

## APPRECIATION OF CHANGING CLIMATIC CONDITIONS, HYDROGRAPHY AND SOIL DISTRIBUTION IN COSTULENI VILLAGE

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### Abstract

The climate of the Republic of Moldova and its Central Region is temperate continental with a transitional character and is formed under the influence of three groups of climatogenesis factors: radiative, dynamic and physico-geographical. Also, the climate of our Republic is characterized by mild and short winters, with little snow, long, hot summers, but with an insufficient amount of atmospheric precipitation, which fall predominantly in the warm period of the year in the form of showers. In this paper will be examined the ecological status of Costuleni locality, Ungheni district. The evaluation and study were carried out according to the standards and normative acts in force for the Republic of Moldova. The research consists in identifying the ecological status of the locality, through observations, comparisons, as well as, data collection, organization and evaluation. Environmental impact assessment - represents the assessment (quantification) of the effects of human activities and negative natural processes on natural elements and factors, ecosystems, human health and safety, as well as on material goods. Various specialized publications, scientific papers, legislative and normative acts, plans and strategies for sustainable development, statistical and activity reports of the Ministry of Environment and State Ecological Inspectorate, as well as those of the Ungheni Ecological Inspection were studied. Ensuring the long-term survival of ecological systems, the main provider of resources on which development and human well-being depend, can only be achieved in the case of sustainable development. Equally important is the role of biodiversity in providing services provided by ecological systems, such as determining soil and climate conditions, water purification, mitigating the effects of natural disasters, etc.

**Key words:** environmental impact, climatic conditions, hydrography, soil, Costuleni village

The state of the environment is one of the priorities and fundamental problems of humanity. At present, humanity is particularly concerned about the danger of depletion of natural resources, the increased risk of pollution and the impact of ecological imbalance on health, the decline in the quality of the environment, the huge stocks of industrial and radioactive waste (Bardhad *et al*, 1980).

The technological transformations of the environment in the post-war years under the influence of the anthropogenic factor have led to various changes with detrimental effects on human health. Thanks to the development of science, new production methods have been developed, cutting-edge technologies that are particularly efficient, but with serious consequences for human health. As there are currently insufficient financial resources to solve environmental problems on a global scale, it is very important that each individual country address these issues as a matter of priority. Environmental protection and rational use of natural resources is one of the global problems of society at the present stage, which

determines not only the level of socio-economic development of the Republic of Moldova, but also the living conditions of the next generation (Болкова, 1992).

The development of production has led to the pollution of the environment, transforming large areas into a disintegrated and sad landscape, as a result of ignoring the requirements, the self-purification capacity of the Earth's natural systems has been established. From the industrial revolution to the present, either from lack of adequate knowledge (Bogdan *et al*, 1975) or from unilateral, immediate interests, natural resources have been ruthlessly exploited and distorted with harmful substances, the effects of which only now, they are fully felt in certain areas of the world.

The basic ecological problem of the Republic of Moldova - the major pollution of the environment, remains quite alarming, even with some attempts to improve the situation in this direction. To some extent, in recent years, soil pollution in the republic has decreased. This is due to the reduced use of pesticides and mineral fertilizers in agriculture. As a result of

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agrochemical mapping, certain areas with "chemical anomalies" of the soil have been established, which are characterized by a high content of fluorine, phosphorus, nitrates. All this, of course, affects the quality of agricultural products and human health. Thus, the soils with an increased concentration of fluorine and phosphorus are widely found in the south of the republic, with the major concentration of copper in the center of the republic, which is the result of the irrational use of fertilizers in agriculture. Major areas of soil with increased amounts of nitrates are observed around animal complexes (Дедю, 1989).

The serious state of the atmosphere in the Republic of Moldova (Звиняцовский, 1993), which is on the verge of ecological catastrophe, requires the development of technically and economically efficient technologies for capturing nitrogen oxides from gases emitted into the atmosphere. Exceeding the limits of the capacity of similarities specific to nature, pollutants easily spread in water, soil, air, developing and propagating one of the most serious dangers (Дедю, 1989) faced by modern civilization. Through his general activity, insufficiently controlled and not entirely adapted to the realities of the environmental nature, man threatens the ecological balance and his very existence on Earth.

The extent and intensity of the exploitation of the Earth's resources in the twentieth century led to significant effects on the major components of the biosphere, namely the atmosphere, soil cover and biodiversity. This was largely due to rapid industrialization, deforestation and urbanization (Danielsen *et al*, 2013).

Ecosystems that are managed to produce food, fuel or fiber or local public infrastructure comprise large proportions of the world's land area, for example, almost half is used for agricultural areas and almost half of the human population lives in urban ecosystems (FAOSTAT, 2014).

As the human population and per capita consumption increase, so does the demand for resources imposed on ecosystems and the effects of the human ecological footprint. Natural resources are vulnerable and limited. The impact of anthropogenic actions on the environment becomes more obvious. Problems for all ecosystems include: environmental pollution, climate change and biodiversity loss. For terrestrial ecosystems, additional threats include air pollution, soil degradation and deforestation. For aquatic ecosystems, threats also include unsustainable exploitation of marine resources (eg overfishing of certain species), marine pollution, microplastic pollution, water pollution, ocean warming (Alexander, 1999).

## MATERIAL AND METHOD

The research object was selected Costuleni village, Ungheni district (*photo 1*). Costuleni village is a locality in Ungheni District located at latitude 47.0780 and longitude 27.9119, with an altitude of 63 meters above sea level. This locality is under the administration of the town Ungheni. Direct distance to town Ungheni is 18 km away. Direct distance to town Chisinau is 106 km away.



Photo 1. Infrastructure of Costuleni locality, from Ungheni district

In this paper will be examined the appreciation of changing climate conditions, hydrography and soil distribution in the Costuleni village. The evaluation and the study were carried out according to the standards and normative acts in force for the Republic of Moldova. The research methods are those studied and mastered in the disciplines of Ecology. The research consists in identifying the ecological status of the locality, through observations, comparisons, as well as, data collection, organization and evaluation.

Various specialized publications, scientific papers, legislative and normative acts, plans and strategies for sustainable development, statistical and activity reports of the Ministry of Environment and State Ecological Inspectorate, as well as those of the Ungheni Ecological Inspection were studied.

## RESULTS AND DISCUSSIONS

Costuleni is a village in Ungheni district, located 18 km from the city of Ungheni, on the Ungheni-Nisporeni road (*figure 1*), and covers 2911 hectares (along with agricultural land, forests and imas).

Costuleni is the only village in the commune of the same name. The residential spaces comprise only 121 ha, the imas have 314 ha, the agricultural land approximately 2000 ha, and the rest of the forest lands.



Figure 1 Presentation of Costuleni locality executed in the ArcGIS program

The village of Costuleni is located along the Prut River, on a slope that is 150 meters away from the river. In the western part, across the Prut, ie in Romania, it borders the village of Prisăceni. A little further south of the last is the Romanian village called Costuleni. in the south and east it borders the commune of Măcărești from Ungheni district at a direct distance of 6 km. In the northeast, the village of Costuleni has as neighbor the village of Brătuleni in Nisporeni district, located at a distance of 8 km, from which it is separated from the Dumbrava forest. To the north it borders the villages of Șicovăț at a direct distance of 3 km and Morenii Noi at a distance of 6 km. In its north-western part, its neighbor is the village of Valea Mare, at a direct distance of 7 km.

The village covers an area of 2997.26 hectares. The residential spaces comprise only 253.93 ha, the agricultural land belongs to 1549.11 ha, the lands destined for industry, transport, telecommunications occupy 40 ha, and the forest lands belong to 685 ha, the Water Fund owns 67 ha of lands, and the Reserve Fund owns 402.22 ha. The roads in the village are 26 km long.

The town has mineral resources such as clay, sand and gravel, which is exploited.

The climate of Costuleni locality from Ungheni district is temperate continental, as in the whole republic. The winter is mild and short, the summer is warm and long, with an average temperature of + 20-25 °C (figure 2). The average annual temperature of the year is positive and oscillates between 5 °C and 7 °C (figures 4-5). The average annual amount of precipitation ranges between 35 and 76 mm (figures 3-6). Thus, in the village of Costuleni a temperate continental climate predominates. The climate is mild, with lots of sun. The average temperature in July is + 21 °C and in January - 4 °C. The village of Costuleni is part of the central agro-climatic region, which is characterized by heat, long duration of vegetation and frost-free period, favorable agro-climatic

conditions for cereals, sunflowers, fruit trees, vines, etc.

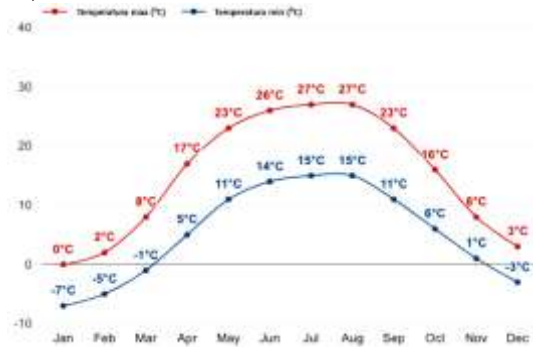


Figure 2 The value of the minimum and maximum annual temperature (°C) on the territory of Costuleni locality (year 2020)

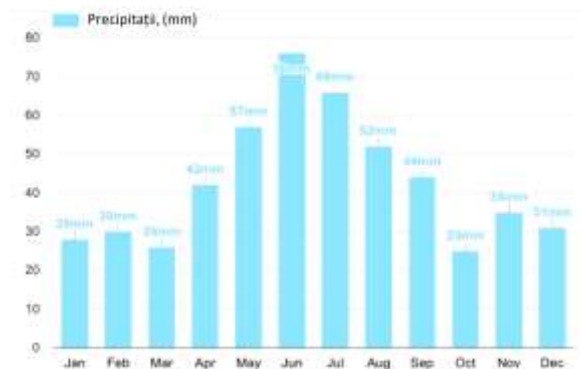


Figure 3 Average annual rainfall (mm) in Costuleni village (year 2020)



Figure 4 Representation of values of temperature, precipitation and average wind speed

The „mean daily maximum” (solid red line) shows the maximum temperature of an average day for every month for Costuleni. Also, the „daily average minimum” (solid blue line) shows the average minimum temperature. Warm days and cold nights (dotted blue and red lines) show the average of the warmest day and the coldest night of each month in the last 30 years. For planning your holidays, you can expect average temperatures, be prepared for warmer or colder days.

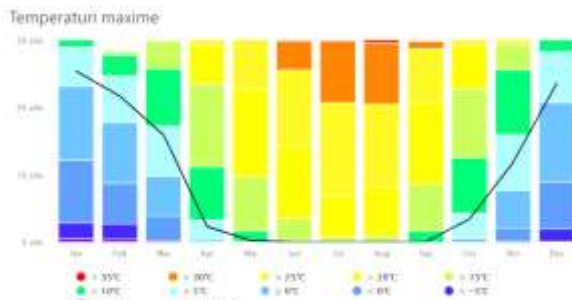


Figure 5 The maximum temperature diagram for Costuleni displays how many days per month reach certain temperatures

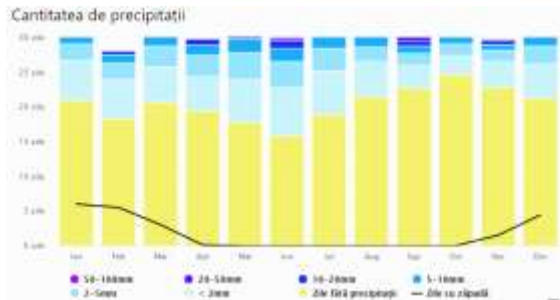


Figure 6 The precipitation diagram for Costuleni shows on how many days per month, certain precipitation amounts are reached

The specific geological structure with numerous tectonic fractures, predominated by loose and porous sedimentary rocks, caused favorable conditions for the wide development of landslides and erosion relief forms, represented by various ditches, ravines, canyons, valleys.

The development of landslides, karst, flat and linear erosion, which greatly affects the region's agriculture, is significantly stimulated by environmentally friendly anthropogenic activities (mass deforestation of forest strips, forests and orchards), uneven distribution of rainfall

throughout the year and the torrential nature of summer rains.

Geological and climatic conditions have favored the development of a fairly dense river network in the region, consisting of rivers and streams with low flows, but very variable over time, with frequent floods, which has contributed to the formation of large valleys, very old and deep, with obviously terraced slopes.

Costuleni is located on the banks of the Prut River 13, the second largest river in Moldova and crossed by the left tributary of the Prut River - Brătuleanca River (figure 7). For example, the multiannual flow of the Prut River in Ungheni can be 83.2 m<sup>3</sup>/sec.

The village has rich drinking water resources, being located in the valley of the Prut River. There are over 100 wells and springs in the locality. But there is also a centralized water supply system. From the analysis of the data processed following the monitoring of the physico-chemical parameters at the wells located in the groundwater, there were exceedances to the total hardness, total mineralization, nitrates and nitrates.

The water pollution index (IPAcc, %) characterizes water, in the vast majority, as being from intensely polluted to medium pollution = 59% (Sandu *et al.*, 2019).

Thus, the presence of water pollution of the left tributaries of the Prut River is demonstrated, especially with chemically degradable substances and their influence on the self-purification and nitrification processes that take place in natural water.

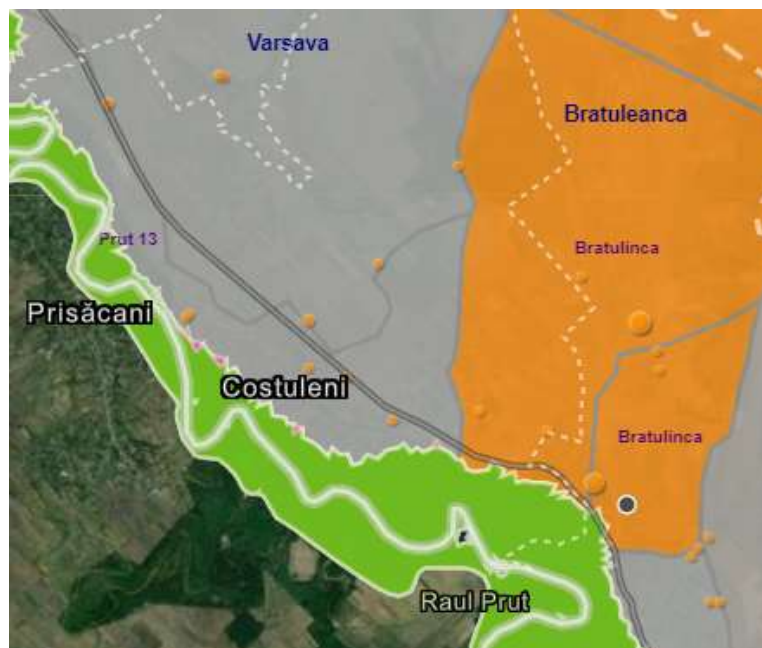


Figure 7 Hydrographic representation from Costuleni locality

The soil is very fertile. About 85% of the soil is chernozem. Eight types of chernozem have been recorded here, most of the soils present are typical and leached. According to the analyzes, the amount of humus in the soil is about 4%. Soil credit varies between 75 and 92 points, being suitable for agricultural crops such as: vines, fruit trees, perennial field crops and others. On the territory of Costuleni locality, the main soil subtypes are: ordinary and carbonate chernozem, alluvial and deluvial soils (figure 8).



Figure 8 Maps of soil distribution on the territory of Costuleni locality

The subtype of the soil was studied in the field. Samples were taken from the genetic horizons of the soil profile, which were analyzed in the laboratory to determine their substantial composition and highlight the physico-chemical peculiarities. Below we present the data obtained for carbonate chernozem (figures 9-14).

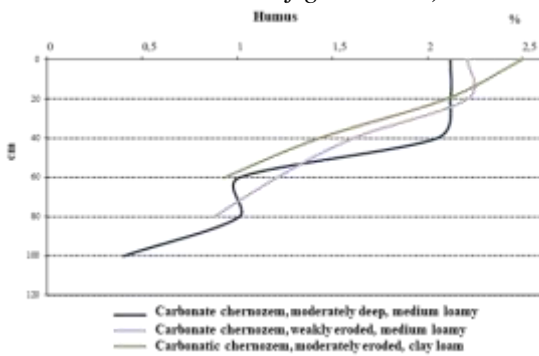


Figure 9 Humus values (%), for carbonate chernozem depending on the degree of erosion

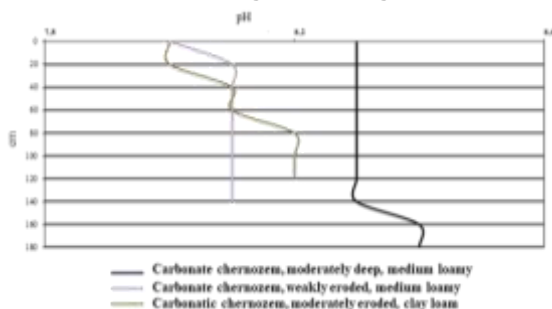


Figure 10 pH values for carbonate chernozem depending on the degree of erosion

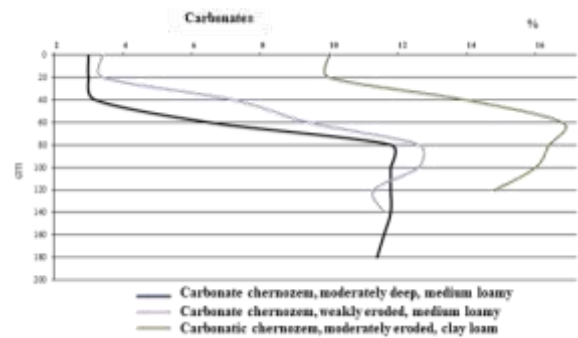


Figure 11. Carbonate values (%) for carbonate chernozem depending on the degree of erosion

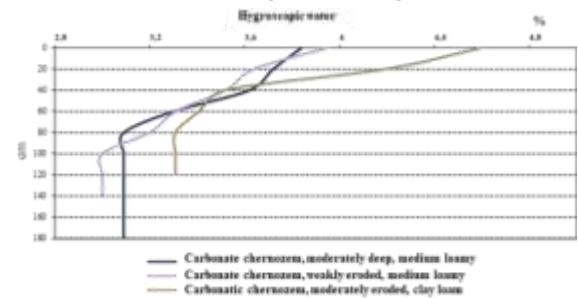


Figure 12 Hygroscopic water values (%), for carbonate chernozem depending on the degree of erosion

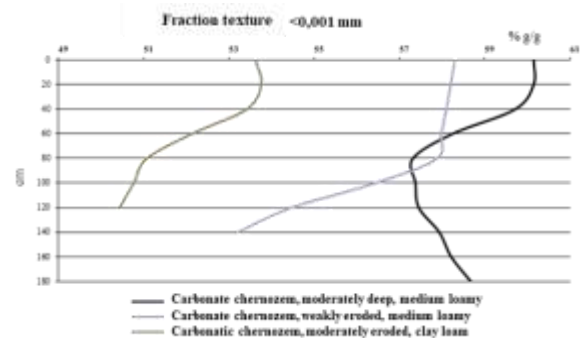


Figure 13 Texture values fraction < 0.001 mm (% g/g), for carbonate chernozem depending on the degree of erosion

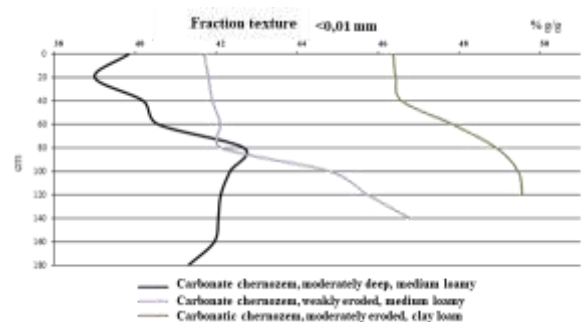


Figure 14 Texture values fraction < 0.01 mm (% g/g), for carbonate chernozem depending on the degree of erosion

The average creditworthiness of agricultural lands according to the soil structure at: Ordinary chernozems, loam-clayey is 82 points; Ordinary chernozems, weakly eroded, loamy-clayey with creditworthiness - 66 points; Carbonated chernozems, eroded weakly, loam-clayey is 50 points; Carbonate chernozems, moderately eroded, loamy, 38 points; Carbonate chernozems, heavily

eroded, clayey has the creditworthiness - 26 points; Layered alluvial soils, loam-clayey have the creditworthiness - 80 points; Layered, loamy alluvial soils have the creditworthiness - 72 points; Layered alluvial soils, loamy-clayey, moderately glued have the creditworthiness - 48 points. The humus reserves in the soil layer of the moderately deep carbonate chernozem are over 1 meter thick.

Carbonated chernozems are less humid and contain carbonates from the surface, have a less stable structure. Active landslides in the assessed area lead to damage to the soil cover and removal of fertile land from the agricultural circuit, destruction of roads and housing.

### CONCLUSIONS

For the locality of Costuleni it is necessary to undertake a series of concrete measures, such as some capital allocations of funds, anti-erosion measures, in some cases, it would be necessary to build sewerage systems, etc., which as a result will lead to reducing environmental pollution and improving the health of the population.

The village of Costuleni is part of the central agro-climatic region, which is characterized by heat, long duration of vegetation and frost-free period, favorable agro-climatic conditions for cereals, sunflowers, fruit trees, vines, etc.

The village of Costuleni is located along the Prut River, on a slope that is 150 meters away from the river.

The development of landslides, flat and linear erosion, which greatly affects the agriculture of Costuleni, is significantly stimulated by

anthropogenic activities (mass deforestation of forest strips, forests and orchards) and the uneven distribution of rainfall during the year and the torrential nature of summer rains.

Every human being must realize, accept and take responsibility for his or her impact on the environment.

### REFERENCES

- Alexander D. 1999** - *Enciclopedia științei mediului*. Springer. ISBN 978-0-412-74050-3.
- Bardhad B., Palade S., Muica N. 1980** *Intoxicațiile cu pesticide*. București, Ed. „Medicală”, 384 p.
- Bogdan S., Hansgeorg Killyen, 1975** - *Ecologie: probleme generale și de tehnologie didactică*. București, Ed. „Didactică și Pedagogică”, 289 p.
- Danielsen F. et al., 2013** - *Linking public participation in scientific research to the indicators and needs of international environmental agreements*. Conservation Letters 7: 12-24. DOI: 10.1111/conl.12024.
- FAOSTAT, 2014** - *Food and Agriculture Organization of the United Nations. Resources – Land*. The Statistics Division of the FAO.
- Sandu Maria, Tăriță A., Lozan Raisa et al., 2019** - *Indicele de nitrificare a ionilor de amoniu în apele din râul Prut și afluenții lui de stânga*. Chișinău. Buletinul AȘM. Științele vieții. Nr. 3(339). Ecologia și Geografia. pp. 152-160.
- Болкова Н. 1992** - *Учет эффекта суммаций загрязняющих веществ, поступающих в водную среду промышленных центров*. Москва, Изд-во «Наука», 401 с.
- Дедю И. 1989** - *Экологический энциклопедический словарь*. Кишинев, Изд-во «Штиинца», 589 с.
- Звinyaцкий Л. 1993** - *Влияние комплекса факторов окружающей среды на заболеваемость населения*. В: Журн. Гигиена и санитария. № 4. 126 с.