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# CHEMICAL CHARACTERISTICS OF THE FOREST SOILS FROM PRAHOVA COUNTY

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***Abstract***

*Chemical, physical and biological characteristics of forest soils are very important for foresters especially for assessing the capacity of forest sites for timber production. More and more foresters started to take into consideration the relation between the forest soils, the tree layer composition and the silvicultural measures in order to find the best combination from a sustainable development point of view. The aim of this study was to realize a description of the forest soils from Prahova County. The data for the timeframe 1988-2012 from the forest management plans of the eight state-owned forest districts within Prahova Forestry Directorate were taken into account. The most common forest soils across Prahova County were the eutric cambisol, the dystric cambisol and the luvisol. By taking into account the values of the pH and soil base saturation, two of the most relevant chemical characteristics of forest soils, we can say that the forest sites with eutric cambisols and luvisols provide the optimum conditions for the development of beech and Norway spruce. In order to conserve or to increase the chemical characteristics of the forest soils to an optimum level, future silvicultural measures should be focused on promoting the mixed stands, even if by doing this, the forests managers will have to face several challenges.*

***Key words*****:** *dystric cambisol, eutric cambisol, forest soils, luvisol, Prahova*

## INTRODUCTION

Knowing that the biological, physical and chemical properties of forest soils represents for foresters one of the main way to assess the capacity of certain forest sites especially in terms of timber production [19].
Nowadays, more and more foresters, both from research and production fields, are taking into consideration the impact of certain silvicultural measures on the forest soils [10], including their capacity for carbon sequestration [14], [15].
It is well known that the tree harvesting, especially the ones with high intensity (*e.g.* clear cuttings) is mainly affecting the activity of several soil microorganisms by changes that are occurring in plant cover, compaction of the top layer of the soil or reduction of organic matter [16].
Moreover, by maintaining or changing different tree layer compositions, the foresters have a direct impact on the biological, physical and chemical properties of the soils. For example, in the case of pure Norway spruce forest stands [*Picea abies* (L.) H. Karst.], it was reported that the physical properties of the soils were negative affected, especially regarding the content of Magnesium and Calcium [2].
The impact of forest stands planted on former agricultural soils is also notable. For example, according to a research done in Lithuania, Sweden and Denmark, where plantations with small-leaved lime (*Tilia cordata* Mill.) and Norway spruce were established on arable lands, almost four decades later, the soils where linden was planted recorded higher values for base saturation and pH in comparison with the stands planted with Norway spruce [9]. *P. abies* was expanded beyond its natural distribution across Europe in the last century [20] and perhaps this is one of the main reasons for soil acidification in most of the stands, several proofs being recorded [12]. Soil characteristics are linked

to soil fertility [2], determining also the quality of the water in the soil [17].
The aim of this paper was to realize a description of the forest soils from Prahova County.

## MATERIALS AND METHODS

Data and information regarding the soil types and their chemical characteristics were collected from the forest management plans (FMPs) of the eight forest districts within Prahova Forestry Directorate, namely Azuga, Câmpina, Măneciu, Ploiești, Sinaia, Slănic, Văleni and Verbila [1].
Special attention was given to the soil pH, soil base saturation, humus content, the total cation exchange capacity and nitrogen content. The main chemical characteristics were recorded separately on pedogenetic horizons. Some examples of horizons are given in Fig. 1.

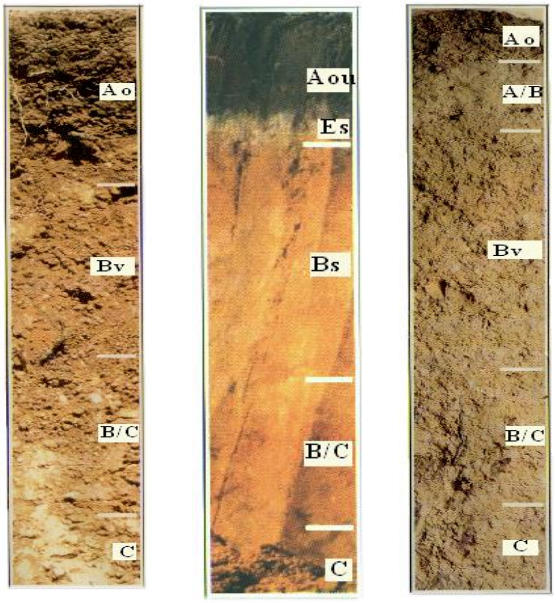


Fig. 1. Examples of soil profiles
Source: Soils of Romania [22]

Prahova County covers an area of almost 2% of the total area of the country [4], having all three main landform types and a high degree of torrentiality in the mountainous regions, especially on Prahova Valley [5].
The total forest area from Prahova County accounts for about 146.600 hectares, being composed, in majority (76%), of hardwood species, mainly beech (*Fagus sylvatica* L.). Almost two thirds of the forests are managed by Prahova Forestry Directorate, the rest being managed by private-owned forest districts, Ever Green and Ingleby having the highest shares across the county [7].
The county has a good tourism potential especially thanks to the socio-economic perspective [8] and the landscape across Prahova Valley [11], [13]. The forest vegetation from Prahova Valley is mainly composed by beech, silver fir (*Abies alba* Mill.) and Norway spruce [18], some of them being natural forests [3], that were recently included in the National Catalogue of Virgin and Cvasi-Virgin Forests of Romania.

## RESULTS AND DISCUSSIONS

The soil samples taken into account for this study were collected in the timeframe 1988-2012, a total of 550 soil profiles and 1.584 pedogenetic horizons being analyzed.
Thirteen forest soils types were identified across the forest lands managed by Prahova Forestry Directorate.
Eutric cambisols and dystric cambisols were the most common ones (50% and 17%, respectively), followed by luvisols (14%), rendzic leptosols (6%), phaeozems (3%), preluvisols (3%) and others (Fig. 2).

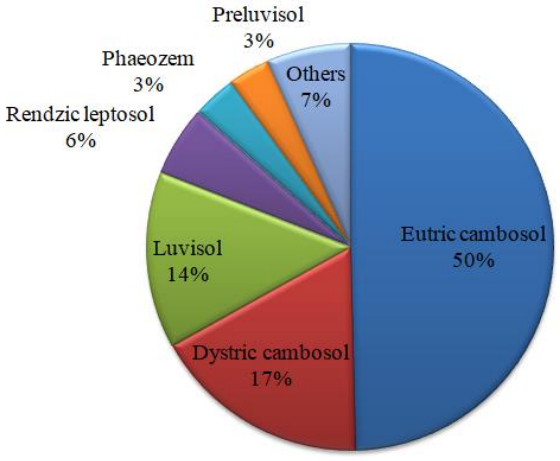


Fig. 2. The main forest soils types from Prahova County
Source: centralized data from the FMPs [1]

Very low represented were the phaeozem, preluvisol, entic podzol, chernozem, luvisol, gleysol, solonchak, solonetz and vertisol types (in total, 7% of the forest soils).

As regards the top three, the results are similar with the situation reported at national level [6], according to which dystric cambisol is placed on the first place in terms of occupied area (35%), luvisol on the second position (22%) and eutric cambisol on the third (13%).
The values of the soil pH, which was differentially calculated on pedogenetic horizons for the three most common soil types, are presented in the followings.
In the case of the most common forest soil, the average pH value in Ao horizon was 5.36 and 5.90 in Bv horizon, respectively.
Similar values were recorded also for the luvisols. The average pH value in Ao horizon was 5.32, while in Bt horizon the value was 5.42, and slightly smaller in El horizon (*i.e.* 5.06), respectively.
Dystric cambisols had an average pH value of 4.58 in Ao horizon and of 4.68 in Bv horizon, being a strongly acid soil.
By taking into account the average values of the pH recorded for the main three forest soils types and corroborating them with the data from specialized manuals as regards the optimum range of the site characteristics for certain forests species [21], we can say that the beech and Norway spruce pure or mixed stands have optimal condition in forest sites with eutric cambisol and luvisols and suboptimal condition is sites with dystric cambisols.
The average values of the soil base saturation (V%) for the main three forest soil types from Prahova County are given in Table 1.

Table 1. Average values of soil base saturation (V%)

| Soil type | Horizon (V%) | | | |
|---|---|---|---|---|
| | Ao | Bv | Bt | El |
| Eutric cambisols | 66.66 | 74.75 | - | - |
| Dystric cambisols | 45.12 | 43.49 | - | - |
| Luvisols | 61.97 | - | 64.39 | 46.28 |

Source: centralized data from the FMPs [1]

Based on these values, eutric cambisols are classified as mesobasic soils, while the dystric cambisols are oligomesobasic soils.
In the case of the luvisols, the differences between the values recorded for the main horizons were bigger, being oligomesobasic (El horizon) – mesobasic (Ao and Bt horizons) soils.
All these values recorded for all of the three forest soil types are optimal for the beech and Norway spruce, pure or mixed stands [21].
The average humus content (H; %) and the total cationic exchange capacity (T; me/100 g soil) for the main three soil types from Prahova County are given in Table 2.

Table 2. Average humus content and total cationic exchange capacity for the main forest soils from Prahova County

| Soil type | H/T | Horizon | | | |
|---|---|---|---|---|---|
| | | Ao | Bv | Bt | El |
| Eutric cambisols | H | 6.44 | 2.84 | - | - |
| | T | 27.79 | 22.32 | - | - |
| Dystric cambisols | H | 6.07 | 2.52 | - | - |
| | T | 27.58 | 22.01 | - | - |
| Luvisols | H | 6.94 | - | 2.58 | 2.16 |
| | T | 29.5 | - | 22.03 | 20.92 |

Source: centralized data from the FMPs [1]

Based on the values recorded for humus content in the first horizon (*i.e.* Ao), all three soil types are classified as being intensely humiferous soils.
The nitrogen content, which was calculated only for the first pedogenetic horizon, is given in Table 3.

Table 3. Average nitrogen content of the main forest soils from Prahova County

| Soil type | N content |
|---|---|
| | Ao |
| Eutric cambisols | 0.309 |
| Dystric cambisols | 0.336 |
| Luvisols | 0.262 |

Source: centralized data from the FMPs [1]

The highest quantity of nitrogen was found for the dystric cambisols, followed by eutric cambisols and luvisols.

## CONCLUSIONS

The most common forest soils across Prahova County were the eutric cambisols, dystric cambisols and luvisols.
As regards the values recorded for soil pH for the main three forest soils types, the dystric

cambisols are classified as acid soils, while the eutric cambisols and luvisols are moderately acid soils. By corroborating the pH values with the ones of the soil base saturation, we conclude that the forests sites with eutric cambisols and luvisols present the optimal condition for the development of the two most common tree species across Prahova County, namely the common beech and Norway spruce.

Based on the above-mentioned aspects, in our opinion, in order to conserve or to increase the chemical characteristics of the forest soils to an optimum level, future silvicultural measures should be focused on promoting the mixed stands to the detriment of the Norway spruce pure stands, even if by doing this, the forests managers will have to face several challenges.

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