

## **ABSTRACT**

In the broadest sense of the word, erosion means the natural modeling process that occurs continuously at the earth's crust, under the action of the atmosphere and biosphere. This situation includes the processes of disintegration and alteration of rocks, the processes of erosion by water and wind as well as landslides.

In the narrow sense of the word, however, erosion can be defined as the process of detachment, transport and deposition of solid particles, under the influence of water or wind.

As for the extent of erosion processes and the importance of control activity, soil protection against erosion is considered to be part of the great problem of environmental protection and therefore all countries attach great importance to combating soil erosion.

In Romania, almost two thirds of the territory is located on slopes and climatic conditions favor erosion and consequently the issue of combating soil erosion was as important as in other European countries.

After 1990, however, new socio-economic conditions caused alarming erosion concerns to decline alarmingly, with the process of degrading agricultural land by erosion and other sloping processes expanding. Therefore, it was considered necessary to analyze the state of affairs in an area with natural conditions very favorable for the development of the slope processes in order to identify the possibilities of rehabilitation of measures and works with anti-erosion role.

In this context, this paper, without being exhaustive, aims to contribute to the conservation of soil fertility on sloping lands in the Izvoru Berheciului and Pădureni river basins in Tutovei Hills and the restriction of other adverse effects of soil erosion.

The first chapter presents the current state of knowledge in the field of study approached. The erosion process is defined, the determining and favoring factors are presented, the damages generated and the possibilities of restricting this process to admissible values.

Erosion causes changes in soil properties, contributes to reduced agricultural production, causes difficulties in the exploitation of agricultural land, worsens the water supply of springs and rivers and endangers the accumulation routes and human settlements.

Soil erosion causes great difficulties in land use. First of all, the surface erosion brings to light the lower horizons with a heavy texture or hard rocks, which is a great difficulty in

the execution of the soil laurels. The weights increase even more if the ground is furrowed with oaks and ravines. The fragmentation of the relief in many small plots by these formations of the current erosion, sometimes makes it impossible to work the land with agricultural machines or to execute the works in the direction of the level curves. The presence of ogas and ravines not only leads to difficulties in the execution of works on the land between these formations but also makes it difficult or sometimes impossible to transport the products.

The existence of eroded soils leads to a significant change in the regime of surface water runoff. The deterioration of the hydrophysical properties of the soil by erosion contributes to the reduction of the infiltration capacity of the eroded soils, these being not very fertile do not favor the development of a strong vegetation.

Sewage carries a large amount of solid material that covers fertile crops or soils in river meadows or clogs ponds and reservoirs. Clogging of the main valleys can also take place due to the material transported by ravines and gullies. In this case, the risk of flooding increases.

In addition to the quantitative relationships between runoff, erosion and the factors involved in these processes, it is important to know the concrete conditions regarding erosion and erosion factors. A general characterization from this point of view is of interest because it substantiates the differentiation of soil conservation measures on the territory.

Of all the platform units, the Moldavian Plateau has the most regular landforms. Most of the Bârlad Plateau as well as the Moldavian Plain are formed by long slopes with uniform slopes. This regularity of the slope shape is interrupted by landslides or deep erosion. The other units of the Moldavian Plateau have less regular forms of relief. The processes of slope evolution and erosion are closely related to the petrographic composition of the region. Thus, in the central and northern part of the plateau, in addition to the surface erosion, which affects the soil on large areas, the existence of layers of clay, marl and sandstone causes the frequent occurrence of landslides (Racova Valley Basin, Vaslui, Bahlui and Jijia ).

Surface erosion and landslides bring to light salt marshes, which, in the steppe and forest-steppe conditions, cause the appearance of salt on the slopes, or in the meadows of the valleys, insufficiently drained.

Further south, in the Tutovei Hills and the Carpet Platform, where the thick horizons of fine Dacian sands, Levantine sands and gravels, or Quaternary loess predominate, deep erosion is the most serious plague in the region. Deep erosion is accompanied by surface erosion and local landslides.

The Tutova, Zeletin and China basins are units in which deep erosion has reached impressive proportions, both in terms of intensity and the areas it occupies.

The distribution of natural and cultivated vegetation, in relation to the relief, plays a particularly important role in the process of soil erosion. Natural vegetation, represented by

forests and grasses, ensures full protection of the soil if man does not intervene in its use in an irrational way. However, the cultivated vegetation behaves in a special way, according to the type of plant and the cultivation system used.

Unlike irrigation and drainage, where the main share is the landscaping works and installations for bringing water on the cultivated land or its evacuation, in soil conservation the landscaping works for water retention are combined on the same territory, with those for their directed evacuation and agrotechnical methods of preserving or disposing of water that drains to the soil surface. The technique of soil conservation has many similarities with the technique of soil improvement with temporary excess moisture, where the works of water assessment in the rainy season must also be combined with those of conservation in the dry season.

The basic problem in the fight against erosion is the execution of in-depth studies on the erosion process and the factors involved, for the appropriate choice of methods to stop this process.

The second chapter contains references to the elements of the natural setting in the areas on which observations and measurements were made.

From an administrative point of view, the works to combat soil erosion existing in the Izvoru Berheciului river basin, with a total area of 28106 ha, are located in the

The relief peculiarities of the plateau area represented by the Bârlad Plateau, with the Colunele Tutovei subunit, is crossed from N to S by the Berheci brook with a length of about 66 km.

In the western part of the physical-geographical unit, the hydrographic network sections the coast, the peaks being longer. The peak between Filipeni and Berheci and Racova is sectioned by streams that highlight short peaks placed in the east-west direction, with steep slopes at the level of the slopes.

Morphometrically, the Izvorul Berheciului river basin has an average altitude of 189 m, with a variation gap of 372 m, between the minimum value of 47 m and the maximum, the maximum value of 419 m, east of Vultureni locality.

More important differences are found between the 3 sectors, the elevations of the land decreasing to the south.

On average, most altitude values are between 125 and 150 m, in a proportion of over 39%.

Petrographic conditions play a dominant role even in areas with fewer structural-lithological differences.

In terms of favorability for soil erosion processes and other slope processes, the slope map shows a significant proportion of slopes with a slope greater than 5%, which are more exposed to the erosive action of torrential rainfall that occurs frequently in the area.

The climatic regime of the Berheci basin is of continental climate specific to the Tutovei Hills, characterized by hot and dry summers, cold winters often haunted by strong blizzards.

Although the annual values of this climatic element are low, the non-uniformity of the rainfall regime plays the main role in the production of runoff and erosion on the slopes and torrential valleys of the Izvoru Berheciului hydro-amelioration system.

Most precipitation (60 - 70%) falls in the warm season, usually with the character of showers and the maximum values in 24 hours are around 70 mm for the 10% insurance and exceed 80 mm for the 5% insurance.

The predominant soils within the researched area are characterized by a low resistance to erosion.

Under the natural conditions in the territory, the characteristic formed soils are mainly represented by the soils of the Chernisols class, represented by the chernozem and phaeozium types, but also those of the Luvisols class, of the preluvosol and luvosol type.

From the group of cultivated plants predominate on the largest area, those that provide the soil with poor anti-erosion protection, especially corn and sunflower.

From the presented results that the particularities of the relief from the Izvoru Berheciului hydro-amelioration system are very favorable for the erosion process.

This aspect must be taken into account when establishing the structure of crops and anti-erosion culture systems.

The third chapter specifies the purpose, objectives of the study, research material and method.

The aim of the research is to assess the current state of concern for fertility conservation and environmental protection in this hilly area prone to intensification of soil degradation processes on the slopes in order to state the possibilities of rehabilitation activities to prevent and combat soil erosion.

The following objectives and associated activities have been set out in this regard:

1. establishing the changes that have occurred in the structure of the categories of agricultural land use and anti-erosion works;
2. estimating the anti-erosion efficiency of anti-erosion works;
3. elaboration of the project of organization and anti-erosion arrangement of the lands from the Pădureni hydrographic basin from the Tutovei Hills.

The paper was elaborated benefiting from the data kindly provided by the Directorate for Agriculture Bacău, the Territorial Branch of Land Improvements Bacău and the Communal Agricultural Chambers within the system as well as based on detailed studies and observations made in the field by the author together with the doctoral supervisor.

Topographic maps (sc. 1: 50,000; 1: 100,000) and soil map (sc. 1: 200,000) of the area where the Izvoru Berheciului river basin is located were also used.

Of course, specific steps were taken to carry out the scientific approach, which aimed at documenting, making observations and measurements in the field, analyzing and processing the data obtained in the laboratory and preparing the final material.

The fourth chapter is the one in which the results of the researches regarding the preoccupations for combating the soil erosion in the Izvoru Berheciului river basin are presented.

After presenting the inventory of the works for the control of soil erosion carried out in the basin, the evolution of the structure of the categories of use of the agricultural train as well as of the anti-erosion cultivation systems practiced within them is analyzed.

The sharp decline in the proportion of anti-erosion cultivation systems on these sloping arable lands to a large extent greatly favors the intensity of erosion and soil degradation on slopes.

The conditions of the natural environment, but especially the practice of abusive grazing, from early spring to late autumn, with a large load of animals, caused the damage of the green carpet on an appreciable surface of the territory.

It has been found that both before and after 1990, the unrestricted grazing area is much larger than it rationally grazes. In the period 1990-2020, the area of only 40.4% that was rationally grazed in 1990 was halved in favor of unrestricted grazing, which increased by more than a third.

The technical and improvement efficiency of the works performed in the territory was also evaluated. The works for combating soil erosion under the administration of ANIF - Bacău Territorial Land Improvement Branch, in the Berheci river basin, include a set of works carried out in two stages, the first during 1976-1979 and the second, with completion works during 1982-1984, with the main purpose of combating surface and deep erosion, regularizing runoff on slopes and restoring in the agricultural circuit of marshy lands in lowland areas.

After about 43 years of operation, the existing landscaping works present a differentiated technical and functional state in terms of their structural integrity, stability and functional role in ensuring the maintenance of surface soil erosion within acceptable parameters, prevention of deep erosion, elimination excess surface moisture and avoidance of damage to other socio-economic objectives.

The technological anti-erosion roads made, due to the significant leaks produced during torrential rains, show significant damages and degradations on more than 80% of the total length of the network, until the decommissioning on some sections.

The marginal canals to the valley technological roads and to the slope technological roads, which were usually made of earth and biologically consolidated by grassing are decommissioned due to very strong clogging, in percentages between 80 and 100%.

Exhaust channels from deep erosion formations and valleys, on sections that have been reinforced with concrete walls, show serious damage and destruction of the slabs along the entire length.

The catchments of the springs show the catchment chambers as well as the degraded discharges, strong clogging of the adjacent chambers and drains, two of them being taken out of operation.

Earthquakes and forced slopes generally have an unsatisfactory state of their earthworks, especially on downstream slopes where there are intense erosion phenomena with runoff, landslides, subsidence and subsidence due to runoff over the canopy and adjacent area and affecting their structural integrity.

Analysis of the behavior in operation of these works, establishing the need for modernization, completion, efficiency and extension works.

Through the investment works proposed by S.C. Energopark S.R.L. the studied area will be enriched with new elements that integrated in the landscape do not alter the quality of the environment but on the contrary, highlights the extent of these actions-silent systems independent at a great distance from residential areas and occupy small areas on the ground.

The installation of these turbines on degraded surfaces involves the construction of concrete foundations placed up to a depth of 40 m, which can contribute to the stabilization of the slopes in question.

The design of the anti-erosion organization and arrangement of the lands in the Pădureni river basin constitutes the fifth chapter of the doctoral thesis.

When designing the land use, the characteristics of the relief were taken into account, expressed by shape, slope, length and exposure, suitability and favorability of the soil cover for the categories of use and crops and the degradation processes by slope processes.

Thus, according to the recommendation of the specialists from SCCCES Perieni - Bârlad, the arable use category was provided only on lands with a maximum slope of 18% and for those with a higher degree of inclination, it was considered opportune and rational to set up improved pastures and forest plantations.

Respecting the rational criteria of sustainable exploitation of the lands that constitute the sloping agricultural land fund, it was necessary to reduce the plowed areas by 95.4 ha, ie by 16.4%.

In the concrete conditions in the field, for the studied area it is recommended to practice the cultivation system in strips as well as the construction of bench terraces.