# ASPECTS OF SOIL DEGRADATION IN GORJ DISTRICT

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***Abstract:*** *The Gorj District has an agricultural land of 243.768 ha. Of this surface, 78.909.40 ha (19%) is affected by different human activities. In order to identify the soils that undergo degradation in Gorj District as well as the effects of this degradation on soils, during 2008-2009 period there was made an inventory and mapping of the soils degraded by different industries. There was noticed that the main human activities that determine the soil degradation are represented by mining industry, energetic industry and building material industry. The surfaces degraded in this way are as follows:1. Mining industry = 13.509.4 ha of which: surface mining = 13,034.60 ha; oil extraction = 874.80 ha. 2. Energetic industry (dust from power plants) = 50.000.00 ha. 3. Building materials industry (cement dust) = 15,000.00 ha. The total surface affected by different pollution sources in Gorj District = 78,909.40 ha. It was observed that because of these human activities the most affected soils have been the eutricambosoils and luvosoils. The eutricambosoils have been affected on surface of 21,371.08 ha of which 4,381.68 ha by physical pollutionsand 16,989.40 ha by chemical pollution. The luvosoils have been affected on a surface of 23,542.92 ha of which 2,373.42 ha by physical pollution and 21,169.50 ha by chemical pollution. As relief the soil degradation is represented as follows: 38,372.52 ha on slopes, lowlands and terraces and 37,069 ha on ridges and plateau. The paper presents an analysis of the changes induced to soils by human factors and their effect on different soil horizons. It is a valuable tool for elaborating recovery measures of ecological buildup on every soil type and relief form.*

***Key words*****:** *mining industry, geomorphology, geological deposits, physical pollution, chemical pollution*

## INTRODUCTION

The Gorj District is located in the south – western part of Romania, northern Oltenia on the middle course of the river Jiu. At north the district is limmited by the $45^0$38" parallel of northern latitude at Parangul Mare peak and in southern part by the $44^0$58" parallel of latitude near Tantareni village. At the eastern end, near Alinjesti village there is $23^0$39" meridian of eastern longitude and the western limit is Dobra peak of $22^0$6" western longitude.

The total surface of the district is of 5,601 sq km (560,174 ha) that represents 2.35% of the country land (the 21st district as surface). This surface is represented by 243,768 ha of agricultural land, 273,868 ha of forests, 10,251 ha of unproductive lands and 25,787 ha of land for other usage (NEGREA, 2009).

This surface is undertaken to degradation processes both by natural and anthropic factors. The natural factors, especially erosion affect aproximatelly 166,099 ha and the anthropic factors, by different industries determine physical and chemical degradation as well as soil pollution.

## MATERIAL AND METHODS

In order to evaluate the anthropic degradation of the soils from Gorj District there was emphasized the main anthropic activities that produce the pollution of soils from Gorj District as well as their effect on different soil types.

On the basis of this study there was noticed that the main pollution sources are:

1. The mining industry with 13,509 ha of which: 13,034 ha of open cut mining; 874.8 ha of oil wells.
2. Energetic industry (powerplant powder) with 50,000 ha.
3. Building materials industry with 15,000 ha

Total of affected surface = 78,909.4 ha.

After inventory of these surfaces there was performed the classification of these soils that are affected by physical and chemical pollution and then the establishing of surfaces affcted as regard their geomorphological status. There was, also, established:

- the physical and chemical characterisation of the geological deposits brought to surface by open cut mining.
- The changing of chemical features of the oil and salty water polluted soils as well as of the ones polluted by powerplant and cement factories powders.
- The loading degree by heavy metals near powerplants

**RESULTS AND DISCUSSIONS**

Surfaces affected by physical and chemical pollution within Gorj District is given in the first table. From these data there results that the total surface of 78,909 ha anthropically polluted includes the most affected soils of the cambisoil class (eutricambosoils) of 27% and luvosoils class by 40.6%.

*Table 1*

The surfaces of polluted soils from Gorj District

| Soil class | Physical pollution (ha) | | | | Chemical pollution (ha) | | | | | Total ha | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Excavation | Dumps | Underground | Total | Mixt | Salty water | Powerpl powder | Cement powder | Total | | |
| Cambisoils | 2017 | 2295 | 69 | 4381 | 68 | 125 | 8295 | 8501 | 1698 | 21371 | 27 |
| Luvisoils | 2394 | 52 | 631 | 3778 | 291 | 163 | 24671 | 3194 | 28320 | 32099 | 40 |
| Pelisoils | 68 | - | - | 68 | - | 195 | 78 | - | 273 | 341 | 0.5 |
| Antrisoils | 134 | - | - | 254 | 29 | 1 | 12425 | 3101 | 15556 | 15810 | 20 |
| Associatin | 2006 | 514 | 2030 | 4551 | - | - | 4531 | 209 | 4735 | 9286 | 12 |
| Total | 6621 | 3681 | 2731 | 13034 | 389 | 485 | 50000 | 15000 | 65874 | 78909 | 100 |

These forms of pollution have been analyzed by geological forms resulting data from the second table of which the most affected by the anthropic pollution are slopes accounting 38,372 ha followed by lowlands and terraces with 37,069 ha, ridges and plateau with 3,767 ha.

*Table 2*

The distribution of the polluted surfaces on the main relief forms

| Pollution factors | Relief forms affected (ha) | | | |
|---|---|---|---|---|
| | Ridges and plateau | Versants | Lowland | total |
| Physical (open cut mining) | 635.1 | 6,944.6 | 5,454.9 | |
| Chemical pollution<br>Oil and salty water<br>Powerplant powder | <br>97.7<br>2,735 | <br>512.9<br>30,915 | <br>269.2<br>31,350 | |
| Total chemical pollution | 2.832.7 | 31,427.9 | 31,614.2 | |
| Total physical and chemical | 3,467.8 | 38,372.5 | 37,069 | 78,909.4 |

2. The physical and chemical characterization of the geological deposits brought to surface by open cut mining

The open cut mining of lignite determine a physical pollution of the initial soil and its place have been taken by diverse materials with a high physical and chemical diversity that belong to the quaternary age, respectivelly, Holocene and Pleistocene (in lowlands and

terraces) followed by levantine deposits, dacian and pontian that belong to Neogen (hilly zone) (CRAIOVEANU, 2002; NOSTEA, 1973).

Within the table 3 there are presented the main chemical features of these deposits. There can be noticed that, no matter their size nature the chemistry of these deposits is least satisfactory (pH 4.9-8.9) lime till 18.5%, available phosphorus of 2.3 – 49 ppm, available potash of 14-172 ppm.

*Table 3*

The main agrochemical features of the geological deposits brought to surface by open cut mining

| Type of material | Agrochemical features | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | pH | SB me/100g | V% | Lime % | Org. matter % | NI | P ppm | K ppm |
| Sands | 6.8-7.2 | 7.5-8.4 | 83-95 | 0.5-6.0 | 0.05-1.28 | 0.05-1.0 | 3.5-6.4 | 14-15 |
| Sandy silt | 6.6-7.5 | 9.3-21.4 | 90-96 | 0.3-9.5 | 0.25-2.5 | 0.25-2.0 | 3.6-32 | 40-87 |
| silt | 5.7-7.7 | 24-32.5 | 91-97 | 0.9-13 | 0.25-4.7 | 0.2-4.0 | 4.0-36 | 25-115 |
| Clayey silt | 7.0-7.7 | 12.5-26.0 | 94-96 | 1.0-9.5 | 0.45-5.9 | 0.5-5.2 | 2.5-38 | 26-110 |
| Silty clay | 4.9-8.5 | 21.5-36.5 | 75-96 | 1.5-18.3 | 0.4-4.4 | 0.4-3.5 | 7.5-35 | 97-165 |

3. The changing of the physical and chemical features of the soils polluted by oil and salty water

The oil industry in Gorj District affects a surface of 874.8 ha. This form of pollution is determined by incidents during oil extraction and transport and consists of oil leakage along with salty water at the soil surface that determine a pollution on 5-20 cm depth with the following consequences:

- all life forms dissapear;
- the air and other changes between soil and atmosphere do not exist anymore

The agrochemical study of these soils reveals that a salinisation of the soil took place, the increasing of the C/N ratio, the increasing of chlorine content (table 4).

*Table 4*

Analytical data on soil samples taken from oil and salty water polluted zones

| Sample nr. | Depth cm | pH | Org. Carbon % | N % | C/N | P ppm | K ppm | Cl me/100 g | Na me/100 g | K me/100 g |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-20 | 6.7 | 10.39 | 0.124 | 97.1 | 3.7 | 58 | 0.49 | 0.60 | 0.01 |
| | 20-40 | 6.3 | 1.87 | 0.049 | 44.3 | 3.0 | 40 | 0.88 | 0.91 | 0.01 |
| 2 | 0-20 | 7.5 | 4.19 | 0.118 | 41.2 | 2.8 | 210 | 43.6 | 32.7 | 0.16 |
| | 20-40 | 7.3 | 1.92 | 0.088 | 25.3 | 2.3 | 250 | 43.5 | 31.7 | 0.17 |
| 3 | 0-20 | 7.2 | 1.55 | 0.079 | 24.6 | 2.4 | 104 | 22.5 | 20.7 | 0.06 |
| | 20-40 | 4.1 | 0.99 | 0.025 | 39.6 | 3.0 | 70 | 15.8 | 12.5 | 0.03 |

4. The loading degree by heavy metals of the soils from pwerplant zone

The energetic industry determines the pollution by powders from powerplants that burn lignite. Within Gorj District there are two large powerplants that burn lignite at Rovinari and Turceni. There have been researched the soils from the affcted zones by these two powerplants notticing that after 30 years of pollution by powders the main physical and chemical features of the soils, including the anthropic ones have undertaken a series of changes on a 7.5 km radius, especially the loading with heavy metals (table 5).

*Table 5*

The loading degree with heavy metals of the soils near the Turceni and Rovinari powerplants

| Sample | Soil | Specification | Heavy metals (ppm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cu | Zn | Pb | Ca | Ni | Mn | Cr | Cd |
| 1 | Luvisoil Eutricambosoil | Conc. range | 14.5-52 | 35.5-506 | 14-52 | 6-19 | 10-59.5 | 70-832 | 36.5-91 | 0.6-1.2 |
| 2 | | Normal conc. | ‹21 | ‹101 | ‹21 | ‹21 | ‹21 | ‹31 | ‹31 | ‹1.1 |
| 3 | | Maxim limit | 100 | 300 | 100 | 50 | 50 | 1500 | 100 | 3 |

## CONCLUSIONS

- the Gorj District is affected by a series of phenomena of soil degradation because of several industries e.g. lignite extractive industry, energetic industry and building materials industry;
- the surfaces afected by these industries are 78,909 ha that means 14% of the District surface;
- the most affected are luvisoils 40.6% and cambisoils 27%;
- by human activities there are produced essential changes in the soil profile involving the reversing of the soil layers, the increasing of the sodium and chlorine content or increasing the heavy metals content;

  All these changes have as a result the degradation of the quality status of these soils.

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