Journal of Young Scientist, Volume V, 2017
ISSN 2344 - 1283; ISSN CD-ROM 2344 - 1291; ISSN Online 2344 - 1305; ISSN-L 2344 – 1283

# EXPERIMENTAL RESEARCHES REGARDING THE DETERMINATION OF THE PHYSICO-CHEMICAL CHARACTERISTICS OF SOIL

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***Abstract***

*The study's purpose is to determine the physico-chemical characteristics of soil (granulometry, organic substance, pH, humidity), the samples being gathered from three different areas regarding the internal zoning, but similar regarding the altitude, the aspect, the slope and the type of vegetation. The sample A1 from the strictly protected zone, the resort Corongis, is the control sample.*
*The granulometric analysis has been realized by using the Kacinski method. The soil's humidity (W) has been determined by drying in a stove at 105˚ C, the pH has been determined by using the Glass electrode method and the organic substance has been determined by using the Calcination method.*

***Key words:*** *soil, granulometry, pH, organic substance, humidity, analysis.*

## INTRODUCTION

The geographical location of the Rodnei Mountains National Park overlaps with the geographical and morphological contact area of Rodnei's Mountains, representing an integral part of the Oriental Carpathians from the Northern Range. It spreads on a surface of 47.177 ha, the altitude being between 587 and 2303 m. This altitudinal range entails the existence of various conditions and landforms.
From a pedological point of view, the pedogenetic processes were conducted in the massif under the influence of bioclimatic factors specific to the different layers of vegetation but also under the direct influence of the lithologic substrate. The brown luvic soils are frequent in the hilly and sub mountain levels from the western and south-western branch of the massif, the automorphic soils from the mountain stage are brown acid and black acid. In the sub-alpine floor there are organic lithosoils, underdeveloped, which are evolving on crystalline rocks, usually boulders and consolidated gravels. They have a clayey texture, with a strongly acid reaction and a high percentage of organic matter. Under the upper limit of the sub-alpine floor and in the alpine lower floor, on the lands covered by shorter scrubs and primary pastures we find peaty soils, evolved on the excessively humid lands around the springs and sub-alpine brooks.
The internal zoning of the park is made depending on the importance, necessity and the protection of the species living in the park but also considering the sustainable development of the area, resulting the following zones presented in Figure 1:

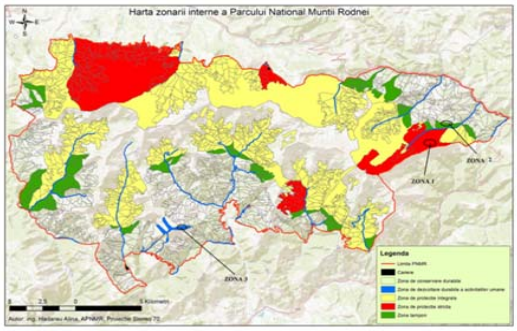


Figure 1. The map of the zoning of the Rodnei Mountains National Park and the soil sampling point locations (source: management plan 2017 Rodnei Mountains National Park)

In Table 1 there are presented the surfaces of each zone.

Table 1. The internal zoning of the Rodnei Mountains National Park (source: management plan 2017 Rodnei Mountains National Park)

| *Zone* | *Surface (ha)* |
|---|---|
| The strictly protected zone (Scientific reservation) | 5 104 |
| Fully protected zones | 19 967,7 |
| The first row of whole limitrophe parcels of the zones strictly or fully protected | 2 524,92 |
| The buffer zone (sustained conservation) excepting the first row of parcels | 19 384,44 |
| The buffer zone (sustained conservation) | 21 909,36 |
| Zone of sustained development | 195,94 |
| **Total area** | **47 177** |

## MATERIALS AND METHODS

Considering the forest harvesting in the research area, the same type of soil (rendzina) has been studied in the following experimental versions (Figure 1):
1. Soil from the strictly protected zone Corongis (zone 1)
2. Soil from the buffer zone (zone 2)
3. Soil from the sustained conservation area (zone 3).
The geographic coordinates of the studied areas from which the samples were swabbed are presented in Table 2.

Table 2. The geographic coordinates of the areas from where the samples were swabbed

| *Zone* | *Lat* | *Long* |
|---|---|---|
| Zone 1 | 47°31'49.51"N | 24°58'11.73"E |
| Zone 2 | 47°32'54.09"N | 24°58'57.28"E |
| Zone 3 | 47°26'58.51"N | 24°49'1.28"E |

We have chosen these three areas, from different locations within the park according to the internal zoning in agreement with Chapter 9 al 14 from the Regulations of Organization and Operation of the Rodnei Mountains National Park, Reservation of Biosphere, Nature Site 2000 (ROSCI0125 and ROSCPA0085).
The deduction of soil samples for physico-chemical and biological analysis has been made from the three zones previously mentioned in agreement with the methodological rules set in STAS 7184/1-84 "Soils. The deduction of the samples for pedological and agrochemical studies" and have been operated in agreement with the SR ISO 10281-6:1997 and SR ISO 11464:1998 standards called "The quality of soil.
According to the 184/1997 Order the number of the swabbing areas will be established depending on the surface of the study area. In advance, the swabbing areas are marked on the situation plan of the area, the vegetation has to be completely removed, and a probe or a spade will be used.
Considering the total surface of RMNP, 47.177 ha, measurements have been made in the three zones and finally the deduction of the three composed samples has been decided from a surface of 6 ha, 2 ha from each zone of study. Each sample has been noted A1, A2, and A3 (Figure 2).

Figure 2. The soil samples from the Rodnei Mountains National Park

In order to achieve the three composed samples, between 25-30 initial samples weighing 60-80 g have been deducted, in order for the composed sample to be as representative as possible.
The samples have been deducted with a probe-dill and a spade and then they have been introduced in air-tight bags and then homogenised.

The soil samples have been harvested from the depth of 10-25 cm by crossing the area in zig-zag. Every sample has been labelled, the place, date and depth from which the sample has been deducted being mentioned. The samples have been kept in the refrigerator, at the temperature of 4˚ C, until they have been operated.

## RESULTS AND DISCUSSIONS

### The analysis of physico-chemical properties of the soil from the sampling points

The analysis of the physico-chemical properties of the soil has been realised through field and laboratory methods, able to encompass and convey as accurately as possible the characteristics of the studied soil, these characteristics being represented by: the granulometrically fractions, the textural class, organic carbon, pH, conductivity, humidity and organic substances.

The analysis of the physico-chemical properties of the deducted soil have been realised by the National Institute of Research - Development for Pedology, Agrochemistry and Environmental Protection - ICPA Bucharest and The Environmental Protection Agency Cluj.

Table 3. Analytical results (ICPA)

| | Granulometric fractions ( mm) (% of soil mineral part) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse sand | | | | Fine sand | | | | Dust | Clay | |
| Code | 2.0-0.2 | 2-1 | 1-0.5 | 0.5-0.2 | 0.2-0.02 | 0.2-0.1 | 0.1-0.05 | 0.05-0.02 | 0.02 | 0 | 0.01 |
| A2 | 29.2 | 11.3 | 8.4 | 9.5 | 39.4 | 7.2 | 0.4 | 31.8 | 21.4 | 10.0 | 17.4 |
| A1 | 41.5 | 18.3 | 9.6 | 13.6 | 38.6 | 8.2 | 0.8 | 29.6 | 12.7 | 7.2 | 13.2 |
| A3 | 37.7 | 12.8 | 10.3 | 14.6 | 31.5 | 10.3 | 0.8 | 20.4 | 26.0 | 4.8 | 24.3 |

The granulometrical analysis has been made according to the Kacinski method, mentioning that the samples which had over 5% organic matters have been treated with perhydrol.

The separation of the granulometric fractions bigger than 0.2 mm has been made through sieving and of those under 0.2 mm through pipetting.

The group of textural classes, the textural class and the textural subclass of the soil samples have been established by using the triangular diagram of texture.

The soil's humidity (W) has been established by drying in a stove at 105˚C.

For establishing the pH (soil's reaction), the pH of the aqueous slurry has been measured ($H_2O$ pH) established for a soil-water report of 1:2.5 potentiometer with a double electrode of calomel glass.

The organic substance has been established through the Calcination method, meaning the elimination of the organic substance from the sample through calcination as a result of the carbon's oxidation with atmospheric oxygen. The loss of weight through combustion is established through weighing.

Regarding the soil's conductivity, it is established by calculating the electrical conductivity value at the temperature of 25˚C with correction (k) for the cell's geometry, then the total amount of soluble mineral salts is calculated by multiplying the calculated value of electrical conductivity with a F factor (experimentally determined).

***Physical Parameters***

The total granulometrical fractions (in mm) of the samples from the 3 zones are: coarse sand (2.0-0.2 mm) 41.5% for the zone 1 (the strictly protected zone), 29.2% for zone 2 (the buffer zone) and 37.7% for the zone of sustained development (Figure 3).

The percentages of fine sand, in the three studied zones are: 38.6% (zone 1), 39.4% (zone 2) and 31.5% (zone 3) and those of the dust are 12.7% (zone 1), 21.4% (zone 2) and 26.0% (zone 3). As a result of the granulometrical analysis, the clay's percentages are of 7.2% in zone 1, 10% in zone 2 and 4.8% in zone 3.

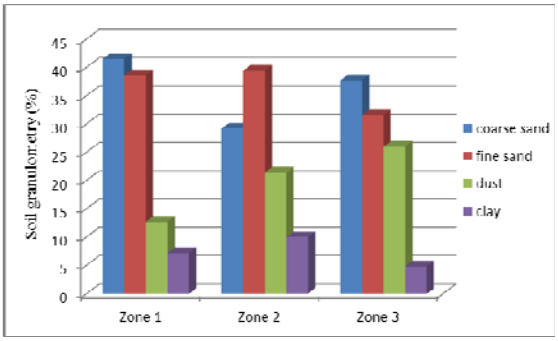


Figure 3. Granulometrical fractions (%) of the analysed soil

The content of the organic substance in the soil (Figure 4) is quite high in the strictly protected zone, 19.117%, in the buffer zone is 5.566% and in the zone of sustained development is 8.567%.

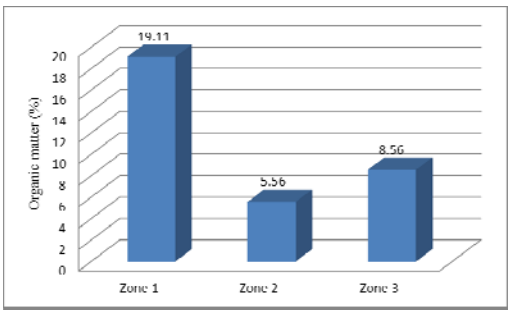


Figure 4. The organic matter content in the soil samples

The content of organic matter has been established through the Walkley-Black method, respectively wet oxidation. Generally, the low content of organic substance is due to the terrain's slope, to the usage type and to the vegetation (According to ICPA).

***The chemical characterization of the studied soil***

The distribution of vegetation in the Rodnei Mountains National Park plays an important role in the determination, acknowledgement and characterization of the soil in pedological studies.

The pH of the deducted and analysed samples shows the following values: 5.09 in zone 3, 7.53 in zone 2 and 7.59 in zone 1 (figure 5), which denotes a weak acid and neutral pH (weakly alkaline).

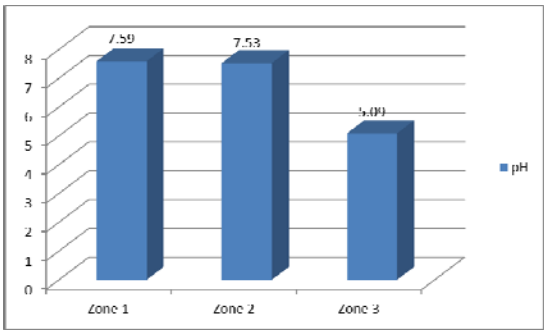


Figure 5. The pH values of the studied samples

The pH values have been established by calculating the percentage ratio between the content of exchangeable bases (SB, me/100g soil, determined through the Kappen method) and the total cationic exchange capacity. The soils having a pH reaction > 6.9 have been classified as saturated.

*The soil's humidity* is the amount of water that is physically connected to the soil at the moment when the samples are deducted. This water evaporates at 105˚C. The humidity of the soil is influenced by the climate, temperature, area's altitude, vegetation and the usage but also by the inclination and orientation of the field. Knowing the soil's humidity is important agrotechnically and ecologically speaking but also for choosing the required methods for the reconstruction of a degraded terrain, respectively the Rodnei Mountains National Park.

According to the studied area, the three zones show significant differences regarding the degree of water retention in the soil.

As follows: in zone 1, the strictly protected one, we have 43.69%, in the buffer zone 23.22%, where there is forest exploitation we have 16.82%.

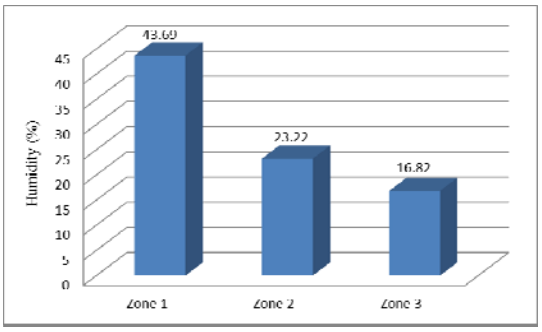


Figure 6. The humidity of the collected soil

Due to the higher humidity in the areas where there was forest exploitation or which are heavily wooded, we can say that the soil's texture is not fragile and does not cause the removal of the soil as dust under the wind's action, but it becomes more fragile, which causes the removal of the soils as dust in some periods where there is a higher wind activity.

## CONCLUSIONS

The physical and chemical characterization of the collected soil highlights some major differences between the three studied zones.

During the study, the sample from the zone 1 (the resort Corongis) is the control sample.

This sample has been chosen because in the zone 1 there are no forest exploitation activities, the zone being still a virgin one.

The purpose of this study is to highlight the importance of a protected area of national interest, the manner of usage of the terrain,

respectively the practices of each specific area of the park, being also of importance.

By using the achieved data (pH, humidity, organic substance, granulometry) the soil's degree of susceptibility to erosion can by quantified.

## REFERENCES


Regulations of Organization and Operation of the Rodnei Mountains National Park, Reservation of Biosphere, Nature Site 2000 (ROSCI0125 and ROSCPA0085)

The 184/1997 Order From 21st of September 1997 for the approval of the Procedure of Environmental Audits

Management plan 2017, Rodnei Mountains National Park