

LAND QUALITY CLASSES AND NATURAL LANDSCAPE OF THE MINING AREA VALEA MĂNĂȘTIRII 2, GORJ COUNTY

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Abstract. *The most aggressive form of soil degradation ad, hence, of the entire environment are surface mining operations that because of the disrespect of technical operation plans, cab result in true ecological disasters. The process of soil recovery around the mining operations in the Gorj County, Romania, is directly influenced by the natural factors of the area. Reintroducing these soils in the economic circuit and the recovery of the lands for agricultural purposes should follow specific paths both methodologically and practically. In this context, our concerns aimed at identifying the genesis, distribution, features, and quality classes of the soils. The main objectives were the distribution of technosoils in Valea Mănăștirii 2, Gorj County, Romania, resulted from surface mining operations; the study of the natural landscape of soil formation in the area because of surface mining operations; the morphological, physical, and chemical characterisation of the soils affected by the mining operations; the assessment of the production potential through grades; and the establishment of quality classes. These objectives were reached during field and laboratory research as well as through information processing.*

Key words: *soil resources, mining, quality classes, Mănăștirii Valley, Gorj County*

INTRODUCTION

It is known that useful mineral have been extracted since times immemorial, but corporations organised to produce millions and even millions of tonnes annually appear in the 20th century. Because of their intense activity, the area of degraded agricultural lands has increased considerably, which asked for special measures to be taken; in addition, the population is increasing steadily, land degradation diversifies and worsens, increasing agricultural areas is more and more difficult and needs huge investments, and potential agricultural land reserves will soon be exhausted.

MATERIAL AND METHODS

For field research focused on the identification, delimiting, and morphological description of the soils, we used the methodology developed by the Institute for Soil and Agrochemistry Research (I.C.P.A.) of Bucharest. We described six soil profiles and we sampled and analysed in the laboratory the most representative ones.

Sample analysis was carried out in the laboratories of the Soil Science Department and of the Office for Soil Studies and Agrochemistry of the Gorj County, as follows:

- Colour was determined with the Munsell Soil Colour Charts colour atlas in both moist and dried soil samples;

- Granulometric composition (soil texture) was determined by treating the soil with a solution of Natrium pyrophosphate and by separating granulometric fractions through the moist sieving method (coarse sand), the siphoning method (fine sand), and pipetting method using a Kubiena mechanical pipette (dust and loam);

Establishing textural class was done with a texture triangle.

To establish quality classes in the area analysed, we assessed the agricultural lands in question.

Land assessment is a complex operation meant to better know plants' growing and fructification conditions and to measure the favourability of these conditions for each type of use and crop using a system of technical indicators and assessment grades.

Land favourability for different crops was done with assessment grades in natural conditions.

For the calculus of assessment grades in natural conditions, we used assessment indicators. Crop productivity depends on an entire ensemble of environmental conditions.

Classification of agricultural lands into quality classes is done depending on assessment grades; there are **five** such classes:

- 1st class: 81-100 points;
- 2nd class: 61-80 points;
- 3rd class: 41-60 points;
- 4th class: 21-40 points;
- 5th class: ≤ 20 points.

RESULTS AND DISCUSSIONS

1. Geomorphology

The **Valea Mănăstirii 2** dump is located, from the point of view of the megarelief, in the great geomorphologic unit called **Piemontul Getic**, north from **Strehaia Platform** and **Jiului Platform**, more precisely in the Motru River flooding meadow, and it is the result of the surface exploitation of coal and of storing the resulting sterile.

The dumping technology consists in storing the excavated earth from the quarries on relief forms not disturbed by mining operations such as meadows, terraces, narrow valleys, which results in artificially created positive geomorphologic forms with wide variations from the point of view of the slope and material type.

The mining management of the Valea Mănăstirii 2 dump resulted in a slightly sloped relief, rather even with a slope of 0-5% (plateau), bordered north-west, south-west and east by slightly sloped surfaces with slopes of 5-12%.

We also took into account water management to reduce soil erosion. Surplus water from the slopes will be taken over by the existing canal (watch canal) and by the Motru River in the south-west, respectively.

2. Geology and lithology

Studied from a geological and lithological point of view, the dump is very complex because of the long lasting action of the hydrological network through:

- **the depth of the hydrological network** – we updated materials of different ages and with different physical and chemical features;
- **The transport action of the hydrological network over wide areas** – materials of a great geological variety were brought and mixed in a heterogeneous way.

Because of the daily exploitation of the coal, the natural lithological structure of the land has been altered in depth from 2-3 m to 150-200 m.

The lithological materials stored in Valea Mănăstirii 2 dump have been carried from the Motru Hills.

3. Hydrology and hydrogeology

From a hydrological [point of view, the studied perimeter belongs to the **Motru hydrographic basin**.

Hydrology has three main features that affect the area more or less:

- The **ground water** is 10 m deep in the ground and it has a negative effect on the soilification process and a negative effect on the water supply process: at this depth, the water cannot be used by the plants' root system;

- The **rainwater** can produce, because it flows on sloped areas, surface and depth erosion making up flows and trails because the lithological materials are not cohesive enough;

- The **stagnant waters** should be removed from both micro depression and fine material areas to avoid the negative impact on the growth and development of the plants.

4. Climate

According to climate data, the area is part of the climate province c.f.b.x. – continental temperate climate, with mild winters and moderate summers, with sufficient rainfalls unevenly distributed, abundant in winter and autumn but insufficient in summer.

5. Vegetation

From a floristic point of view, the studied area belongs to the area of **Quercus forests**.

The woody species in the area are represented by the genus *Quercus* – *Quercus polycara*, *Quercus robur*, and *Quercus petraea*.

Spontaneous vegetation is well established on the Valea Mănăstirii 2 dump, because lithological material is texturally good for the vegetation to develop, since the dump is old and stabilised. The grassy species found there are horse thistle (*Cirsium arvense*), spiny cocklebur (*Xanthium spinosum*), podbal (*Tussilago farfara*) – particularly in sandy areas, field horsetail (*Equisetum arvense*), bristle grass (*Setaria glauca*), blackberry (*Robus caesius*), etc.

6. The Pedo-lithologic Cover

Because of the mining operations, the impact on the soil was hard: through the uncovering and dumping processes, the “soil” either disappeared being mixed with the sterile, or it was separately uncovered (*fertile soil*), setting in special dumps.

“Soil disappearance” means the disappearance of a “living body” constituted in time – first, **fertility**, which confers the proper environment for plant development. In the case of mining dumps, due to the existing conditions, we cannot speak of a soil cover, because in the case of exploiting operations, lithological materials of different geological ages – extremely diverse physically and chemically – are distributed in a heterogeneous way both vertically and horizontally.

The place of the initial soils was taken by lithological materials that differ physically and chemically and that belong to **Technosols - 2012 (Entiantrosols -2003; Anthropie protosols - 1980)**.

These anthropogeneous soils, though they supply a sufficient edaphic material for the development of the root system, do not display **fertility**: they are lithological materials lacking life and having a very low microbial activity.

7. Soil covers

Depending on the granulometric nature of the materials dumped, we identified the following soil units:

7. 1. US 001 – Technosol - 2012 (Entiantrosol - 2003) spolic calcaric N/LN-N

It covers an area of 8.16 ha (9.71%) of the mapped area. It has a slight alkaline reaction (pH=7.6-8.2), medium CaCO₃ content (11.3-12.1%), low organic matter content (0.40-1.92%), low mobile phosphorus and potassium content (Pppm=7.3-24.7; Kppm=36-70). The texture is coarse at the surface and medium-coarse-coarse in the profile. The materials that made up this anthropic soil unit are very little fit for productive activities.

7. 2. US 002 – Technosol - 2012 (Entiantrosol - 2003) spodic calcaric LN-L/LN-L

The area covered by this soil unit is 32.01 ha (38.11%). **In this case, the soil units predominate loams and sandy loams. The reaction is alkaline** (pH=7.9), the content of CaCO₃ is mean (10.5-11.3), the content of organic matter is very low (0.56-0.72). Lithological materials have a low content of mobile phosphorus and potassium (Pppm=6.6-8.8; Kppm=44-54). They are materials very fit for productive activities.

7.3. US 003 – Technosol - 2012 (Entiantrosol - 2003) spolic calcaric - They occupy an area of 22.92 ha (27.28%) of the total mapped area; dusty loams predominate. The physical and chemical features are close to those of the US 002 (low alkaline soil reaction, low organic matter content, low mobile phosphorus and potassium content).

7.4. US 004 – Technosol - 2012 (Entiantrosol - 2003) spolic calcaric LN/LA – It was made up from loamy clays that predominate. It covers an area of 15.35 ha (18.27%). They are materials with a low alkaline reaction (pH=7.9-8.1), medium content of CaCO₃ (10.8-11.5%), low content of organic matter (1.20-1.96%). As for mobile phosphorus and potassium content, it is low-medium (Pppm 15.6-18.1; Kppm=74-86).

7.5. US 005 – Technosol - 2012 (Entiantrosol - 2003) spolic calcaric LA/LA – It covers a small area of the total perimeter analysed, i.e. 2.48 ha (2.96%). The soil unit is made up of clay loams. Its physical and chemical features are close to those of the other soil units.

7.6. US 006 – Technosol - 2012 (Entiantrosol - 2003) spolic calcaric L/AL – This soil unit was made up of clay loams. It has a small area, i.e. 3.08 ha (3.67%). This is a material suited for productive activities.

From the point of view of the texture, the materials identified through US 002, 003 offer good conditions for productive activities. The components of US 001, 004, 005, 006 are sands, loams, and sandy loams at the surface and clay loams and loamy clays offering less better conditions for plant development.

Though the materials dumped within the studied perimeter are fit for productive activities, they lack fertility – the main characteristic of soils (table 1).

Table 1

Soil quality classes

Soil unit/field component	Area (ha)	Average points obtained (pc)	Ponderat average obtained	Quality class
002(01,02)	29,97	47	47	III
002.03	1,27	44		
TOTAL	31,24	-	47	
004(01,02,03), 005(005.03)	16,92	39-40	36	IV
002,04, 003 (01,02), 005,03	17,05	37-38		
003,03, 004,04	1,99	34-35		
005,04, 006(01,02)	2,67	32-33		
001 (01,02), 003,04	11,63	30-31		
001,03, 006,04	2,37	27-28		
001,04	0,13	24		
TOTAL	52,76	-	36	IV

CONCLUSIONS

The studied perimeter covers an area of 84 ha.

The **Valea Mănăstirii 2** dump is located, from the point of view of the megarelief, in the great geomorphologic unit called **Piemontul Getic**, north from **Strehaia Platform** and **Jiului Platform**, more precisely in the Motru River flooding meadow, and it is the result of the surface exploitation of coal and of storing the resulting sterile.

Geologically, the materials making up the dump belong to the tertiary, Neogene, more precisely Pliocene and Miocene. These materials are alternate layers made up of Piedmont deposits represented by the materials mentioned above, Pontic, and, in small amounts, Dacian (sands).

The lithology is very complex and varied over small areas – at present, medium texture materials predominate (clays, dusty clays), medium fine (loamy clays) and, on small areas, coarse materials (ands and clay sands) and fine materials (loamy).

The hydrographic network belongs to the Motru hydrographic basin.

As for the thermal regime, mean annual temperature is 10.2⁰C, and annual mean precipitations reach 753 mm.

The pedo-lithologic cover is very heterogeneous both vertically and horizontally. The materials that make up the dump come from deep down and belong to the **group of materials with medium fertility potential**.

Depending on the granulometric nature of the materials dumped, we identified six soil units:

- US 001 - Entiantrosol spolic calcaric N/LN - N - 8.16 ha (9.71%);
- US 002 - Entiantrosol spolic calcaric LN-L/LN-L - 32.01 ha (38.11%);
- US 003 - Entiantrosol spolic calcaric LP-LNA/LN-LNA - 22.92 ha (27.28%);
- US 004 - Entiantrosol spolic calcaric LN/LA - 15.35 ha (18.27%);
- US 005 - Entiantrosol spolic calcaric LA/LA - 2.48 ha (2.96%);
- US 006 - Entiantrosol spolic calcaric L/AL - 3.08 ha (3.67%).

Land assessment resulted in the following quality classes:

3rd class – Lands in this quality class cover an area of 3124 ha (37.19%). Ponderate medium score was 47 points. Component soil units are 002 (01, 02, and 03).

4th class – Lands cover an area of 52.76 ha (62.81%), with the following soil units: 001 (01, 02, 03, and 04); 002 (04); 002 (04); 003 (01, 02, 03, and 04), 004 (01, 02, 03, and 04); 005 (01, 02, and 03 04); 006 (01, 02 04). Ponderate medium score was **36 points**.

This paper will serve to the **establishment of land quality classes of the lands recovered for production and granted to beneficiaries**.

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