# DEGRADATION OF GROUNDS BY SUFFUSION WITHIN THE EASTERN SECTOR OF THE SOUTHERN BARAGAN

# DEGRADAREA TERENURILOR PRIN SUFOZIUNE ÎN SECTORUL ESTIC AL BĂRĂGANULUI SUDIC

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***Abstract:*** *This project presents some aspects of the fields' degradation by suffusion within the Eastern part of Southern Baragan. The observations were performed in three points, in North, in Ciulnita Plain, in North-East and East of Hagieni Plain. Due to the precipitations' water infiltrations on the abrupt front sides of the grounds and terraces there are some loess wells, which enable the torrential leakages and condition the formation of some tight and by stages with an aspect of badlands. The appearance of these geomorphologic processes determines practical problems by the degradation of sloping grounds.*

***Rezumat:*** *În această lucrare sunt prezentate câteva aspecte ale degradării terenurilor prin sufoziune, în partea estică a Bărăganului Sudic. Observaţiile au fost efectuate în trei puncte, în nord, în Câmpul Ciulniţei, în nord-est şi est în Câmpia Hagieni. Pe frunţile abrupte ale câmpurilor şi teraselor, datorită infiltraţiei apelor din precipitaţii se formează puţuri în loess, care uşurează scurgerile torenţiale şi condiţionează formarea unor văi înguste şi în trepte, cu aspect de badlands. Apariţia acestor procese geomorfologice ridică probleme de ordin practic, prin degradarea terenurilor în pantă.*

***Key words*****:** *loess, suffusion, degradation, Bărăgan*
***Cuvinte cheie***: *loess, sufoziune, degradare, Bărăgan*

## INTRODUCTION

Southern Baragan is the most important and magnificent field of the Romanian Plain, mostly suspended by the Eastern corner over Ialomita marsh. Bent over Ialomita in North, on a distance of almost 120 km, which dominates it abruptly, straight and convex, as well as between Mostistea valley and Ialomita marsh, Southern Bărăgan is an asymmetric field, higher on the North side and lower in South, where it presents itself in stages towards Danube Riverside. From West to East, this sector presents a large waving, with greater heights in West as well as in East, in Hagieni Plain, where it reaches the greatest height (96 m) near the Danube and which borders the centre part, the lowest and smoothest, having about 40 m heights, of Ciulnita Field.

Loess deposits, accumulated under variable conditions in different parts of Southern Baragan were decisive for its general aspect, for the presence of the modelling processes as well as for the functionalism of this plain. The oldest and also the thickest deposits of loess are found in Hagieni Field, where the sedimentation started earlier. On the whole of the plain, the thickness of loess layer varies from 5-6 m, up to 35-40 m, depending on the age of the surfaces it gathered.

The degradation of grounds represents the continuous and insensitive diminution of soil quality. The processes of mass movement are shifting under gravity action, of some deposits masses under the influence of other transport agents. The suffusion, geomorphologic process characteristic to loess is a landslide by mechanic causes, due to natural support damage or ground mass units' damage, in which the water plays a secondary role.

**MATERIALS AND METHOD**

In view of accomplishing this present project, on the basis of the ground researches and by the analyses of map supports three observations' sectors were settled in the Eastern part of South Baragan Plain, where grounds degradation forms by suffusion were identified – Cosâmbeşti, in North, in Ciulniț Field, Platoneşti – Hagieni, in north in Hagieni Field, Feteşti – Stelnica, in South East of Hagieni Plain.

On the surfaces covered by loess and loess deposits came out a relief with specific features of its behaviour to the modelling agents action. The loess specific relief forms are varied, but the suffusion ones will be rendered obvious, as there are characteristic to the Northern, Eastern and South-Eastern sectors from Southern Plain of Baragan.

An important factor within the relief forms' genesis is represented by the actual state of loess, whether the registered cohesiveness level is greater or smaller. One of the main features of the morphology developed on loess is its weak resistance. Although the loess is a friable stone, that the falling and subsidence permanently act, the slopes are generally abrupt. The most pregnant note within the loess morphology is given by the valleys, which go strongly deep among vertical walls; intensively fragment the area, not only at the surface but also in depth, amplifying a lot the landscape aspect. The vertical development of the relief forms is strongly dependent on the loess thickness.

The fast degradation of the relief is happening when the loess was deposited on slopes relatively prominent and will determine the processes of grounds sliding, formation of bad-lands. Situations like these can be met in Southern Bărăgan, where the loess formations have considerable thickness up to 40 m. In table 1 there are also mentioned the main geotechnical features of loess belonging to this sector of Bărăgan Plain.

*Table 1*

Geotechnical features of Southern Baragan loess

| Thickness (m) | Plasticity index Ip | Porosity n% | Humidity % | Compressibility method $M_{2-3}$ kgf/cm$^2$ | | Supplementary specific subsidence by moistening under 3 kgf/cm$^2$ |
|---|---|---|---|---|---|---|
| | | | | At natural humidity | Saturated state | |
| 25 – 40 | 6 – 12 | 50<br>43 – 45 | 9 – 13 | > 80 | 50 | 3 – 12 |

The main processes that govern the actual morpho-dynamics of Baragan Plain are suffusion, formation of hollows and depressions of subsidence greater in loess, the processes related to the fluvial activity of erosion and accumulation over the river bottoms, as well as torrential erosion on the abrupt slopes tightly connected to the suffusion, deflation and wind accumulation. The process of suffusion creates a circular hollow on the surface which continues deeper with a vertical and narrow tunnel (aven or horn), which goes through the loess deposit on its whole thickness. Due to the union of circular hollows suffusion precipices come up, delimited by abrupt slopes and closed by the two extremities. In order to reach to reach their source the suffusion slopes have underground caves have connections with other suffusion circular hollows by underground galleries. Some superficial sliding can come up in loess or loess deposits due to intense humidity, especially when the infiltration water stops at the basis of loess where it meets an impermeable rock.

Due to the flowing on the loess slopes with a more compact structure pyramids or colons can be formed. These forms, being quite fragile, deteriorate quickly, especially after the abundant and intense rains, as well as after the snows melting.

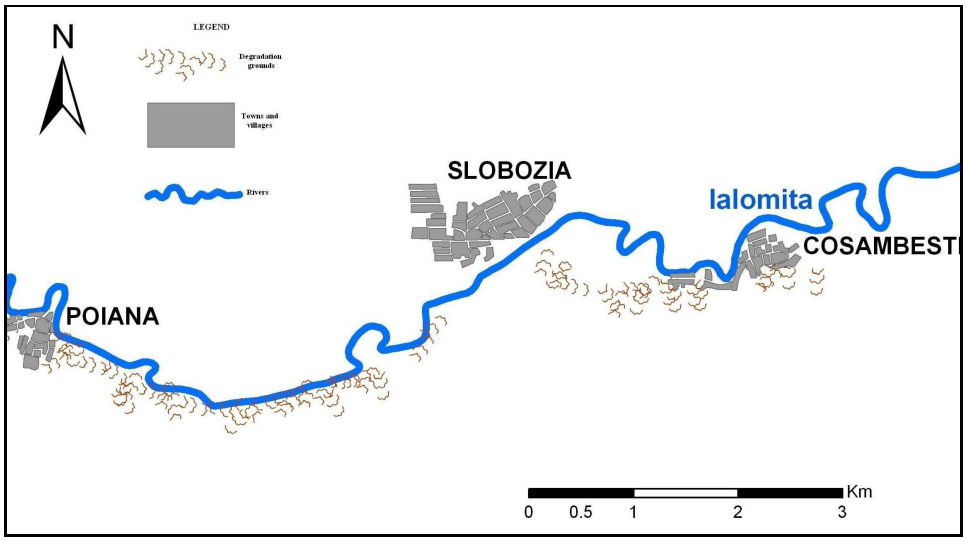


Figure1. Damaged grounds in Poiana – Cosâmbeşti sector, in the North of Ciulniţa Field

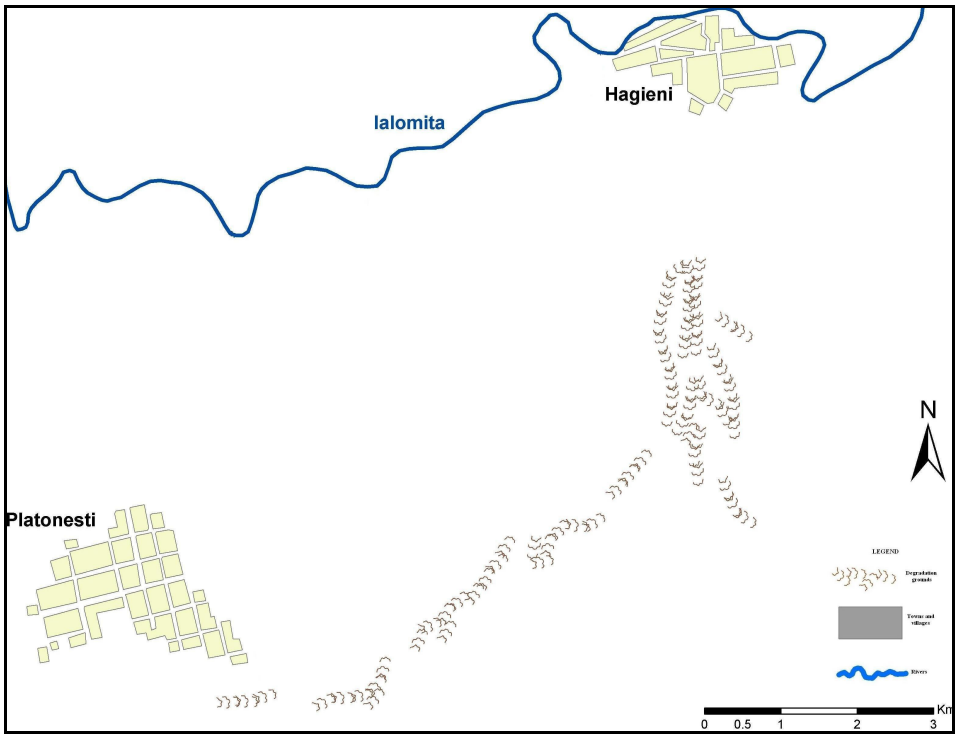


Figure2. Damaged grounds in Platoneşti – Hagieni sector, in North-East of Hagieni Field

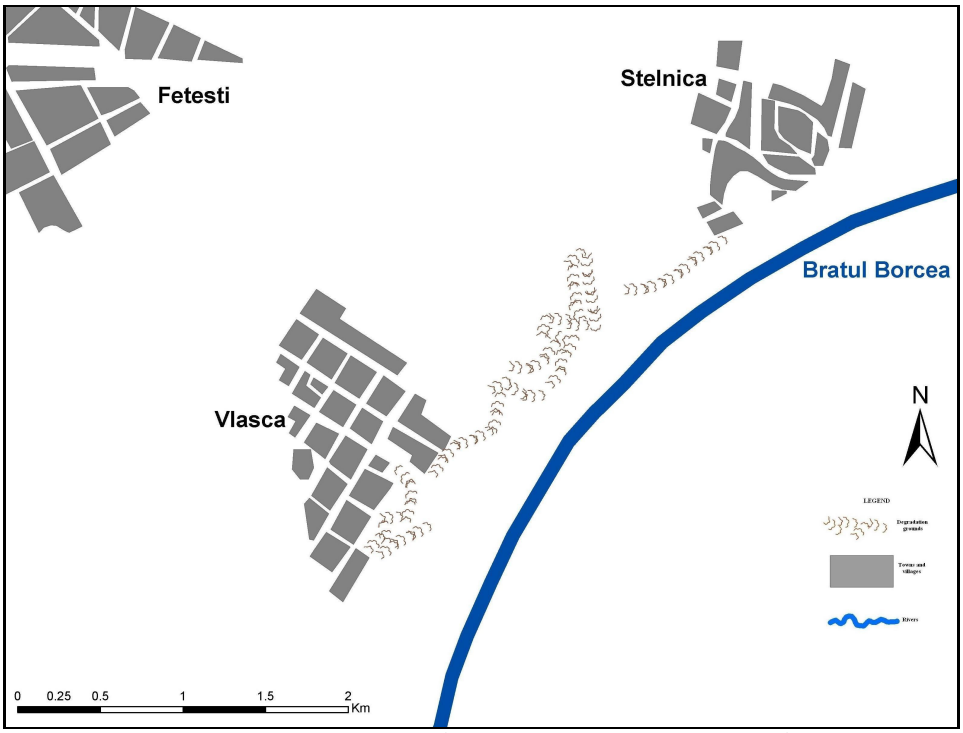

Figure3. Damaged grounds in the East side of Fetesti municipality, on the border of Borcea Branch

**RESULTS AND DISCUSSION**

Due to their structure, loess and the loess formations split in vertical plans, creating slopes which contrast with the horizontal lines of the fields. This feature comes up from the fact that, through the loess formations – due to its specific porosity – the water circulates only vertically, leading to transporting of these rocks by the dissolving of limy particles and its deposit under calculus forms close to the formation basis, where a horizon which is more resistant, whitish, full of irregular knots is formed. Another consequence of the vertical circulation of water is, as a characteristic of relief, the appearance of prismatic colons and small earth falls in stages. With good reason it was stated the fact that there are only vertical and horizontal lines in loess, with angular combinations, the curve or bend lines totally lacking in the initial phase of the formation and evolution of these relief elements.

A necessary condition for the generating of suffusion processes is, beside the loess formations features mentioned, the existence of a dry climate, even an aridity one, which is specific to the Southern Baragan. Closely related to such a climate the discontinuous drainage of the waters on the loess basis is forming, and which circulates as underground streams and torrents.

This area, due to the existent loess formations and to the drier climate, fits in the region with a maximum development of suffusion, South-East of Romania.

The steep between Baragan and Danube riverside, at North of Feteşti, split in thick loess deposits of over 30 m, reveals ample and complex suffusion forms rarely seen in other

regions of the country. In Stelnica sector – Feteşti these forms are the most representative ones from many points of view, finding in there a complex of suffusion forms of all kinds.

The conditions under which the suffusion is developing in this sector are outside the loess deposits 30-35 m thickness, from the surface of Bărăgan up to the level of Borcea waters which reach the feet of this steep, are as follows: arid climate with rainfalls about 400 mm annual and with long period of dryness, and as a consequence of the prominent porosity of loess deposits and of limited rainfalls, the considerable depth of underground water and its lack of organisation in continuous layer. The entire village of Stelnica starting from North of Fetesti is provided with water exclusively from Borcea. The steppe vegetation is also added here, which having its deep roots, contributes in a certain measure to the development of suffusion processes enabling the infiltrations.

The steep slope of Hagieni Plain towards Borcea pan, having a height of 30-35 m, entirely split in loess deposits, offers a varied landscape of the same forms but showing greater dimensions and often united in complexes which present more advanced phases within the dynamics of the suffusion processes. In his superior side the vertical steeps having 5-6 m are predominant here and there reaching even 15-20 m. In this side of the steep circular hollows and horns can be seen. Also, quite characteristic are the suffusion avens having the depth of 10-15 m ant the diameter of 5-6 m in width. Most of them are split so that bits of loess with the height of 10-12 m can be seen, fact which proves the way these avens were made up. In his inferior side these ones communicate with the exterior through horizontal or slightly bend underground channels, which sometimes reach at the dimensions of small caves. Therefore one of them has a height over 2 m and about 1 m width.

Along the steep slope between Stelnica and Fetesti suffusion valleys can be seen.

The fields have as a characteristic the overlying bed of loess and in places sands. Subsidence and suffusion are developing on loess and on the right arm of Ialomita and North-East of South Baragan the flowing is added.

The suffusion develops itself in a singular manner or combined with the subsidence. It is more active in the vicinity of Ialomita and Danube riversides or even in the vicinity of deeper valleys where the loess has a thickness over 4 m. The summer dryness and winter frost which can determine certain cracks within the soil stimulate the suffusion. On the valleys' riversides, but especially on the left riverside of Ialomita, the suffusion combines with flowing. The latest process distinguishes itself by many ravines and precipices which are situated on the right of Ialomița, biting the field in an extremely notched shape. The depth of these ravines is about 10 – 30 m, becoming very impervious in Poiana – Cosâmbeşti sector.

The Aeolian action is bringing the sands from Ialomita riverside and acts especially as a deflation process which is present over the South Baragan sands. The process is very active when the soil is unveiled and when strong winds are present as it reduces it effects as the distance to the south of Ialomita River grows. Hagieni Field is mostly dominated by deflation. Still, the majority of the sands are solidified, levelled and fixed.

The degradation of grounds in the field units is achieved by subsidence and suffusion, by deflation on the right of Ialomita, erosion by deflation, on the sands of Hagieni Field, Ciulnita and Facaieni Field.

Where works have been performed over the layer of loess, as the opening of loess quarry for the building of highways, railroads and most recently state highway, the phreatic layer was sectioned and the water pumped out from this opening. Therefore, openings like avens came up in the vicinity of quarry slopes, producing the degradation of the grounds by anthropic intervention.

## CONCLUSIONS

The processes of suffusion are very slow, its effects cumulating during very long periods of time, due to the infiltration water circulation on vertical and to the ground water layer on horizontal. It is very difficult to talk about measures of diminution of relief effects.

The gravitational processes come up only along the steep slopes from the right of Ialomita, on the South-East and East side of Hagieni Field, always as an effect of the lateral undermining of the steep slopes and ravens depths or of the suffusion. Usually, these processes combine depending on the local conditions.

The evolution of suffusion processes from simple forms of the circular hollows and caves to the complexes like suffusion valleys and plains, is the same as on Borcea riverside at North from Fetesti, fact which confirms that the suffusion constitutes a special group from the great whole of the denudation processes, having its own evolution and its own specific forms, generated by a well differentiated agent – mechanic force of underground waters flowing.

Under the practical report, the suffusion processes is interesting due to the great damages that can be produced by the landslides in the vertical riversides of the loess formations, therefore its instability endanger the constructions from the superior side of the steeps and even of the those quite distant from the steep, due to the underground caves which come up to great distances.

At the inferior part of the steeps, the land sliding slopes can also cause the roads covering, water sources covering but they still constitute the fixing element which partially limits the progress of this process.

## LITERATURE


1. BADEA, AL., *Analiza efectelor amenajărilor funciare din Bărăganul de Sud prin mijloace Teledetecție-SIG*, Ed. Universitaria, Craiova, 2006.
2. BALLY, R., J., ANTONESCU, I., *Loessurile în construcții*, Ed. Tehnică, Bucureşti, 1971.
3. COTEŢ, P., *Câmpia Română – studiu de geomorfologie integrată*, Ed. Ceres, Bucureşti, 1976.
4. SURDEANU, V., *Enciclopedia geografică a României*, Ed. Enciclopedică, Bucureşti, 2000.
5. STAN, CR., BOGDAN, O., *Județul Ialomița*, Ed. Academiei, Bucureşti, 1971.
6. TUFESCU, V., *Modelarea naturală a reliefului şi eroziunea accelerată*, Ed. Academiei, Bucureşti, 1966.
7. xxx., *Geografia României*, vol. V, Ed. Academiei Române, Bucureşti, 2005.
8. xxx., *Enciclopedia geografică a României*, Ed. Academiei, Bucureşti, 1982.