THE TROPHICITY OF A STAGNIC LUVOSOL UNDER THE INFLUENCE OF DOUGLAS (*PSEUDOTSUGA MENZIESII*) AND SESSILE OAK (*QUERCUS PETRAEA*) FOREST

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Abstract: *Trophicity it's an important characteristic of forestry resorts. The trophic potential of non – degraded natural ecosystems can be explained by the potential global trophicity index. The objective of the presented work is to show the influence of forest vegetation, represented by Douglas of 40 year old and Sessile oak (Quercus petraea) of 70 year old, on the global potential trophicity of a epihipostagnic luvosoil from the area of Tinca Forest District, U.P. 3 Gepis. The humus quantity is higher in case of Sessile oak than in case of Douglas all depth long of the profile, with 0,14 – 11,94 % an exception being the clay accumulation horizon of Btw argic. The degree of basic saturation is superior on the profile under Douglas compared to the profile under sessile oak with values between 2,11 % and 4, 31 %. The ratio between the edaphic amount represented by soil amount, less than the soil occupied by skeleton and the amount of tree roots and the amount of the analyzed soil was appreciated of 0,9. If in the first two horizons the two soils are included in silty sandy loam textural subclass, in the ElwBtw transitional horizon will pass from the silty sandy loam to the silty loam and in the illuvial argic horizon Btw go from the medium clayey loam to the silty clayey loam. Estimated bulk density values according to textural classes of the soil horizons are between 1, 30 g/cm in the bioaccumulation horizon A for both soil profiles; and between 1,37 and 1,39 g/cm^3 in the horizon of accumulation Btw clay. The analyses of the soil were made by the „County Office for Pedological and Agrochemical Studies Oradea" in accordance to the „Methodology of Elaborate Pedological Studies" – The Research Institute for Pedology and Agrochemistry, Bucharest. The potential global trophicity index it has the value of 54,65 in case of profile under Douglas and 56,70 under sessile oak. The differences between the two profiles are not essential, both of them being characterized as mesotrophic soils. Indicele de troficitate potențială globală are valoarea de 54,65 în profilul de sol de sub duglas și respectiv 56,70 în profilul de sub gorun. Diferențele dintre cele două profile nu sunt esențiale, ambele fiind caracterizate ca soluri mezotrope.*

Key words: *Douglas forest, sessile oak forest, proxihipostagnic luvosoil, trophicity;*

INTRODUCTION

In the relations between the pedosphere and biosphere, the most important relation of interdependence is represented by the fact that the soil represents the natural support, assures water and nutritious elements necessary for growth and development of vegetation, while the biosphere, through the quantity and quality of organic matter distributed on the surface and depth of soil, influences the quantity, quality and distribution of humus in the profile's depth. [5.]

The growth and production of biomass of trees and stands according to soil's capacity of supply with water and with nutritional elements, namely soil's trophicity. Soil's trophicity depends not only on the fund of available nutritional elements but also on the available water and the soil's favorability for root system development. [7.]

Trophicity it's an important characteristic of forestry resorts. The trophic potential of non–degraded natural ecosystems can be explained by the potential global trophicity index. [3.]

The objective of the presented work is to show the influence of forest vegetation, represented by Douglas (*Pseudotsuga Menziesii*) of 40 year old and Sessile oak *(Quercus petraea)* of 70 year old, on the potential trophicity index of a epihipostagnic luvisols from the area of Tinca Forest District, U.P. 3 Gepis.

The soil is laid on a relatively flat surface with little waves, with an altitude of 280 m, this is a reason why it presents stagnic properties, on the superior part of the profile.

The type of herbal flora, after BELDIE and CHIRIȚĂ, is: Genista tinctoria - *Poa nemoralis* and other guiding plants (frequent accompanying) are: Carex contigua, Dactylis glomerata, *Galium pseudoaristatum*, *Lapsana communis*, *Melampyrum bihariense*, *Cytisus nigricans*. [1.]

Former researches about soil evolution from the Ocolul Silvic Tinca area, U.P. 3 Gepiș under the influence of sessile oak forest in the last 40 years it has registered some changes of Physico chemical properties compared to those from the profile under Douglas forest in 70 years. [4, 6.]

MATERIAL AND METHODS

In order to reach the proposed objective, on the epihipostagnic luvosoil from U.P. 3 Gepis were opened two soil profiles, until the depth of 1 m, one in the 38 F parcel, occupied by 40 year old Douglas (Profile no.1) and the other one in the 38 B parcel, occupied by 70 year old Sessile oak (Profile no.2) on a distance of approximately 30 m between the profiles. [8.] (Figure 1).
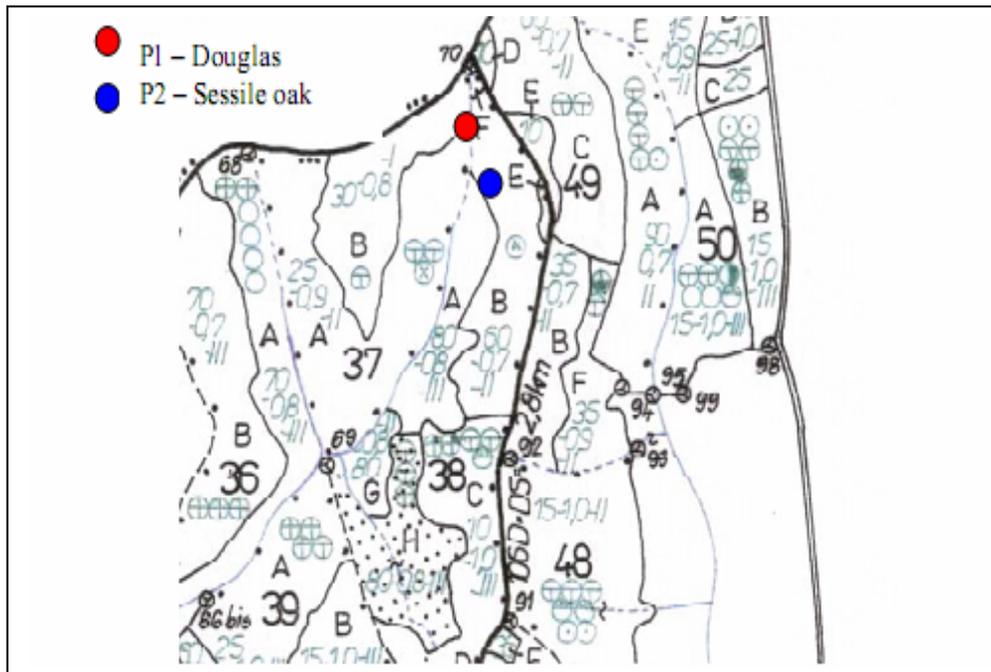

Figure 1. Emplacement of soil profiles

After the delimitation of horizons there were crapped samples from each horizon inducing the following characteristics: texture, reaction (pH H2O), hydrolytic acidity (Ah), the

sum of bases (SB), saturation degree in bases (V %), humus (H %), total nitrogen (N %), phosphor (P p.p.m.) and mobile potassium (K p.p.m.).

In order to appreciate soil's trophicity it has been used the potential global trophicity index, calculated with the relation settled by Chiriță C., 1964:

$$Itp = \sum_{i=1}^{n} Itp_i = \sum_{i=1}^{n} H_i \cdot d_i \cdot V_i \cdot 0,1 \cdot rv_i \cdot DA_i; \qquad [1.]$$

where: H - humus content (%) from horizon i;

       d – Thickness (dm) of i horizon;

       V – The degree of basic saturation (%) of horizon i;

       0, 1 – derogation coefficient in order not to reach high index values;

       rv – the ration between edaphic amount (soil without skeleton and roots) and the amount of soil from horizon i;

       DA – seeming density from horizon i;

Thanks to the fact on the opening of the two soil profiles, there were taken soil samples in cylinders, in order to determine the seeming density; this was appreciated using the triangular diagram of seeming densities for the agrarian soils from Romania; from figure 2, according to the soil's texture. [2.]

The analyses of the soil were made by the „County Office for Pedological and Agrochemical Studies Oradea" in accordance to the „Methodology of Elaborate Pedological Studies" – The Research Institute for Pedology and Agro chemistry, Bucharest.

RESULTS AND DISCUSSIONS

The humus quantity is higher in case of Sessile oak than in case of Douglas all depth long of the profile, with 0,14 – 11,94 % an exception being the clay accumulation horizon of Btw argic, where under the Douglas stand is registered a difference of 0,18 % compared to sessile oak stand. (Table 1.)

Table 1.

Humus content modifications due to forest vegetation

Horizon	Depth (cm)	Humus (%)		
		Profile no.1. Douglas	Profile no. 2. Sessile oak	Differences
O	0 – 3	29,08	37,02	+11,94
Ao	3 – 10	4,03	6,12	+2,09
Elw	11 – 32	1,08	1,37	+0,29
ElwBtw	33 – 56	0,66	0,80	+0,14
Btw	57 – 100	0,58	0,40	-0,18

Analyzing the contents distribution of humus in the depth of those two analyzed profiles it is remarked that for both profiles the content of humus is higher in horizon O and reduced reversed proportional with the profile's depth. (Figure 3.).

The degree of basic saturation is superior in case of profile under Douglas compared to that under sessile oak, with values between 2,11 % and 4,31 %. The biggest difference it's registered in the ElwBtw transition horizon. (Table 2.)
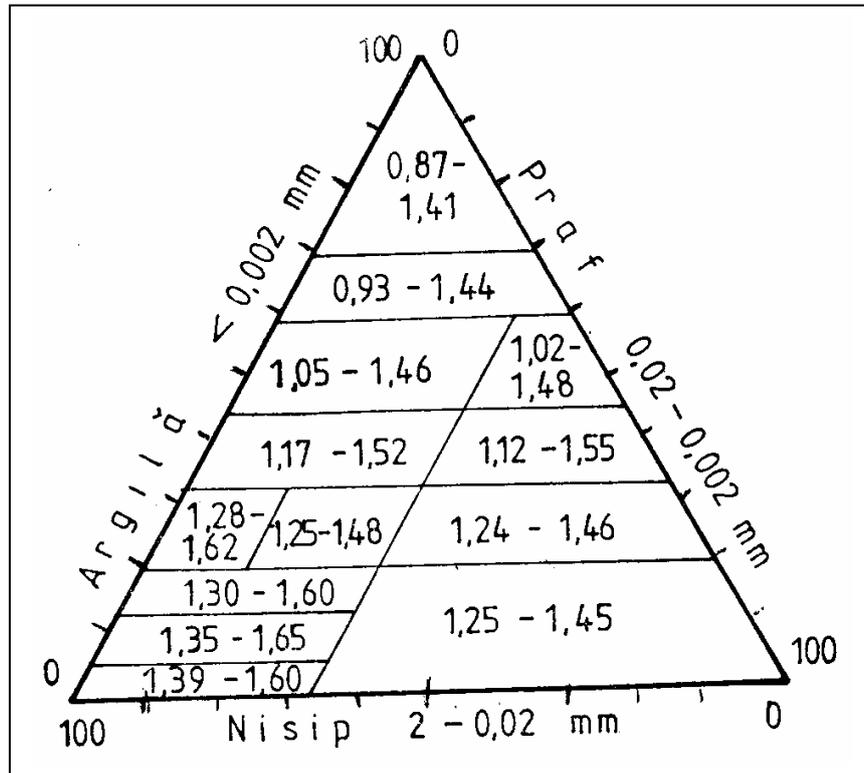

Figure 2. Frequent bulk density values (g/cm^3) in agrarian soils from Romania
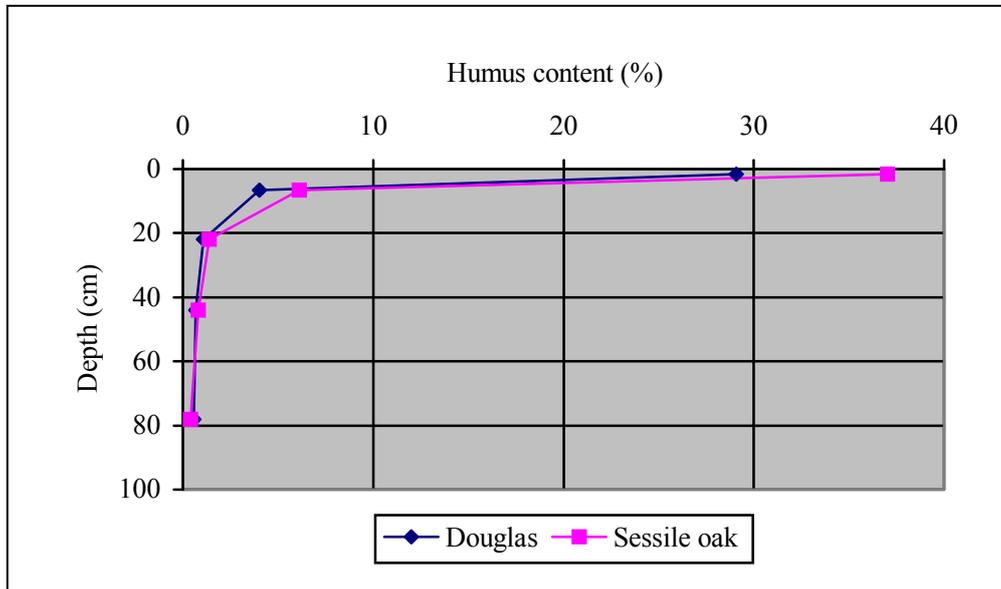(according to CANARACHE A., 1990)

Figure 3. Humus content variations in depth

Table 2.

Modifications of saturation grades in the bases (%) owed by forestry vegetation

Horizon	Depth (cm)	Saturation grade in bases (%)		
		Profile no.1. Douglas	Profile no. 2. Sessile oak	Differences
Ao	3 - 10	43,90	41,79	+2,11
Elw	11 - 32	34,83	32,67	+2,16
ElwBtw	33 - 56	49,70	45,39	+4,31
Btw	57 - 100	70,83	66,73	+4,10

The ratio between the edaphic amount represented by soil amount, less than the soil occupied by skeleton and the amount of tree roots and the amount of the analyzed soil was appreciated of 0,9.
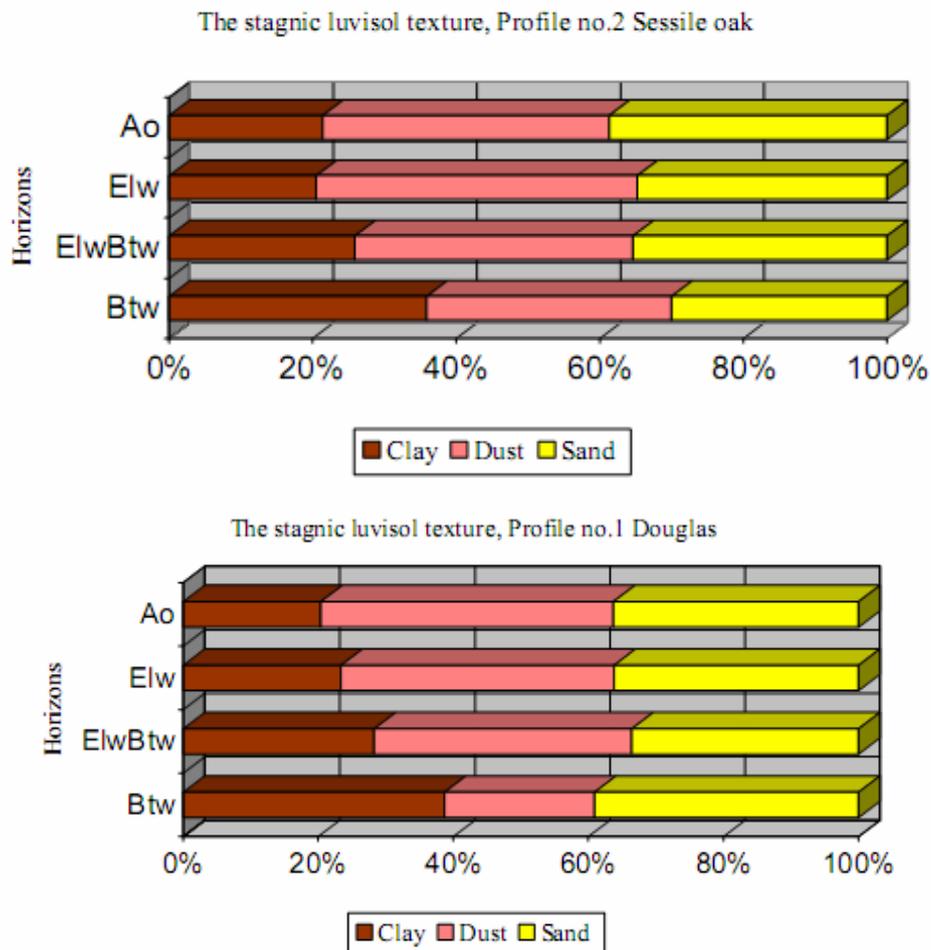
The stagnic luvisol texture, Profile no.2 Sessile oak

The stagnic luvisol texture, Profile no.1 Douglas

Figure 4. The size composition for stalled luvosoil occupied by Douglas and sessile oak

Analyzing the percent-participation of clay size, dust and sand fractions for the two studied profiles we mention the fact that for both profiles the percent of clay is rising starting from the surface until the basis of the profile. (Figure 4.)

The percent of dust, in case of luvosoil under Douglas has a decreasing tendency, starting from the surface until the depth, decreasing that is less evident in case of the profile under Sessile oak.

In case of sand, we can see the same tendency of decreasing under Sessile oak, while under Douglas the percents are close in the first two horizons Ao and Elw, it is reduced to the ElwBtw transition horizon so as the level of argic Btw horizon to overpass the content on the surface of profile.

The difference between the clay content of the two profiles of analyzed soil indicates the fact that the bioaccumulation horizon produces a meaningless decreasing of clay content in the profile under Douglas than under Sessile oak. This tendency is inverted starting from the

level of eluvial Elw horizon towards eluvial argic Btw, the content of clay growing under Douglas compared with the profile under Sessile oak with values between 2,4 % and 2,9 %.

If in the first two horizons the soil is included in silty sandy loam subclass, in the ElwBtw transitional horizon will pass from the silty sandy loam to the silty loam and in the illuvial argic horizon from the medium clayey loam to the silty clayey loam.

Bulk density values estimated according to the textural classes of horizon soil with the help of triangular diagram Canarache A. are include between 1,30 g/cm^3 in the bioaccumulation horizon A_o for both soil profiles and respectively 1,37 and 1,39 g/cm^3 in Btw clay accumulation horizons, the biggest values being registered under Douglas. (Table 4.)

The potential global trophicity index was calculated on the horizons components of both analyzed soil profiles, the value of each profile was obtained by cumulating the values corresponding to the component profiles. (Table 5.)

The values of potential trophicity index of the component horizons are reduced from surface towards depth, being influenced by the humus content that presents the same variation. There is an exception in case of Btw argic horizon for which the values of the same index don't respect the same rule, owed to the influence of saturation grade in bases.

Table 4.

Estimated values of bulk density (g/cm^3)
(According to CANARACHE A., 1990)

Pro-file	Horizon	Size composition (%)			Nf/Gg	Variation interval DA	Bulk density (g/cm^3)
		Sand	Dust	Clay			
Douglas	Ao	36,3	43,3	20,4	24,9	1,24 - 1,46	1,30
	Elw	36,2	40,4	23,4	20,3	1,24 - 1,46	1,28
	ElwBtw	33,6	38,1	28,3	17,7	1,24 - 1,46	1,32
	Btw	39,1	22,2	38,7	25,1	1,17 - 1,52	1,39
Sessile oak	Ao	38,7	39,9	21,4	24,8	1,24 - 1,46	1,30
	Elw	34,8	44,7	20,5	17,3	1,24 – 1,46	1,28
	ElwBtw	35,4	38,7	25,9	15,1	1,24 – 1,46	1,32
	Btw	30,0	34,1	35,9	14,8	1,12 - 1,55	1,37

The potential global trophicity index has the value of 54,65 in the soil profile under Douglas and respectively 56,70 in the profile under sessile oak. The differences between the two profiles are not essential, both of them being characterized as mesotrophic soils. (TIII).

Table 5.

Potential global trophicity index

Pro-file	Horizon	Humus (%)	Horizon depth (dm)	Saturation grade in bases V (%)	rV	Bulk density DA (g/cm^3)	Itp $H_i d_i V_i 0,1DA$
Douglas	Ao	4,03	0,7	43,90	0,9	1,30	14,49
	Elw	1,08	2,1	34,83	0,9	1,28	9,10
	ElwBtw	0,66	2,3	49,70	0,9	1,32	8,96
	Btw	0,58	4,3	70,83	0,9	1,39	22,10
	Σ						54,65
Sessile oak	Ao	6,12	0,7	41,79	0,9	1,30	20,95
	Elw	1,37	2,1	32,67	0,9	1,28	10,83
	ElwBtw	0,8	2,3	45,39	0,9	1,32	10,30
	Btw	0,4	4,3	66,73	0,9	1,37	14,62
	Σ						56,70

Taking into account that the soil hasn't got salinisation and solodization problems, and making abstractions of stagnogleization influence, the potential trophicity index can be considered as effective trophicity index which characterizes the creditworthiness of resorts and the capacity of stands.

CONCLUSIONS

The humus quantity is higher in case of Sessile oak than in case of Douglas all depth long of the profile, with 0,14 – 11,94 % an exception being the clay accumulation horizon of Btw argic, where under the Douglas stand is registered a difference of 0,18 % compared to sessile oak stand.

The saturation grade in bases it is superior on the profile under Douglas compared to that under sessile oak with values between 2,11 % and 4,31 %.

In the first two horizons the soil is included in silty sandy loam textural subclass, in the ElwBtw transitional horizon will pass from the silty sandy loam to the silty loam and in the illuvial argic horizon from the medium clayey loam to the silty clayey loam.

Bulk density values estimated according to textural classes of soil horizons with the help of triangular diagram Canarache A. are included between 1,30 g/cm^3 in bioaccumulation horizon A_o for both soil profiles pentru ambele profile and respectively 1,37 and 1,39 g/cm^3 in Btw clay accumulation horizon.

The potential trophicity index values of the component horizons are reduced from the surface towards depth being influenced by humus content that presents the same variation. There is an exception in case of Btw clay horizon for which the values of the same index don't respect the same rule, owed to the influence of saturation grade n bases.

The potential global trophicity index has the value of 54,65 in the soil profile under Douglas and respectively 56,70 in the profile under sessile oak. The differences between the two profiles are not essential both of them being characterized as mesotrophic soils.

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