presented in the form of a horst, with 83% of the surface covered by Mesozoic limestones, the rest being made up of crystalline schists, subhercynian magmatites , Permian sandstones and conglomerates. Exokarst features include sinkholes and depressions, as well as karst plateaus and outcrops. The climate and the composition of the rocks contributed to the formation of deposits of bauxite, refractory clay and raw materials for the production of binders. The relief is characterized by fragmented platforms in peaks and isolated massifs in the form of apples. In the western part of the region, Valea Iadului is distinguished by a narrow and high summit, with peaks such as Măgura Beiuşele (1004 m), Hodrânguşa (1027 m) and Dealul Boţii (968 m). In the center of the massif there is an extensive, strongly fragmented surface with smaller hills and peaks, such as Culmea Ponoraşului (858 – 825 m), Rujet Hills (844 m), Cărmăzan (851 m), Roşiorului (750 m) and Crucii Hill (722 m). Below these formations is the Zece Hotare plateau, located at an altitude of 600-700 meters, with interfluves that descend to Bucuroaia, Vârciorog, Crişul Repede and Crişul Negru, up to approximately 500-400 meters. On the calcareous rocks of the karst plateaus Damiş, Zece Hotare, Vărciorog, a complex karst relief was formed, with uvales, sinkholes, karst depressions, caves and avens. In this region, 680 caves have been identified, with a total length of over 105 km, among which the following caves stand out: Vântului, Vadu Crişului and Meziad.

The present study stops with the analysis in the north of the Pădurea Craiului Mountains, it starts from the area of the Zece Hotare plateau, continues with Roşiorului hills, Dâmbul Nuchii and Oarzăna hills up to the area of the village of Călăţea., an area where the climate and the composition of the rocks contributed to the formation of clay deposits (Dealul Cărmăzan) and of bauxite in the area of the villages of Zece Hotare, Tomnatic and Călăţea.

RESULTS AND DISCUSSIONS

Regarding the climatic aspects, the montan area of the Pădurea Craiului falls under the moderate climate conditions of Romania, with a variety of natural landscapes that change during the seasons, favorably influencing the tourism industry. The combination of the country's temperate-oceanic and continental climates helps moderate the negative aspects associated with these two types of climate (such as dense fog and heavy rains for the oceanic climate, and wide temperature variations and cold waves for the continental climate). Also, the specific climate of these lower mountains, having altitudes below 1000 meters, does not allow a clear differentiation of climatic zones as in the case of higher mountains.

The climate in the Pădurea Craiului Mountains region is influenced by geographical factors such as relief and latitude, causing significant variations in temperature and precipitation. The average annual temperature is between 9 and 11°C, falling within the average annual temperatures of Romania, which vary from 8.5-9°C in the south to 11°C in the northern part of our country, and each increase of 1000 meters in altitude brings a decrease of about 6 degrees Celsius. The average temperature of the three years (2019, 2020 and 2021), in the studied area, is 10.63°C. The average annual rainfall decreases

progressively from west to east, reflecting the diminishing oceanic and Mediterranean influences. The average annual rainfall in Romania is 637 mm, with higher values in the mountainous areas (1,000 - 1,400 mm/year) and lower in the east, below 500 mm/year in Bărăgan and below 400 mm/year in Dobrogea and the Danube Delta. In the studied area located in the Pădurea Craiului Mountains, the average precipitation during the analyzed period (2019, 2020 and 2021) was 709.3 mm/year. The meteorological data for the years 2019, 2020 and 2021, in the area of interest, come from the Banat-Crişana Regional Meteorological Center in Timişoara, which uses the information collected from the Meteorological Station in Borod, the closest to the analyzed area, because the weather station in Zece Hotare is no longer operational.

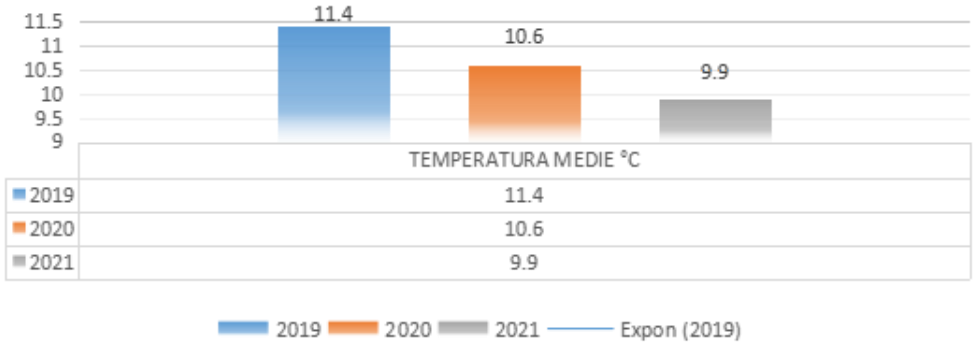


Figure 1. **Temperature evolution, annual averages (2019, 2020, 2021), The Pădurea Craiului Mountains** (source: Banat-Crișana Regional Meteorological Center)

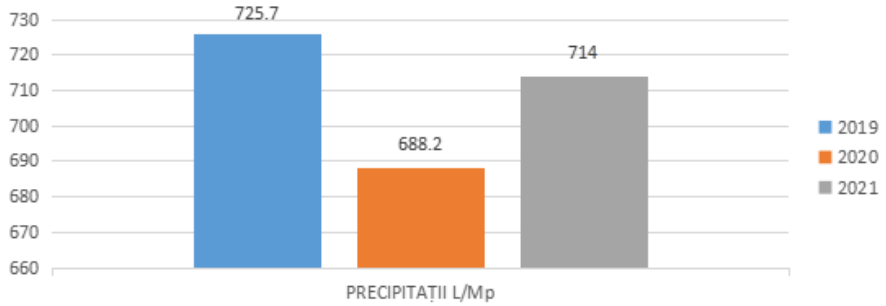


Figure 2. **Precipitation evolution, annual averages (2019, 2020, 2021), The Pădurea Craiului Mountains** (source: Banat-Crișana Regional Meteorological Center)

During the three years analyzed, there was a decrease in the average annual temperature by 1.1 degrees Celsius. Thus, in 2019, the average annual temperature was 11.4 degrees Celsius, in 2020 it dropped to 10.6 degrees Celsius, and in 2021 it reached the value of 9.9 degrees Celsius. This represents a 15% decrease in temperature over the three years.

Regarding the amount of precipitation, it is noted that in 2019 it was 725.7 liters/m2, in 2020 it decreased to 688.2 liters/m2, and in 2021 there was an increase to 714 liters/m2.

The analysis shows that both temperature and precipitation fall within the annual averages, with no significant differences. This situation, together with the favorable soil factors and the absence of pollution in the studied area, contributes to a harmonious growth of plants from the spontaneous flora, which is reflected in the superior quality of the products compared to other regions.

The analyzes carried out on the soil at OSPA Bihor, in three different points both in terms of altitude and area, revealed the fact that the soil has a fine texture, having in its composition both medium clay, loamy clay and clay-dusty soil. For soil analyses, three agro-chemical samples were collected, at a depth of 5-25 cm. The first point for soil analysis was installed at the foot of Roşiorului Hill, in the area called Bradea by the locals, the second point for analysis was established at the point called Drumul Aştilenilor located at the foot of Oarzăna Hill and the third point was installed at

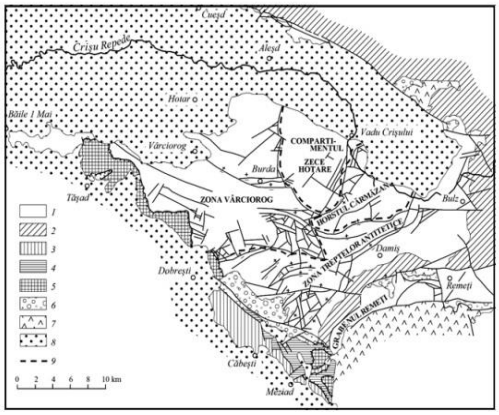
Pancului bridge at the confluence Cornetu hill with Mniera stream.

Table 1

The synthetic situation of the agrochemical samples (analyses carried out by OSPA Bihor)

The studied territory: village ***TOMNATIC and*** *village* ***CĂLĂȚEA***

.Crt.nr.	Name parcel of fertilization	Samples agrochemical on the plan		pH (H_2O)	Al	Ah	SB	V%	H%	IN	Azote total %	P_{AL}	K_{AL}	Fixed rezidue	Other assays					
															Nitrates		Texture			
		Agrochemical samples	Depth cm.		ml. la 100 g. sol							ppm			N-NO3	N-NH_4	Ng	Nfin	Praf	Arg.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Bradea	1	5 – 25	5,25	0,6	8,8	6,0	40,5	9,57	3,9	0,479	29	200	0,017	50,8	5	29,6	24,1	24,2	22,1
	The Aștilenilor Road	2	5 – 25	8,15	-	-	-	-	2,49	-	0,125	6	130	0,044	14,6	8,5	10,3	10,0	39,5	40,2
	The Pancului Bridge	3	5 – 25	7,9	-	-	-	-	6,88	-	0,344	9	360	20,030	14,1	14,1	5,7	18,2	21,0	55,1



Schița structurală a Munților Pădurea Craiului (după harta geologică 1:200.000, foaia Șimleul Silvaniei, cu completări după date inedite ale lui D. PATRULIUS, din V. IANOVICI et al., 1976).
Autohtonul de Bihor:
1 - formațiuni sedimentare permo-mezozoice;
2 - formațiuni cristaline.
Sistemul Pânzelor de Codru;
3 - Pânza de Vălani;
4 - Pânza de Finiș;
5 - Pânza de Arieșeni.
Formațiuni post-tectonice:
6 - depozite neocretacice (facies de Gosau);
7 - magmatite subhercinice și laramice;
8 - depozite neogene;
9 - limita unităților din cadrul Autohtonului.

Following the soil analyses, we have the following results: Bradea: medium texture - medium clay (LL); Aștilenilor Road: fine texture - clay-dusty loam (TP); Pancului bridge: fine texture: - loamy clay (AL). According to Iancu Orăseanu, in the Karst Hydrogeology of the Apuseni Mountains, the researched area is one with Permo-Mesozoic sedimentary formations, bordered by the Mniera valley fault and the Carmăzan horst.

Fig. 3 **Structural sketch of the Pădurea Craiului Mountains** (Source: I Orășanu, 2016)

CONCLUSIONS

We have four soil categories in the studied area, primarily due to pedogenetic conditions. The first category of soils is intrazonal or lithomorphic soils. The second category of soils is represented by luvisols, usually superimposed on a layer of limestone and dolomites, from the Middle and Upper Jurassic, together with Cretaceous formations (limestone, bauxite) belonging to the Bihor Unit. The third category of soils is represented by cambisols. The last category of soils is represented by undeveloped soils, lithosols. The mining operations continued by the massive deforestation led to the change of the structure of the relief, through the appearance of anthropic forms of relief. The traces left by the older bauxite mining and the new clay mining are known (the latter led to the change of the structure of an important part of the Carmăzan hill). Through the washing of the soil left by the exploitations by the meteoric waters, a landscape is created with flats, even desert, and the penetration of the infiltration water is blocked underground (NOVAC, I, 2006). We can conclude that in the analyzed area the soil is the result of the synergistic evolution of the rocks in the substrate, of the vegetation, of the water but also of the superficial deposits under the particular influence of the topoclimates and the climate in general. These are a geographical symbiosis of the links between the autrophic components with the biotic and abiotic.

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