STUDY REGARDING THE ECOPEDOLOGICAL CONDITIONS OF LANDS DEGRADED BY MINING ACTIVITIES FROM RECEA QUARRY, BIHOR COUNTY

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***Abstract*:** *The study area is a small area of land around the village Şuncuiuş. The sterile waste dumps, once under the influence of external natural modulating factors, tend to create hydro-geological systems with specific shapes and dynamics that evolve more or less rapidly due to their particular characteristics, influencing the odds of foresting activities. The mining activity within perimeter of Recea quarry led to profound changes of the relief resulting in geo-mechanical (landslides, compactions), pedological, agrochemical and biological changes. By estimating the impact of sterile dumps on environmental factors, several aspects have been revealed: the initial destination (forest) of lands has been changed and these have been used for storage of the mining waste, relief has been changed, instead of the stable forest associations, balanced and productive, appeared very poor and sporadic associations of ruderal herbaceous plants. The sterile dumps have been studied especially under textural and agrochemical aspects, being performed measurements regarding soil reaction, degree of nitrogen, potassium, phosphorous supply, humus content, content of soluble salts. The natural flora existing on surfaces which have been affected by mining activities was completely destroyed and on these surfaces was installed a new vegetation but in a different from baseline. On the studied dump have been identified 29 species, 28 genera and 16 families. Family of Asteraceae (Compositaceae) with 9 species is the most representative. The other families are represented by 1-3 species. The dominant plant life forms were: hemicryptophytes (44,83%), followed by annual therophytes (17,24%), and megaphanerophytes (13,79%). The other categories are low represented The initial (construction) stability of the waste dumps is the most important factor in the rehabilitation process.*

Key words: *degraded land, mining activity, sterile dumps, vegetation, plant life forms, geoelements.*

INTRODUCTION

The most aggressive type of soil degradation is degradation due to mining activities, which is developing by 1,4-1,7 times faster than other industrial branches (Blaga 1981).

The studied objective is located in the periphery of Şuncuiuş commune, the southern side of Şuncuiuş locality.

The perimeter of exploitation quarry of Recea is part of the deposit of refractory clay of Şuncuiuş, located in the north side of Mountains Padurea Craiului, on the territory of Şuncuiuş commune. This is delimitated at north by the River Crisul Repede, at east and south by the Valley of Misid, and at west by the Valley Izbandis.

Soil samples have been analyzed under aspects concerning pH, humus content, total nitrogen, phosphorus, and potassium.

As for the flora, it has been studied separately on each waste dump and then the results have been compared (floras of the studied waste dumps). The values describing the parameters plant life forms, geoelements, and ecological indicators were established as indicated SANDA et al. (1983).

MATERIAL AND METHODS

The methods used for research of flora in the studied perimeter consisted of repeated trips on site, opportunity which allowed us to perform a series of measurements, determinations, and also photos mainly focused on vegetation and on other factors. The encountered species have been taxonomically determined according to Ciocârlan, 2000.

For the physical, chemical, mineralogical, biological, micromorphological etc. characterization, soil has been sampled in order to be analyzed in laboratory, by specific methods. The number of soil samples and the sampling method depend on the kind and purpose of the analysis.

RESULTS AND DISCUSSIONS

Sector of Recea, together with Sector of Balanca, constitute the Exploitation Perimeter of Şuncuiuş, the deposit of refractory clay of Şuncuiuş, located in the inferior formations of Liasic. The inferior Liasic, in Gresten facies, is placed on the karst surface of the marble chalks of Ladinian age, being represented by quartzite sandstones alternating with clay lens, some of them with refractory properties.

The transition from chalks to sandstone complex is made through a horizon of red clays, by continental genesis, with variable thicknesses by 0-30 m which constitutes a mark horizon for the productive complex.

The mining activity within perimeter of Recea quarry led to profound changes of the relief resulting in geo-mechanical (landslides, compactions), pedological, agrochemical and biological changes.

The sterile dumps have been studied especially under textural and agrochemical aspects, being performed measurements regarding soil reaction, degree of nitrogen, potassium, phosphorous supply, humus content, content of soluble salts. Basing on this information and also on field measurements we concluded that these surfaces represent a heterogeneous mixture of vegetal soil, sand, gravel, and clay, heterogeneously distributed.

Studying the physical and chemical features of the sterile dumps, there was found a low heterogeneity degree of them, which determines a various installation of plant species. This fact constitutes an argument for using the technology consisting of coverage of dumps with a soil layer.

Table 1

Chemical characteristics of the studied degraded surfaces

Number of sample	Specification	pH in H_2O	Total nitrogen %	Humus %	Phosphorous (AL) ppm	Potassium (AL) ppm
1	Not amended 0-10 cm	5.70	0.040	0.08	1.75	123
2	Not amended 10-20 cm	5.86	0.051	0.10	2.62	94
3	Amended 0-10 cm	7.68	0.054	0.15	1.31	111
4	Amended 10-20 cm	5.72	0.061	0.12	2.10	112
5	*Hippophae rhamnoides* plateau	5.48	0.046	0.10	2.90	91
6	*Hippophae rhamnoides* versant	5.57	0.067	0.12	3.28	92
7	External plateau	5.38	0.046	0.19	2.22	120
8	Clay	4.89	0.052	0.12	2.25	208

Regarding the texture, high differences have been observed, the dump material has a very heterogeneous texture, which denotes that it has been lowly or not at all homogenized, and on depth 50 -100 cm it contains gravels and boulders by various sizes, with diameter up to

25-30 cm, mixed with soil. By analyses, there was found that the mean values describing the clay content of the sterile material and soils are highly different.

The reaction of the sterile material ranges from acid to low acid.

The content of phosphates available to plants (expressed as ppm) ranged from 1,31 to 3,28 ppm. The degree of phosphorous supply was very low in the studied sterile dumps. The content of assimilable potassium ranged between broad limits, from 91 to 123 ppm, from very low to low.

As general aspect, the vegetal cover appears as groups of plant individuals more or less mono-specific, of herbaceous plants with isolated trees and shrubs.

The structure of species installed on the studied sterile dumps is extremely heterogeneous, especially on the young dumps, where predominant are the species with low requirements regarding life factors, plants considered extremely rustic and in the same time pioneer plants. These plants rapidly succeed to fix the sterile dumps.

The horizontal structure of vegetation is characterised by scattered groups of individuals. Considering the phytocoenogenesis, this phase consist of several stages like colonisation, aggregation, to competition. On the studied dump have been identified 29 species, 28 genera and 16 families. Family of *Asteraceae* (*Compositaceae*) with 9 species is the most representative. The other families are represented by 1-3 species.

Table 2

Statistics of plant life forms within studied perimeter

Plant life forms	Annual therophytes Th	Bi-annual therophytes TH	Helophytes-Hydrophytes HH	Hemicrypto-phytes H	Geo-phytes G	Chamae-phytes Ch	Nanophanero-phytes N	Megaphanero-phytes MM	Mesophanero-phytes M	Total
Number of species	5	1	-	13	3	1	-	4	2	29
%	17,24	3,45	0	44,83	10,34	3,45	0	13,79	6,90	100

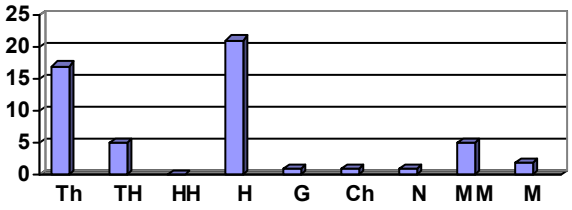

Figure 1: Spectrum of plant life forms of flora found within the studied perimeter

The plant life forms dominant on this dump are: hemicryptophytes (44,83%), followed by annual therophytes (17,24%), and megaphanerophytes (13,79%). The other categories are low represented.

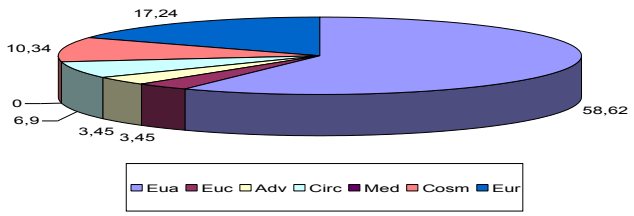

Figure 2: Spectrum of phytogeographical elements of flora identified in the studied perimeter

CONCLUSIONS

The studied area (Recea Quarry) represents a small land surface nearby Şuncuiuş locality. The mining exploitations have a strong impact here both through extraction activities and by sterile deposits.

Excavations made in the quarry radically changed the aspect of relief: the versants have been transformed in terraces and received inclinations larger than initially, and vegetation and soil layer disappeared, remaining visible the living bedrock.

By estimating the impact of sterile dumps on environmental factors, several aspects have been revealed: the initial destination (forest) of lands has been changed and these have been used for storage of the mining waste, relief has been changed, instead of the stable forest associations, balanced and productive, appeared very poor and sporadic associations of ruderal herbaceous plants.

The natural flora existing on the surfaces affected by mining activities have been totally destroyed. Most of these surfaces have been occupied by new vegetation, but in different arrangement as initial.

On the sterile waste dumps from Recea is found a flora of colonisations with annual species and few perennial herbaceous species, *Tussilago farfara* being the most frequent herbaceous species, and implicitly with the great capacity of colonisation.

The woody species with high capacity to colonize the sterile waste dumps, on eroded versants, assures the premises necessary that forest vegetation evolves into stable vegetation: *Salix capraea, Populus tremula, Betula verrucosa.*

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BIBLIOGRAPHY

1. CIOCARLAN V., 2000 – Flora ilustrată a României. *Pterydophyta et Spermatophyta*. Editura Ceres, Bucureşti
2. DUMITRU M., BORZA I., 2006 – Evaluarea impactului ecologic. Editura Eurobit, Timişoara.
3. SANDA V., POPESCU A., DOLTU M., DONITA N., 1983 – Caracterizarea ecologică şi fitocenologică a speciilor spontane din flora României. Stud. şi com. Şt. Nat. Muzeul Bruckenthal, supl., 25, Sibiu.