GEOMORPHOLOGY AND PEDOCLIMATIC CONDITIONS OF MĂRU LOCATION, CARAȘ SEVERIN COUNTY

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Abstract. *The aim of the work is the geomorphological, pedological and climatic characterization of the Măru locality in Caraş Severin county, an area famous both for its natural landscapes and its geomorphology. The methods used are based on a series of own observations, along with studies and research provided by Zăvoi City Hall, OSPA Caraş Severin and local residents. To characterize the climate, we used the weather data from the Caransebeş Station. In the case of the present study, numerous field trips were carried out, observations and comparisons were made with previous studies carried out by various researchers, which led to the following results: from a geomorphological point of view, the relief of the area is characterized by a great variety of forms, represented by mountains 65.4%, depressions 16.5%, hills 10.8% and plains 7.3%; from the pedological point of view, the soils are arranged in altitude steps, depending on the relief and climate, which determines the zonal character. In the high area (mountain area), we find districambosols, in the lower area, eutricambosols and luvosols, and in the Bistra valley, alluviosols. From a climatic point of view, the area is characterized by the circulation of Atlantic air masses that give a moderate character to the thermal regime. In the summer months, average temperatures are increasing, but without significant jumps from one month to the next, compared to the spring months, when there is a sudden and progressive increase in average temperatures. In the higher area, the winters are relatively harsh. Autumn is warmer than spring by about 1ºC in the lowlands and over 3ºC in the mountains. The climate is characterized by average annual temperatures varying between 11º-12ºC, the multiannual average amount of precipitation being around 600-750 mm.*

Key words: *geomorphological conditions, pedoclimatic conditions, soils, Măru*

INTRODUCTION

Heat or thermal resource has an extremely varied manifestation in time and space and a relatively easy to represent and demonstrate influence on the growth and development of plants. The primary factor of vegetation, the thermal resource divides geosystems into isothermal portions, within which the accumulation, in a certain period of time, of a sum of degrees of average, maximum or minimum temperatures, which define the conditions for survival and development of different plant species. Like all other vegetation factors, the thermal factor acts associated with a series of other factors: relief, slope, exposure etc. (VRÎNCEANU, CALCIU I., 2000).

Each area, region or other portion of land more or less extended vertically and/or horizontally has a specific range (sometimes very wide) of thermal situations, with multiannual average or absolute average differences. This range of situations directly influences production capacity, excluding even culture or use if the condition is totally restrictive. As such, in the Romanian credit rating methodology, the only factor that can exclude one culture or another from a certain area is the thermal resource, which cannot be effectively and economically intervened in order to change and improve it (IANOȘ, GH., BORZA, ET AL., 1992, 1997)

The water resource of atmospheric origin, i.e. the amount of precipitation during a year or in different intervals of the year ensures the development of the vital processes of the plants, the possibility of synthesis of plant matter and finally, the level of harvests. The natural water resource may be greater or less in relation to the uses or plants we are considering. This factor has the possibility to be parameterized in relation to the biometric characteristics and the harvest (MIHUȚ, C., NIȚĂ L., 2018). In order to single out the effect of the water resource, it was necessary to isolate it by choosing those cases in which the precipitation was variable, and the thermal and edaphic resource was constant. Extrapolating the research of different authors on the influence of hydrothermal conditions on the globe or of D. Teaci in Romania (DAVID, G., ŢĂRĂU, D., ŞANDOR, C. I, NIȚĂ, L., 2018).

Unlike the thermal source, the water source, once it reaches the surface of the land, can accumulate in the soil and then spend during the vegetation period. However, the way of storage and release is different from one soil to another, from one plant to another. Because of this, studying the actual effect of precipitation on harvests is very difficult (OKROS, A., ET AL., 2019; ROGOBETE, GH., IANOS, GH., 2012).

The current methodology for the qualitative assessment of agricultural land uses the thermal resource as a multi-year average, which it corrects according to the slope of the land and the permeability of the soil, a method which, for scales equal to or smaller than 1:10 000, seems to be considered good for now (RĂUȚĂ, C., CÂRSTEA, S., 1993; RĂUȚĂ, C., 1995).

Later, the concept regarding the influence of the water resource as well as the entire range of climatic influences was modified, crystallizing a new vision on the possibility of determining the effect of major climatic factors (PASCU, R., M., 1983)

The results of research in the field of soil science obtained in the last decades, particularly numerous, are very important for the improvement of plant cultivation technology and aim at directing the process of plant nutrition, controlling the state of fertility and pollution, through the physical and chemical analysis of the soil and the plant, etc. (ȘMULEAC, L., ET AL., 2020; SOFO, A., ZANELLA, A., PONGE, J.-F., 2019).

From the point of view of their functionality, the elements of the natural environment, compared to cultivated plants, are divided into environmental conditions and vegetation factors.

MATERIAL AND METHODS

The objectives targeted in the paper refer to: the characterization of the natural setting, where I made a presentation of the area from a geographical, geological, hydrographic, hydrological and climatic point of view; characterization of relief, geology, presentation of specific soils and their distribution; the climatic conditions, the hydrographic network, with the description of the main rivers and their tributaries, the flora, vegetation and fauna dominant in the studied area (MIRCOV, V. D., ET AL., 2021).

For the preparation of the work, data obtained both from field observations and data taken from previous researches, ASPA Caraș Severin and Zăvoi City Hall were used.

I made a series of field trips, after which I was able to make a series of observations. I compared these observations and studies with previous studies carried out by various researchers and with those provided by OSPA Caraș Severin and Zăvoi City Hall, but also with data obtained from local residents.

RESULTS AND DISCUSSIONS

The village of Măru belongs to the commune of Zăvoi, which is located in the corridor of Bistrei, in the county of Caraș-Severin, respectively in the extreme south-west of Romania. It is bordered to the north-west and north by Timiş county, to the north-east by Hunedoara county, to the east by Gorj county, to the south-east by Mehedinţi county, to the south by the Danube and to the south-west by Serbia and has an area of 8520 km2, representing 3.6% of the country's surface, being the third largest county in Romania, after Suceava and Timiș counties.

This area offers the county a natural setting of great complexity and variety (ŢĂRĂU, D., LUCA, M., 2002).

The commune of Zăvoi is bordered to the north by the commune of Rusca Montană, to the east by the communes of Marga and Băuţar, then by the counties of Hunedoara and Gorj to the southeast, to the southwest by the commune of Teregova, to the west by the communes of Bolvaşniţa, Turnu Ruieni, Obreja and the town Steel-Red (figure 1.). The commune is made up of six localities: Zăvoi, Măgura, Măru, Poiana Mărului, Valea Bistrei and Voislova. The village of Măru is located along the Bistra river, at DJ 683 towards Poiana Mărului at a distance of about 7 km from the commune residence (ŢĂRĂU, D., BORZA, I., ŢĂRĂU, I., RACOVICEAN, M., 2005).

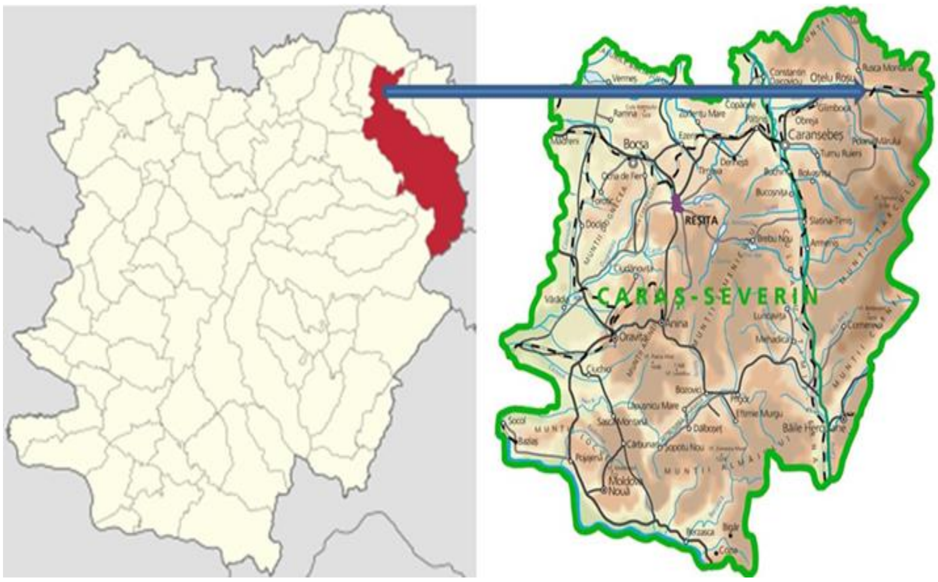

Figure 1. Location of Măru locality at the level of Caraş-Severin county

From a geomorphological point of view, the relief is represented by a wide variety of shapes: plains, hills, depressions and mountains.

From a geomorphological point of view, the locality is located in the depression corridor of Bistra, bounded to the east and southeast by the Ţarcu Mountains, to the north by the Poiana Ruscă Mountains, to the west by the Sacoş-Zăgujeni hills and communicates with the Timiş depression.

From a geological point of view, the youngest formation - the Holocene - stretches across the Bistrai Valley to the downstream of Bucova village, corresponding to the meadow area. In small portions, the Holocene is also found in the lower reaches of the Bistra Mărului, Rusca and Niermeş-Marga rivers. In the western part, Miocene formations join (the Sarmatian, on the right side and the Tortinian, on the south side). South of the Bistrei Valley stretches a vast area of crystalline shale limited to the west by the Bistrei Mărului Valley. To the east of the upper course of the Bistra and to the south of the valley of the Peceneaga stream.

Sedimentary formations appear in hilly peripheral areas and in sedimentary basins. Within these formations, two main associations of rocks with different effects on the modeling of the relief can be distinguished: strongly consolidated rocks, represented by Jurassic limestones, conglomerate sandstones and Cretaceous marls, and weakly consolidated rocks represented by marls and sandy sandstones, sands and gravels of Mio- Pliocene.

Even before the main Mesocretaceous orogenic phases, the series of infragetic sedimentary deposits was deposited over the autochthonous crystalline. The Mesozoic areas of Poienia Mărului are made up of clay shales and black phyllites belonging to this series.

Geologically, the intramontane basin of Bistra was formed in the Neogene by the sinking of the formations along some fault systems. The oldest formations in the area belong to the Cretaceous (Vracovian, Cernomanian, Sennonian), consisting of sandstones, marls, limestones and conglomerates.

Neogene deposits made up of conglomerates, sands, marls, limestones, gypsum follow each other. The succession of Neogene formations ends with the Pannonian deposits placed discordantly over the Tortonian or on crystalline shales. The Pannonian consists of a succession of sandy clays with irregular intercalations of sands, gravel lenses and coal fragments.

The surface geology is represented by Quaternary Pleistocene-Holocene deposits.

The upper Pleistocene is included in the deposits of the upper and lower terrace, made of gravel, sand, and clay.

The accumulations of the low terrace belonging to the Upper Holocene are made of gravel.

Today's appearance of the Bistra Valley is due both to fluvial erosions and to successive captures, which took place in the first part of the Quaternary.

The landscape of the town of Măru is picturesque, thanks to the nearby mountain slopes, the forests and the streams that flow through it towards Bistra. The area has a rocky foundation, generally built of crystalline shale, mica shale and volcanic sedimentary formations.

They are covered by landslides on the slopes and terraces and by coarse alluvium (boulders), and in the valley they are mostly covered by a thin blanket of dusty clay.

The village of Măru is located in this hydrographic valley of the Bistra river and extends over a distance of 2 km, being encrusted in a hilly form with a height between 460 m and 1806 m altitude.

The geo-morphological units to which the village of Măru belongs include the Southern Carpathians with an altitude of up to 2200 m. On the left side of the Bistra river, starting from the boundary of the village of Măgura upstream we encounter a series of hills, glades and peaks, whose altitude is between 533 m and 1800 m (Dâlmai's Beak).

Due to the geographical location of Caraş-Severin County, not far from the Adriatic Sea and sheltered by the Carpathian Mountains, its territory is part of the temperate-continental moderate climate, the Banat subtype, with sub-Mediterranean nuances. This climate is characterized by the circulation of Atlantic air masses that give a moderate character to the thermal regime.

Following the distribution of the average values of the air temperature, a variation of them can be noted depending on the altitude, reaching differences of about 6oC. In the summer months, average temperatures are increasing, but without significant jumps from one month to another, compared to the spring months, when there is a sudden and progressive increase in average temperatures.

Analyzing the average temperatures by season, it is found that the winters are relatively harsh in the mountainous regions (Semenic -4.8ºC, Ţarcu -8.3ºC), while in Caransebeş (0.4ºC) and Oraviţa (0.8ºC) the temperature value is positive. The summer season is generally moderate, compared to the winter: Semenic 12.3ºC, Ţarcu 7.8ºC, the temperature gradually increasing in depressions: Oraviţa (20.1ºC), Caransebeş (20.1ºC). The spring season sets in suddenly in low areas, while in the mountainous region it comes more slowly and with lower temperatures (-1.8ºC in Ţarcu, 2.4ºC in Semenic). Autumn is warmer than spring by about 10C in the lowlands, and by over 3ºC in the mountains. The climate of the Danube Gorge is sub-Mediterranean, characterized by a higher average annual temperature than in the rest of the country: 10-11ºC. So, the average temperature of January varies between 0 and -1.0ºC, and that of July between 21ºC and 23ºC.

The wind regime is in turn influenced by the landforms and the climate of each area, characteristic being the Coşava wind, particularly intense in the western sector of the Danube gorge.

Analyzing the amounts of atmospheric precipitation, we find that they increase in relation to the altitude. The highest amounts of precipitation in the mountainous area are recorded in the months of June and July, and in the lowlands in the months of May and June. The annual average number of days with snow is 35 in Caransebeş, 38.6 in Oraviţa and 103 in Ţarcu.

To characterize the climate, we used weather data from the Caransebeş station.

The climate is characterized by average annual temperatures varying between 11o-12oC, the multi-annual average precipitation amount is around 600-750 mm

The early frost appears in the first decade of October and at the latest in the second decade of March in the hilly area and in September - May in the mountainous area. The average number of days with frost is 87.5 days, the highest being in January (24.5 days).

Fog appears on average 46.5 days with the highest frequency in the months of December - January. The average thickness of the snow layer is 40.5 cm in the area of the settlements and 200 cm in the mountain area.

A meteorological factor that characterizes both the climate and the conditions for the dispersion of pollutants in the area is the wind with its direction, speed and air stratification.

Winds are not important in the area of the Bistra corridor, but the peaks and high plateaus are exposed to the currents that cross the region. At Vârful Ţarcu, northerly winds predominate (18% of cases), and the wind speed here is between 6-10 m/s (35% of cases).

In the lower regions, the dominant direction of the wind is modified by the relief by directing the air currents along the valleys. The predominant wind directions are those from the south-east sector, with a frequency of 27% and from the north-west sector, with a frequency of 11%. On average in the north-west direction, the wind speed is 0.6 m/s and 3.4 m/s in the south-east direction, resulting in a multi-year average of 2.2 m/s. The air stratification is predominantly stable, a situation found in 53% of cases and with an average instability of 31%.

From a climatic point of view, (table 1. and figure 2.) it was characterized as follows:

Table 1.

Climatic considerations (Meteorological Station Caransebeş)

Month / Monthly averages	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	Annual averages
Rainfall (mm)	106.9	13.6	18.6	89.0	53.0	29.1	52.7	44.2	36.7	72.0	76.3	55.6	53.97 Σ 647.7
Temperature (^{0}C)	8.9	7.6	1.9	-2.7	0.7	5.9	12.3	14.1	19.2	21.3	20.2	15.4	10.4
Humidity (%)	88	83	84	91	85	75	72	79	77	75	82	82	81.08
Temperature soil (^{0}C)	9.5	8.9	1.6	-1.7	0.4	6.8	13.5	16.8	25.4	26.6	23.2	18.0	12.41

In the summer months, the average monthly temperatures are between 19.2 and 21.3ºC.

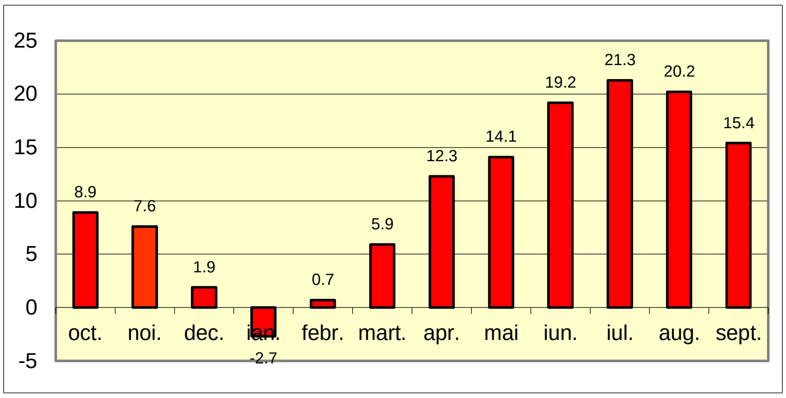

Figure 2. Average monthly temperatures (ºC) in Caransebeş

The average annual air temperature is 10.4ºC, the average monthly temperatures between -2.7ºC (January) and 21.3ºC (July). The maximum is 34.8ºC recorded on July 9 and 22, and the minimum is -19.4ºC recorded on February 13.

Average monthly soil temperatures are between -1.7ºC (January) and 26.6ºC (July).

The average amount of precipitation recorded was 647.7 mm. Precipitation is fairly well distributed over the course of a year (figure 3.).

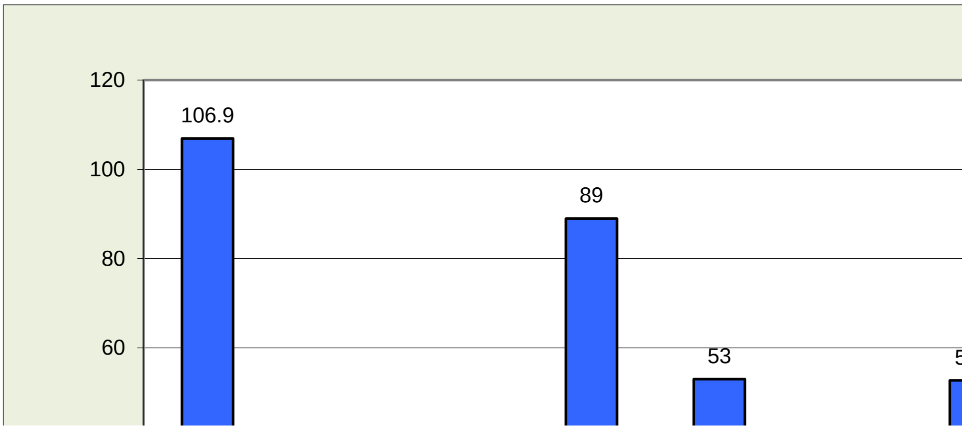

Figure 3. Recorded average monthly precipitation in Caransebeş

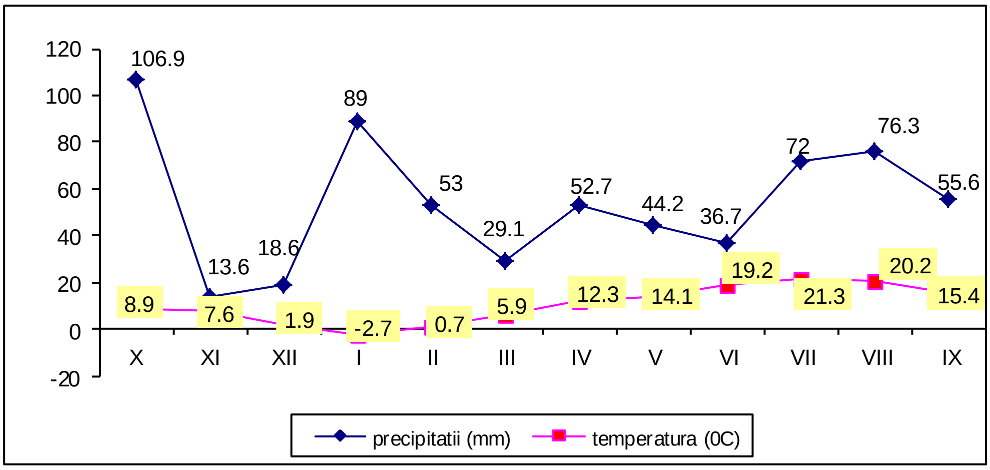

Figure 4. Average monthly temperatures and precipitations recorded in Caransebeş

Air humidity (figure 5.) has values between 72% in April and 91% in January.

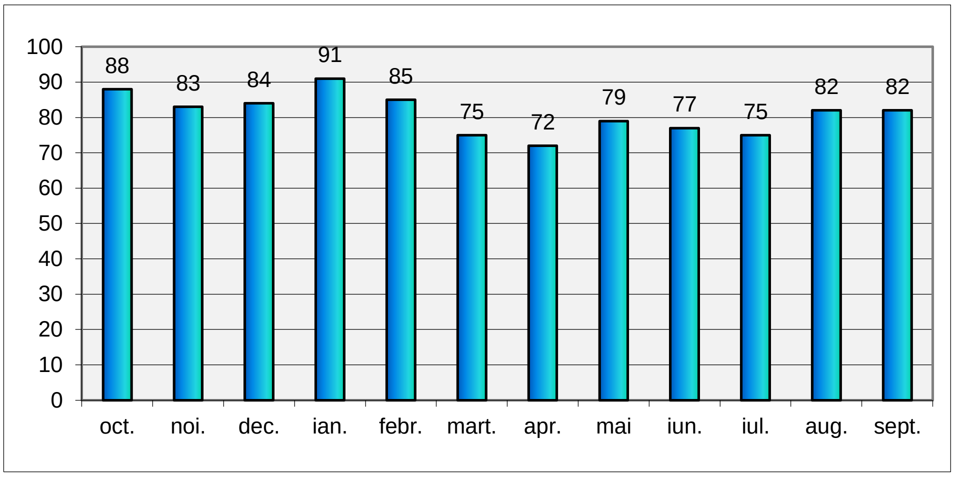

Figure 5. Relative air humidity - monthly averages, in Caransebeş

Average monthly soil temperatures are between -1.7 (January) and 26.6^{0}C (July), with the lowest extreme of -17.6^{0}C, recorded on February 13.

The Bistra basin is included in the following natural units: to the N the Poiana Ruscă massif; to the S it rests on the Southern Carpathian Mountains; to the W it is drawn by the mountain pillars Muntele Mic, Petreanu, the Haţeg piedmonts; to the E is the hydrographic network of the Haţeg Depression developed in the E of the Poiana Ruscă massif.

The main watercourse, which crosses from east to west the commune of Zăvoi, is the Bistra river, the main tributary of the Timiş river. Near the town of Zăvoi, Bistra receives from the left bank its most important tributary, the Bistra Mărului river, which originates under the Şaua Iepii in the Ţarcu massif. Bistra Mărului has an average elevation on the catchment basin of 1162 m, with a total length of 34 km and a catchment area of 275 km2.

The village of Măru is crossed lengthwise by the Bistra river, with more important tributaries on the left: the Balota Stream - springs from under Mount Mic; Bratonea – springs from under Muntele Mic; Sasa - springs from under Vârful Batrânu and Măgulice.

From the point of view of river runoff, the Şucu River and the Bistra Mărului River belong to the high Carpathian type, with basins whose average altitude exceeds 1000 m. The maximum runoff occurs in the spring (approx. 40% of the average annual runoff). The spring waters are followed by floods caused by the rains that fall in early summer. A new increase in flows occurs in the fall.

The features of the relief, the deposition of its units in steps influenced the layering of the vegetation. From the depression region to the mountain ridges, there are several vegetation zones: the area of meadows and cultivated plants, the arboretum area, the area of beech forests.

From the point of view of humidity, xerophytic species predominate. The hydrophilic species of wet biotopes are: Cardamine pratensis, Equisetum palustre, Eriophorum latifolium, Lysimachia vulgaris, Myosotis scorpioides.

From the point of view of temperature, the mesotherm species predominate, followed by eurytherms, microzotherms and moderately thermophiles.

From the point of view of the soil reaction, the euriionic species constitute the most numerous category, and the acid-neutrophil and weakly acid-neutrophil species print the general note of the flora of permanent meadows. Acidophilic species such as Bruckentalia spiculifolia, Cruciata glabra, Genista tinctoria, Hieracium hoppeanum, Hypericum maculatum, Luzula luzuloides, Nardus stricta, Sarothamnus scoparium, Vaccinium myrtyllus, Vaccinium vitis-idaea, Viola canina also appear in the Bistra Valley.

The largest areas are occupied by meadows of furrowed meadow with field grass and red meadow with field grass, which constitute the main associations of meadows replacing forest vegetation.

The forest vegetation is characterized by a hilly layer of gorunets, sedges, a mountain and premontane layer of sedges, a mixed mountain layer, a spruce layer and an alpine layer.

CONCLUSIONS

In the high area of the territory, in the mountainous area, we find districambosols that ensure the development of beech forests and in forests mixed with beech and other species, below we find eutricambosols and luvosols, and in the Bistra valley alluviosols.

Geomorphologically speaking, the relief of this area is represented by a wide variety of shapes: plains, hills, depressions and mountains. The town of Măru is located in the depression corridor of Bistra, and is bounded to the east and southeast by the Ţarcu Mountains, to the north by the Poiana Ruscă Mountains, to the west by the Sacoş-Zăgujeni hills and communicates with the Timiş depression.

Geologically, the youngest formation (the Holocene), stretches in the meadow of Văia Bistrai until downstream of the village of Bucova. These formations are also found in the area of the lower courses of the rivers: Bistra Mărului, Rusca and Niermeş-Marga. To the south of Valea Bistrai, there is a vast area of crystalline shale. Meanwhile, in the hilly peripheral areas, sedimentary formations are found. Within these formations, two main associations of rocks with different effects on the shaping of the relief can be distinguished: strongly consolidated rocks, represented by Jurassic limestones, conglomerate sandstones and Cretaceous marls, and weakly consolidated rocks represented by marls and sandy sandstones, sands and gravels of Mio- Pliocene. A series of sedimentary deposits were deposited over them.

Geologically, the intramontane basin of Bistra was formed in the Neogene by the sinking of the formations along some fault systems. The oldest formations in the area belong to the Cretaceous (Vracovian, Cernomanian, Sennonian), consisting of sandstones, marls, limestones and conglomerates.

Due to the elevation of the relief, the climate and the vegetation, the soils of the Bistra Valley show a zonal distribution with types characteristic of the steppe, silvosteppe, forest and meadow regions.

Today's appearance of the Bistra Valley is due both to fluvial erosions and to successive captures, which took place in the first part of the Quaternary. The landscape of the town of Măru is picturesque, thanks to the nearby mountain slopes, the forests and the streams that flow through it towards Bistra. The area has a rocky foundation, generally built of crystalline schist, mica schist and volcanic and sedimentary formations, i.e. a mixture of metamorphic, sedimentary, precipitation rocks along the Bistra valley and metamorphic, higher up in the alpine and subalpine floor.

They are covered by landslides on the slopes and terraces and by coarse alluvium (boulders), and in the valley they are mostly covered by a thin blanket of dusty clay.

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