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ERODABILITY OF SOILS IN THE RECEPTION BASIN "NEGREA"

Olesea COJOCARU

State Agrarian University of Moldova, 50 Mircesti Street, MD-2049, Chisinau, Republic of Moldova

Corresponding author emails: olesea.cojocaru@bk.ru, o.cojocaru@uasm.md

Abstract

This article is the result of research on soils in Negrea village of Hancesti District concerning the erodability of the terrain. The purpose of this article it is researched territory division of the estate blacks in 6 classes with varying degrees of erodability (presented in accordance N. Florea etc. - very low, low, moderate, strong, very strong, excessive) and the elaboration a map on soils erodability. A first step in harnessing the data (because, for the first time in the Republic of Moldova was determined erodability of soils) was the primary analysis of data obtained in the field, as well as statistical methods. Erodability values of soils in reception basin "Negrea" were calculated based on their characteristics parameters which influence erosion, according to the formula proposed by P. Stanescu (Stanga, 2005) - erodability of soils was estimated based on analytical data humus content, clay content and bulk density of investigated soils. It has been demonstrated that the high risk of erosion is induced medium textures - in the horizon from the surface with a fine texture in the substrate fact that no longer allows infiltration of rain water in depth and, consequently, the more rapidly organization surface runoff that practices the soil particles.
The results of calculation of erodability of the soils in the village Negrea are presented in tables 1and 2. Generally, most reception basin soils because of silty clay loam texture, sandy and low humus content the erodability is characterized by large and are vulnerable to erosion processes. The knowledge of erodability degree is necessary for agricultural activity of farmers.

Key words*: erodability, reception basin, intensity of erosion processes, value of erodability, Negrea village.*

INTRODUCTION

Republic of Moldova is the region where natural conditions (climate, topography, rainfall and other factors) give rise to inevitable erosion and soil cover status and physical indicators and morphometric characteristic determines the intensity of this destructive process. Status of soil quality, effective fertility level, depends largely on crop productivity, development of the zootechnical sector, the ecological and welfare of the population of the republic.

Erodability of soil is a „measure of the ease with which soil can be eroded by the action of water runoff, expressed by the amount of material removed from the soil under standard conditions climate, slope, land use etc." (Cojocaru, 2015; Lupascu et al., 1998).

In other words, *erodability may be considered of vulnerable to soil erosion*, vulnerability given its intrinsic properties and relationships as it is with other factors erosion. Production erosion is modulated by a number of factors, whose share in erosion risk estimation is different depending on the intensity with which manifests itself in a particular field unit.

Erodability is an accumulation of erosion processes in the analyzed area (washing the surface, ravines, torrential, landslides, mudflows, collapses of shores) and classes of erodability shows the potential intensity (from lowest to highest) of erosion.

Theoretically, the entire territory that was analyzed is erodible, differing only the intensity of this potentialities, from the sloping horizontal surfaces, from the lowest to the highest degree of erodability varying from one area to another depending on several determinant factors. For example, small slopes give the land a small degree of erodability.

Lands covered with pastures are more erodible than those covered with vines or forest. Fragmented lands will also be more prone to erosion than unfragmented land and so on.

The purpose of this article it is researched territory division of the estate Negrea in 6 classes with varying degrees of erodability (very low, low, moderate, strong, very strong;

excessive). In the finally will be exposed erodability map of soils (Cojocaru, 2015).
Negrea village residents must know predisposition to land erosion and properly plan and organize administrative actions (where are necessary land stabilization works and where no etc.).
Also, knowing the degree of erodability could be necessary for agricultural activities. Finally, the present study may be consulted by the Municipality, companies or individuals in order to organize their activities.
Currently major attention is paid to improving techniques and tillage systems in reducing energy consumption, reducing human impact on soil stabilization, optimizing its physical and humic substances, preventing the erosion process.
Researches previously conducted both at home and abroad were focused on the link between the intensity of occurrence of erosion processes, physical-geographical natural conditions, the factors - relief, climate, soil cover at the level of subtype and vegetation (crop residues, coverage degree of the soil surface by plants).
Soil degradation processes, including by erosion, are conditioned both by natural conditions and human activity as well.
Among the natural factors that influence degradation of soils is mentioned next: climatic conditions; the geomorphological construction (relief); texture and parent rock composition (Cojocaru, 2015).
Hincesti district is located in the center of Moldova on an area of 1483.4 km^2.
It borders the Ialoveni, Cimislia, Leova, Nisporeni and the neighboring country of Romania.
Also Negrea village is located in Central Moldova in the middle part of the reception basin (hydrographic) of the river Lapusnita (Krupenikov et al., 2001).
Approximate distance from the Negrea village to the main cities is as follows: Hancesti - 23 km, Chisinau - 60 km. The altitudinal deployment and variation of natural and anthropogenic conditions (slope, land use, human impact etc.) require differences in the degree of erodability of the land.
We can say that economic development is based on sustainable principles advantageous in regarding the all-natural components: air, water, soil, forests and subsoil resources.

MATERIALS AND METHODS

One of the peculiarities of surface erosion is that it has a large expansion in space and simultaneously carries on extensive areas of land. Another feature is that the phenomenon becomes sensitive only after a long period of time when the process with all the cortege of concentration, has already occurred. Gradually, fertile and humus-rich horizons are washed as the process continues. Remove the parent material surface rock infertile or parent if the process continues its unfettered development.
Soil erosion in its many forms and features is the consequence of the direct precipitation impact on the soil. Therefore, referring to two factors - rainfall and soil - it requires analysis and their knowledge in terms of their interdependence - cause - effect. From ordinary observations known to be, rains that fall in a given area cause or do not, erosions. Between rains which determines nevertheless, the triggering erosion phenomenon are the rainfall which generates great loss of soil and other, losses is much less, although the conditions of the soil are the same (Cojocaru, 2015).
According to prof. Motoc M. (1963) is the first, which groups soils from Romania according to their resistance to erosion in classes and categories (Table 1). And classes described in groups depending on soils on how in which erosion process changes depending on the genetic horizons, while resistance categories represents the degree of resistance which the soil is opposed of erosion (assessment is done within the class).
Motoc M. et al., distribute the properties of soil which determines the erosion process into two categories (Motoc et al., 1975, 1976, 2000): properties that influence the rate of infiltration by changing the ratio leakage/infiltrations, and therefore the intensity of the erosion process (1); properties that directly determine soil resistance to the action of dislocation and transport exercised by rain and leaking liquid (2). Erodability of the soil thus becomes the product of the two categories of properties results.

Erodability values of soils in the reception basin „Negrea" were calculated on the basis of their characteristics parameters which influence erosion, according to the formula proposed by P. Stanescu (quoted by Stanga, page 187), using humus content, clay content and their apparent density (Stanga, 2005).

$$S = \frac{(100-A)}{(A+n*h)*D}, \qquad (1.1)$$

where: S - erodability index;
A - clay content (%);
h - humus content (%);
D - bulk density (g/cm^3);
n=15 for A=12-32%; n=10 for A=33-45%.

The formula proposed by P. Stanescu is simple and has been successfully used in the calculation of values of soils erodability (Cojocaru, 2015; Stanga, 2005).
The appreciation belonging of soils to different classes of erodability was performed according to the classification presented in Table 1.

Table 1. The classes of erodability of soils according to Florea N. and others (Florea et al., 1987)

Name	Limits
is not the case	0
very small	< 0.6
small	0.6-0.7
moderate	0.7-0.8
strong	0.8-0.9
very strong	0.9-1.0
extremely strong	> 1.0

RESULTS AND DISCUSSIONS

In the slope arable lands of the reception basin from the village Negrea are affected by caused erosion, in general of concentrated leaking under the influence of torrential rains. Farmers, a long time irrational methods used for the cultivation of sloping land, which not only contributed to the outbreak of soil erosion as well as decrease soil fertility.
Anthropogenic factors main to degradation of soil cover are training the maximum territory in the plowing, cutting strips of forest, agricultural work along the slope, placing incorrect road network, insufficient protection of soils with vegetating share exaggerated crop hoes in the crop rotations, soil compaction by heavy mechanisms, failure to comply with agrotechnical for erosion control.
Agricultural activities, without taking into account the peculiarities of soil, relief, lead to continued decline in soil fertility and their degradation. The intensity of agricultural activities in different periods for different usage differs point of view quality and quantity and is varied.
The Universal soil losses equation (USLE) soil erodability factor, K, represents possible losses of soil depending on their specific characteristics. So then the risk erosion for reception basin „Negrea" soils can be appreciated both by calculation using of soil values of specific indices developed in the mathematical formulas for determining erodability and by direct measurement of solid and liquid leaks from a certain area of land, imitating the artificial rainfall precipitation of a certain intensity (Cojocaru, 2015).
The results of the investigations of soil conditions in Romania (Ionita et al., 1985; Motoc et al., 1975, 1979, 2000; Stanga, 2005) under conditions analog of soil, climate and relief on the Tutovei hillsides and including the Falciu hills, was established that the erodability of soils correlates the very well with: content of sand; of dust; clay; organic matter, etc. So now, for the calculation of erodability is necessary determining by pedological researches of soils properties that influence this factor. For lands used for arable after grubbing of vines in the middle part of the territory of reception basin „Negrea" were investigated characteristics the following units of soils (ordinary chernozem) in the framework of delluvial - erosion slope located in the central part of the northwest exhibition of the slope: not eroded (located on the water pinnacle); poorly eroded; moderately eroded; highly eroded and typically delluvial (Cojocaru, 2015).
The purpose research carried out in the village Negrea it was in erodability of soils calculation based on the values for each soil profile characteristics studied and appreciation leakage control plots of the influence of the degree of erosion on the water and soil losses.
Depending on the humidity and essential properties of soil can be distinguish four main mechanisms that contribute to dislodge of soil particles, then facilitating their transport (Emerson, 1967; Florea et al., 1987): the explosion of the structural aggregates by

compression of existing air in the soil pores at the time of rapid moisture (1); mechanical disaggregation under the influence of raindrops (2); micro-breaking by differentiated inflating (3); physico-chemical dispersion (4).

Micro-terracing of slopes under multiannual plantations and other anti-erosion measures in the past the total use of the territory of reception basin under orchards and vineyards led to a decrease the washing processes of soil on the slopes (Krupenikov et al., 2001; Lupascu et al., 1998). The passage of arable lands without being undertaken measures to combat the erosion process increased soil losses.

The calculation results of erodability of investigated soils in the middle part of reception basin „Negrea" are presented in Table 2.

According to calculations, erodability of surface layers of not eroded ordinary chernozems, with varying degrees of erosion and typically delluvial is the following:

- *not eroded* - moderately to small (moderate humus content, satisfactory hydro-stability of the structure);
- *poorly eroded* - moderately (moderate to submoderat humus content, unsatisfactory hydro-stability of the structure);
- *moderately eroded* - moderately (submoderat humus content, unsatisfactory hydro - stability of the structure);
- *highly eroded* - big (small humus content, unsatisfactory hydro-stability of the structure);
- *typically delluvial* - big to very big (dusty-sandy, loam texture, small humus content, unsatisfactory hydro - stability of the structure).

In the village Negrea after grubbing of orchards and vineyards and arable land uses it is absolutely necessary to plan and implement complex measures for combating of soil erosion.

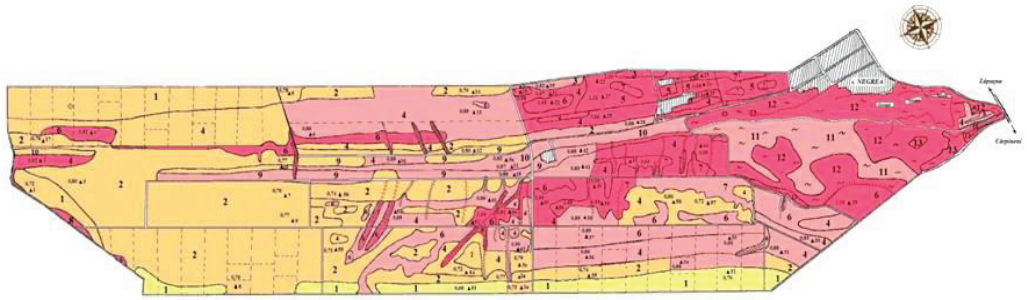
Overall, according to the received results, most soils in the reception basin because of clay-loam, dusty sandy texture, and low humus content are characterized by moderately and big erodability and finally are vulnerable to erosion processes.

From the data of the Table 2 follows that to increasing the degree of soil erosion and deterioration of physical, chemical and physico-mechanical properties, of their values erodability shall be increased accordingly.

The big erodability of typically delluvial soils is due to the high content of fractions of sand and coarse dust in the of their granulometric composition.

Table 2. Erodability index values of the horizons investigated soils

The depth (cm)	The erodability value	Class of erodability
No. 1a profile. Not eroded ordinary cernoziom, humiferous moderately with profound strong humiferous profiles, poorly carbonate, clayey-loam, sloppy		
0 – 20	0.73	moderately
20 – 35	0.61	small
No. 2a profile. Poorly eroded ordinary cernoziom, humiferous moderately with profound moderately humiferous profiles, poorly carbonate, clayey-loam, sloppy		
0 – 20	0.77	moderately
20 – 35	0.61	small
No. 3a profile. Moderately eroded ordinary cernoziom, humiferous submoderat with profound moderately humiferous profiles, poorly carbonate, clayey-loam, sloppy		
0 – 20	0.79	moderately
20 – 35	0.62	small
No. 4a profile. Highly eroded ordinary cernoziom, humiferous poorly with semi-profound humiferous profiles, moderately carbonate, clayey-loam, sloppy		
0 – 20	0.81	big
20 – 35	0.71	moderately
No. 5a profile. Typically delluvial soil, humiferous submoderat, poorly carbonate, silty, with buried soil of the deeper than 70 cm and summary humiferous profile of very powerful deeply		
0 – 20	0.83	big
20 – 35	0.85	big



Conventional signs	The value of erodability	The class of erodability
	< 0.6	very small
	0.6-0.7	small
	0.7-0.8	moderately
	0.8-0.9	Big
	0.9-1.0	very big
The total area of the reception basin „Negrea" - 343 ha		

Figure 1. The soils erodability map of the reception basin "Negrea" (*developed by the author in accordance with existing methodology*) (Cojocaru, 2015; Florea et al., 1987; Stanga, 2005)

Such are observed very good on the map of soils erodability from the reception basin „Negrea" (Figure 1), developed based on the erodability calculation for all soil profiles located in the process of conducting pedological studies in the field.

The determination of erodability of the investigated soils was possible due to the appreciation necessary indices for calculating.

Erodability categories reflect the reality on the ground at a time, for example (Emerson, 1967; Motoc et al., 1979, 2000; Florea et al., 1987; FAO, 1984):

- *the first category of erodability* - are without lands vulnerable to erosion, agricultural use or as a support for the urban center itself;
- *the second category of erodability* - are lands with small vulnerability to erosion;
- *the third category of erodability* - are lands with average vulnerability to erosion. Characterize various forms of relief (slopes, pinnacles, aprons, valleys). The slopes are also varied, and manner of usage varies from one situation to another (shrubs, pasture, vineyards, crops, building space);
- *the fourth category of erodability* - are lands with high vulnerability to erosion;
- *the fifth category of erodability* - are highly erodible lands. Agricultural activity cannot be practiced. The potential use as vineyards or orchards would be possible only in alternation with forest plots and only by strong consolidation works.

In these conditions, it is likely that investment is never diminished. Therefore, to stop the active erosion and prevent degradation of the future, the most recommended way to use is to stabilize by plantations of trees.

CONCLUSIONS

Republic of Moldova is the region where natural conditions (climate, topography, rainfall and other factors) give rise to inevitable erosion and soil cover status and physical indicators and morphometric characteristic determines the intensity of this destructive process.

Erodability is an accumulation of erosion processes in the analyzed area (washing the surface, ravines, torrential, landslides, mudflows, collapses of shores) and classes of erodability shows the potential intensity (from lowest to highest) of erosion.

Soil degradation processes, including by erosion, are conditioned both by natural conditions and human activity as well.

Theoretically, the entire territory that was analyzed is erodible, differing only the intensity of this potentialities.

Fragmented lands will also be more prone to erosion than unfragmented land and so on.

The purpose research carried out in the village Negrea it was in erodability of soils calculation based on the values for each soil profile characteristics studied and appreciation leakage control plots of the influence of the degree of erosion on the water and soil losses.

The big erodability of typically delluvial soils is due to the high content of fractions of sand and coarse dust in the of their granulometric composition.

Negrea village residents must know predisposition to land erosion and properly plan and organize administrative actions (where are necessary land stabilization works and where no etc).

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