THE QUANTITATIVE DETERMINATION OF ECOLOGICAL INDICATORS FOR SESSILE-OAK AND BEECH FOREST SITE (FD3) ON EUTRICAMBOSOILS, FROM THE IALOMIȚA SUBCARPATHIANS

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Abstract

The present work aims at the quantitative determination of ecological indicators used in the evaluation of sessile – oak, beech and mixed hill forest sites of the Ialomita Subcarpathians. Thus the paperwork analyzes the ecological indicator variation for each class of forest site quality, and places them in size and favorability levels, according to the ecological requirments of the two species under investigation. The outcome of this analysis was the comparative polygon of the ecological indicators favorability for the two species, growing on eutricambosoils. This inturn, helps to notice which of the indicators plays a major role on the forestry-sites quality situated on the eutricambosoil.

Key words: soil, site evaluation, site quality, beech, sessile oak, comparative analysis.

INTRODUCTION

Ever since the oldest times, forestry has tried to answer the question ”whether the species used in afforestation-sites maximally valorify the conditions given by the forest-site”.

Therefore, the present work determines the variation interval for the main ecological indicators specific to the sessile, beech and mixed hill-area forest-sites from the Ialomița Succarpathians, growing on eutricambosoils.

The natural environment of the Ialomița Subcarpathians offers appropiate growing conditions for sessile and beech (Târziu, 2006), which can be inferred from the analysis of the forest vegetation distribution on species and productivity-categories (Enache, Spârchez, 2011). The solificatio conditions specific to the Ialomița Subcarpathians have favored the predominant formation of Eutricambosoils and Luvosoils (Enache, Spârchez, 2012).

MATERIAL AND METHODS

The research methods have been diverse, combining bibliographical research with direct observation and measurements, laboratory analysis and statistical treatment.

The accomplishment of the targeted purpose started from the hypothesis lannched by more Forestry specialists, according to which the tree-height represents te best indicator of forest-site quality (Rucăreanu, 1962; Giurgiu, 1972; Leahu, 1994).

Of all classification criteria of forestry-site evaluation, forest stand productivity plays a outstanding role, according to which we identify: superior productivity forest types (1st and 2nd production class), medium productivity forest types (3rd production class) and inferior productivity forest types (4th and 5th production classes) (Pașcovschi, Leandru, 1958). The same productivity criteria is enforced by the romanian-school of forest sites (Chiriță et al., 1977), as well as the forest ecosystem typology (Doniță et al., 1990). As a result of the lack of clear stational criteria, forest-typology has growingly resorted to the use of forest-production classes as a means of characterizing the forest-site quality level.

Thus, the present work involved the analysis of even-aged forest-stands, and the corresponding production class resulted according to the forest-stand age and its average height (Giurgiu, Drăghiciu, 2004).

By analysing the percentage distribution of forest sites type and quality site level, as well as by means of the percentage-distribution analysis on forest types and productivity categories of the investigated territories (Enache, Spârchez, 2011), has resulted a connection between the forest stand productivity level and the forest site quality level, therefore, the production class can be used as an indirect means of classifying the soil chemical analysis bulletin on sites quality levels.

The soil chemical and phisical analysis has been conducted by the Pedology Laboratory of the Faculty of Silviculture and Forest Engineering of Brașov.

RESULTS AND DISCUSSION

The variation interval of the edaphic indices can be consulted in table 1 for eutricambosoil-grown beech and table 2 for eutricambosoil-grown sessile.

Table 1

The main statistical indicators of eutricambosoils from beech forest sites

Chemical properties	Horizon	Statistical indices					
		Level of forest site evaluation					
		Superior		Medium		Low	
		$\bar{x}$	(s%)	$\bar{x}$	(s%)	$\bar{x}$	(s%)
1	2	3	4	5	6	7	8
Edaphic volume (m^3/m^2)	Ao	0,82	21,92	0,61	26,49	0,50	8,49
	Bv						
Apparent density	Ao	1,12	5,49	1,14	5,72	1,19	0,60
	Bv						
pH, (water)	Ao	5,46	10,31	5,29	12,14	4,98	9,09
	Bv	5,66	11,04	5,70	10,99	5,30	5,74
Humus %	Ao	6,11	56,34	4,89	44,25	2,62	20,82
Total nitrogen %	Ao	0,26	38,45	0,26	41,43	0,12	3,63
C/N	Ao	13,45	19,83	10,84	13,31	12,92	17,25
Exchange base, Sb, (me%)	Ao	16,69	55,33	12,34	49,04	6,09	67,11
	Bv	16,58	46,74	14,82	42,27	10,35	15,71
Exchangeable hydrogen, Sh, (me%)	Ao	10,96	34,49	8,18	35,77	9,97	5,25
	Bv	7,95	33,60	6,88	42,78	7,73	31,58
Total exchange capacity, T, (me%)	Ao	27,64	37,04	20,52	27,53	16,06	28,71
	Bv	24,53	35,53	21,71	36,11	18,08	22,49
Degree of base saturation, V (%)	Ao	59,82	25,32	59,06	25,51	35,74	42,48
	Bv	67,38	13,69	68,18	15,23	57,71	6,91
K, mg K2O/100g soil	Ao	17,14	42,50	13,11	53,51	19,93	65,12
P, mg P2O5/100g soil	Ao	8,75	112,58	10,08	113,50	13,85	127,13

The following statistics resulted from determining the production class and from classifying the analysis bulletins on site quality levels:

- regarding the beech-stands, there were analyzed the edaphic indices for 16 experimental areas of superior quality level, 12 experimental areas of medium quality level and 2 experimental areas of inferior quality level;
- as regards the sessile-stands, there were taken into acount the edaphic indices for 12 experimental areas of superior quality level, 7

experimental areas of medium quality level and one experimental area of inferior quality level;

Table 2

The main statistical indicators of eutricambosoils from sessile oak forest sites

Chemical properties	Horizon	Statistical indices					
		Level of forest site evaluation					
		Superior		Medium		Low	
		$\bar{x}$	(s%)	$\bar{x}$	(s%)	$\bar{x}$	(s%)
1	2	3	4	5	6	7	8
Edaphic volume (m^3/m^2)	Ao	0,85	21,98	0,56	21,63	0,51	-
	Bv						
Apparent density	Ao	1,12	4,65	1,12	5,63	1,06	-
	Bv						
pH, (water)	Ao	5,64	12,36	5,44	16,11	5,05	-
	Bv	5,66	10,66	5,65	13,25	5,73	-
Humus %	Ao	5,78	36,27	5,41	47,83	4,53	-
Total nitrogen %	Ao	0,27	27,87	0,27	44,14	0,26	-
C/N	Ao	12,53	16,33	11,43	12,14	10,11	-
Exchange base, Sb, (me%)	Ao	20,30	58,50	15,16	60,17	12,89	-
	Bv	18,41	43,41	10,64	21,82	8,98	-
Exchangeable hydrogen, Sh, (me%)	Ao	9,93	20,75	7,62	48,00	6,23	-
	Bv	7,89	17,85	6,20	48,37	2,83	-
Total exchange capacity, T, (me%)	Ao	30,22	37,66	22,78	39,28	19,12	-
	Bv	26,30	31,88	16,84	16,64	11,80	-
Degree of base saturation, V (%)	Ao	61,63	29,46	69,45	18,54	67,41	-
	Bv	67,75	13,92	67,05	16,84	76,01	-
K, mg K2O/100g soil	Ao	20,22	42,38	16,73	66,16	7,02	-
P, mg P2O5/100g soil	Ao	13,35	115,55	17,03	90,16	1,41	-

According to the average value of the edaphic indices and to the average climatic indices optained by means of the temperature and pluviometric

gradients for the Câmpulung Muscel, Câmpina and Târgovişte weather stations, there was carried out a classification in size and favorability level.

The classification on size and favorability level (Table 3) was carried out according to the ecological sheet for the two species, sheets owed to Stănescu et al. (1997).

Table 3

The ecological sheet for the forest sites situated on Eutricambosoils

Ecological and decisive factors	**Eutricambosoil - Beech**						**Eutricambosoil – Sessile oak**					
	S.S.Q		**M.S.Q**		**I.S.Q**		**S.S.Q**		**M.S.Q**		**I.S.Q**	
	Classes of size and favorability											
	Size	Fav	Size	Fav	Size	Fav	Size	Fav	Size	Fav	Size	Fav
Temperature. a.a (˚C)	IV	H	III	VH	IV	H	IV	H	IV	VH	IV	H
Precipitation a.a (mm)	IV	H	IV	H	IV	H	IV	H	IV	VH	III	H
Relative humidity in july (%)	IV	H	IV	H	IV	H	IV	H	IV	H	IV	H
Total N (%)	III	M	III	M	II	S	III	M	III	M	III	M
Accesible P_2O_5 (mg/100g soil)	V	L	V	M	V	M	V	M	E1	H	I	N
Accesible K_2O (mg/100g soil)	IV	M	III	M	IV	H	IV	VH	IV	H	II	L
Exchange base, Sb (me/100g soil)	III	M	III	L	III	L	III	M	III	L	II	L
Acidity (pH in water)	III	VH	III	VH	III	H	III	H	III	H	III	H
Alkalinity (pH in water)	-	-	-	-	-	-	-	-	-	-	-	-
Water. Humidity Suction (atm)	III	M	III	M	III	M	III	M	III	M	III	M
Edaphic volume	IV	H	IV	H	IV	M	IV	H	III	M	IV	M
Length of the bioactive period (months)	III	H	III	H	III	H	III	H	III	H	III	H

S.S.Q – Superior site quality, M.S.Q – Medium site quality, I.S.Q – Inferior site quality

By means of the ecological sheet that classifies the ecological indices on classes of size and favorability, there was determined their combined action for each quality level. By overlapping the iregular polygons of the ecological favorability indices for each of the two species in discission, according to their quality level, there was optained a comparative chart (Fig. 1 and Fig. 2), by means of which different influences can be more easily determed.

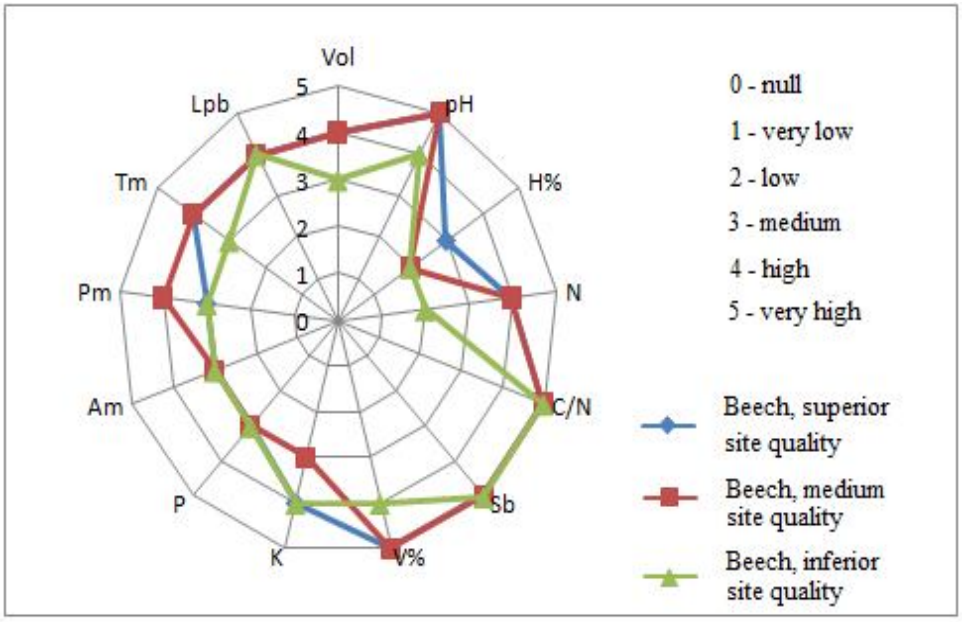

Fig.1. The comparative analysis regarding the favorability of the ecological indices for beech forest sites situated on Eutricambosoils.

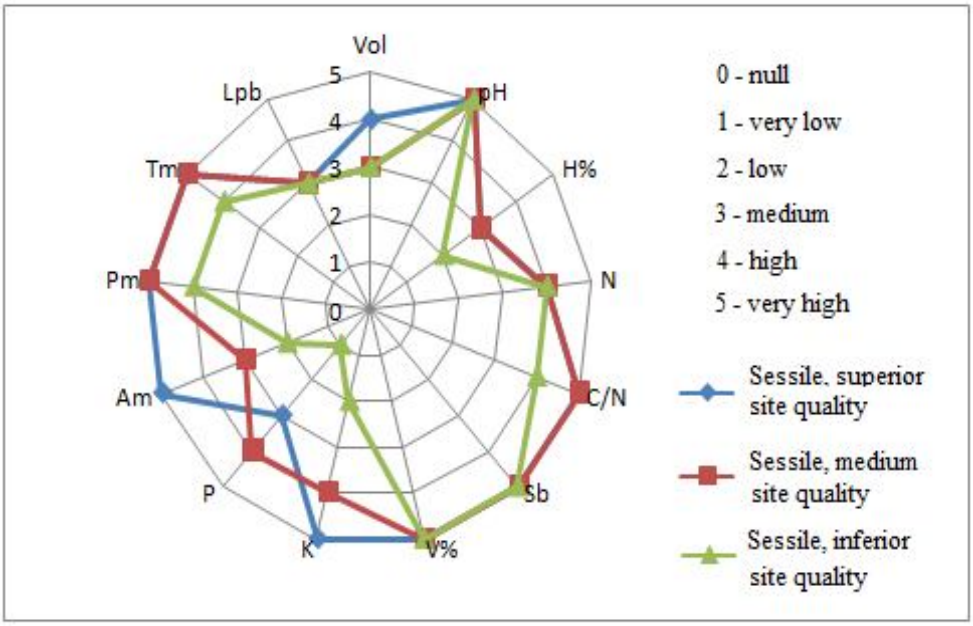

Fig.2. The comparative analysis regarding the favorability of the ecological indices for sessile oak forest sites situated on Eutricambosoils

CONCLUSIONS

One can notice by analyzing the ecological sheet for the beech grown in forest sites of different quality level and from figure 1 illustrating the variation of the ecological index favorability according to site quality, that the forest site quality in the case of eutricambosoil-grown beech stands is influenced as follows:

- between superior and medium quality levels, the decisive influence belongs to the edaphic volume, the humus and the Kalium contents;
- between medium and inferior quality levels, the most significant influences go to the edaphic volume, the nitrogen contents, the base saturation degree, the average temperature and precipitations;

The Phosphorus and Kalium contents obviously influence the eutricambosoil-grown forest sites, when this diminishes under the value corresponding to average favorability.

One can notice by analyzing the ecological sheet for the sessile-oak grown in forest sites of different quality level and from figure 2 illustrating the variation of the ecological index favorability according to site quality, that the forest site quality in the case of eutricambosoil-grown sessile-oak stands is influenced as follows:

- between superior and medium quality levels, the decisive influence belongs to the edaphic volume, the Kalium contents and average altitude;
- between medium and inferior quality levels, the significant influences go to the contents and type of humus, the Kalium and phosphorus contents available, the mean annual precipitation quantities, the average temperature and altitude;

Duo to the clay-sand-dust texture, the analyzed eutricambosoils offer optimal aeration conditions and a moderate density, which facilitate a good development of the rootting-system for both analyzed species.

Regarding the exchange-base supply, the analyzed eutricambosoils are eumezobasic soils, with a moderatly acid reaction which, together with the climatic conditions, favours an intensive humification in the Ao layer, deeply humiferous and containing a type forest mull humus, capable of good supply with available nitrogen.

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