ECOPEDOLOGICAL STUDY OVER SOIL RESOURCES FROM FOREST ECOSYSTEMS IN MOLDOVA PLAIN

STUDIU ECOPEDOLOGIC ASUPRA RESURSELOR DE SOL DIN ECOSISTEME FORESTIERE DIN CÂMPIA MOLDOVEI

BIREESCU L., BIREESCU GEANINA, TEODERESCU EUGEN, STAN CRISTINA OANA, SECU C., BREABĂN GABRIELA IULIANA

Biological Research Institute Iaşi
University of Agriculture Sciences and Medicine Veterinary Iasi
„Al. I. Cuza" University Iasi

Abstract. *The ecopedological study proves, from a quantitative and a qualitative point of view, the way in which qualities and the imperfections of the trophic potential show themselves, within the zonal and the local ecological context. The main twenty determinant ecological, climatic and pedological factors are analysed from a quantitative point of view (in eight ecological classes) and from a qualitative point of view (in six ecologic classes of favourability), following a specific ecological criteria. The formula of the ecological diagnosis of the soil following its own features analyses the trophic potential, in a zonal and a local ecological context.*

Rezumat. *Studiul ecopedologic evidenţiază, din punct de vedere cantitativ şi calitativ, modul de manifestare a fondului de calităţi şi lipsuri ale potenţialului trofic, în context ecologic zonal şi local. Principalii 20 de factori şi determinanţi ecolologici, climatici şi pedologici, sunt analizaţi din punct de vedere cantitativ (prin încadrarea lor în 8 clase de mărime ecologică) şi din punct de vedere calitativ (în 6 clase de favorabilitate ecologică), prin fişa de specific ecologic. Formula diagnozei ecologice a solului după caractere proprii analizează potenţialul trofic al solului în context ecologic zonal şi local.*

INTRODUCTION

The ecopedological study analyses the main qualitative features of the soil, showing the ecological specifics of the pedotop and the favourability of the different factors and of the pedological and the climatic determinants for the plants requierements (Chiriță, 1974; Bireescu, 2004). This analytical study takes into account the excessive presence or lock of the indexes factors and ecological determinant. This factors and ecological determinants should be improved in order to develop partially or totally, their favourability (Bireescu et al., 2005).

Analysing, on the one side the ecological complex of the research station and on the other side the trophic potential of soil we can observe where (on which factors) and how would be necessary in the process of ensuring the best edaphic and nutritional conditions (Bireescu, 2005; Teodorescu et al, 2007).

MATERIAL AND METHODS

The soil samples were taken from the soil profiles of different genetic horizons, they were analysed in field and laboratory by specifically methods (after ICPA). We selected 20 factors and ecological determinants: 15 pedo-ecological factors (growing factors, the pedological determinants, the negative ecological factors, the negative eco-pedological factors, the pedological indexes and pedo-biological synthetic indexes) and 5 zonal and local climatic factors. These factors have been characterized from a quantitative point of view (in 8 ecological classes) and qualitative (in 6 ecological classes of the favourability) following a specific ecological criteria. Then we made the ecological diagnosis synthetic formula of the soil (DE) which analyses how is put to good use the trophic potential of soil in the zonal and local ecological conditions.

RESULTS AND DISCUSSIONS

The results of this ecopedological study were made within the Biostar – Nucleus National Research Project.

A. The main features of soil profile

In table no 1 features the quantitative analyse of the main indexes of the soil profile (stagnic preluvisols) in natural forest from Copalau Botosani and the cambic chernozem profile soil from the forest ecopedotop from Roscani Iasi (Moldova Plain).

a. The forest ecopedotop from Copalau Botosani

- the soil texture has moderate profile differences (medium silt – LL symbol) within the first 20 cm and it is fine deep inside (clay silt – within 20 - 40 cm, T symbol and medium clay silt into 40 - 60 cm deeply – TT symbol); the difference texture index (Idt = 1.505) indicates a strong at the textural on the profile. The percentage of the colloidal clay varies between 28.7% at the top and 43.3 % at the Bt horizon.
- summer consistency of the dry soil is hard and very hard deep inside;
- soil aeration has small values between 8 % at the top and 5 % deep inside;
- exchange base sum (SB) has low values, between 12,7 me at the top and 17,3 me deep inside;
- cation exchange capacity (T) has small values, between 14,9 me at the top and 19,7 me deep inside;
- soil reaction is moderate acid, the values varies between 5,5 and 5,8 pH units;
- humus content has middle values in the bioaccumulation horizon (4,217 %);
- total N content has small values, between 0.128 % and 0.061%;
- P mobile content has middle values at the top (20 ppm) and small values deep inside (15 ppm);
- mobile K content has middle values within profile, between 157 and 136 ppm;
- base saturation level has middle values, between 75 % and 87 %; the soil is mezzo-basic;

- the synthetic index of potential trophicity (TP) measures 105 points, which it means an eutrophic soil;
- the synthetic index of effective trophicity, in the local and zonal climatic context, penalizes, during droughty summer, the trophic potential, with 27 points; which results a value of 78 effective points (mezzo - trophic soil).

b. the forest ecopedotop from Prisecani Iasi

- the the soil texture has little profile differences (Idt = 1.103) on the soil profile. It is fine (silt clay dusty – Tp) with values between 35,1 % and 38,7 % colloidal clay;
- summer consistency of the dry soil is hard and very hard deep inside;
- soil aeration has middle values between 18 % and 15 % and deep inside has small values (11 %);
- exchange base sum (SB) has middle values into profile, from 22.1 me to 18.3 me;
- total cation exchange capacity (T) has middle values, from 23.6 me to 19.8 me;
- soil reaction is a little acid, the values varies between 6.3 and 6.8 pH units;
- humus content has middle values in the accumulation horizon and low values deep inside;
- total N content has medium values into profile, between 0.261 % and 0.154%;
- P mobile content has middle values, between 31 ppm and 16 ppm;
- mobile K content has great values, between 242 ppm and 173 ppm;
- base saturation level has higher values, between 87 % and 98 %; the soil is eubasic;
- the synthetic index of potential trophicity (TP) measures 159 points, which means a mezzo-trophic soil;
- the synthetic index of effective trophicity, in the local and zonal climatic context, it penalizes, during droughty summer, the trophic potential with 34 points resulting a value of 125 effective points (eutrophic soil).

B. The specific ecological file of the ecopedotop

For the ecological interpretation of the qualitative features of the soil in zonal and local ecological context, we have selected 20 important factors and ecological edapho-climatic determinants: 5 ecological climatic factors, 3 pedological growing factors, 2 pedo-ecological factors depending on time and space; 2 negative pedo-ecological factors, 5 ecopedological determinants, 1 pedo-biological determinant and 2 synthetic pedological determinants. They have been analyzed according their values and arranged criteria from a quantitative point of view (8 ecological classes) and a qualitative (6 ecological classes of favourability for vegetation) through specific ecological file of the ecopedotop (table no. 2).

The specific ecological criteria shows an analytical and synthetical image of point of view research station the soil and of its ecosystem; it shows also the factors and the ecological edapho-climatic determinant limiting through their absence or excess and the “qualities” content of the biotope potential. The ecological study shows the ecological specific of the pedotop and the trophic favourability content which are really and objectively influenced by climate.

The analysis of the complex ecological indexes through a specific ecological criteria shows us the following:

a. The forest ecopedotop from Copalau

- the majority of the factors and edapho-climatic determinants are classified into the medium size (III and IV) and medium favourability classes;
- into the small size class (II) are classified through their absence: total N content, the low summer precipitations, the summer atmospheric humidity, the air porosity and the biological activity of soil;
- into the big size class (V) are classified the useful edaphic volume of soil and the bioactive period;
- into the excessive class E1 is classified through its excess, the hard summer consistency of the dry soil;
- into the low favourability class for the forest vegetation are classified the diminished content of N, low level of the summer precipitations, hard summer consistency, soil aeration and the low biologic activity in the bioaccumulation horizon.

b. The forest ecopedotop from Roscani

- the majority of the factors and ecological edapho-climatic determinants are classified into the medium size and medium favourability classes;
- into the small size class (I and II) are classified the low level of summer precipitations, summer atmospheric humidity, low air porosity and soil reaction;
- into the big size class (V) are classified the great K content, the useful edaphic volume, the bioactive lengh period, the potential trophicity;
- in the excessive class E1 are classified through excess the summer consistency of the dry soil;
- in the very low and low favourability classes are classified the low summer precipitations, the night summer consistency of soil and low level of soil aeration.

C. The ecological diagnosis of the soil (ED)

This general synthetic index shows the conditions for the manifestation of the trophic potential of the soil in the zonal and the local edapho-climate ecological conditions. This index is presented in the following formula:

$$ED = \frac{Tp \times Te}{(Ve \times Tx \times C \times O)(pH \times H \times V \times Nt)(T \times P \times Pe) \times Bio}$$

ED = ecological diagnosis of soil

a) fertility index

Tp = synthetic index of the potential trophicity of soil

Te = syntetic index of the effective potential trophicity of soil

b) pedological physical-mechanical indexes

Ve = edaphic volume

Tx = soil texture
C = summer consistency of soil
O = soil aeration

c) chemical pedological indexes

pH = coil reaction
H = humus content
V = base saturation level
Nt = total N content

c) ecological climatic indexes

T = annual average temperature
P = annual average precipitations
Pe = summer precipitations

d) the biological synthetic index

The biological bio – activity of soil

By using the formula for the analyzed local forest ecopedotop, it results the following:

- for the forest ecopedotop from Copalau – Botosani:

$$ED = \frac{Tp_{105} \times Te_{78}}{(Ve_V \times Tx_{III} \times C_{E1} \times O_{II})(pH_{III} \times H_{III} \times V_{III} \times Nt_{II})(T_{IV} \times P_{III} \times Pe_{II}) \times Bio_{II}}$$

- for the forest ecopedotop from Roscani Iasi:

$$ED = \frac{Tp_{159} \times Te_{125}}{(Ve_V \times Tx_{III} \times C_{E1} \times O_{II})(pH_I \times H_{III} \times V_{IV} \times Nt_{IV})(T_{IV} \times P_{III} \times Pe_{II}) \times Bio_{III}}$$

The analyses of the synthetic index represented by the ecological diagnosis of soil, following its own features, shows that the trophic background has medium values (eutrophic) at Copalau and higher values (mezzo-trophic) at Roscani.

In the zonal and the local ecological context this trophic potential is not fully capitalized mainly in the dry summer season. The night summer consistency, the low soil aeration and the fine soil texture inside the B horizon represent stressing factors and ecological determinants for the evolution of the forest vegetation.

Table 1

Main Physical And Chemical Features From Forest Ecopedotops From Copalau - Botosani And Roscani – Iasi

Ecopedotop	Depth (cm)	Colloidal clay (%)	Textural class	Summer consistency	Soil aeration	C/N	SB (me)	T (me)	Humus content (%)	pH_{H2O}	P_{Al} ppm	K_{Al} ppm	V (%)	Potential trophicity (Tp points)	Effective trophicity (Te points)
Forest from Copalau - Botosani	0-20	28.7	LL	hard	8	14	12.7	14.9	4.217	5.5	20	157	75	63	78
	20-40	35.3	T	hard	6	13	15.1	17.8	1.751	5.7	19	141	83	29	
	40-60	43.2	TT	very hard	5	11	19.7	5.8	0.754	5.8	15	136	87	13	
Forest from Roscani - Iasi	0-20	35.1	TP	hard	18	12	22.1	23.6	4.612	6.3	31	242	87	80	125
	20-40	36.2	TP	hard	15	13	20.7	21.7	3.011	6.5	25	181	93	54	
	40-60	38.7	TP	very hard	11	10	18.3	19.8	1.407	6.8	16	173	98	25	

Table 2

The specific ecological file of the ecopedotop

Ecological and edapho-climate factors and determinants	Size classes of ecological factors								Favourability classes of ecological factors					
	0…m	I	II	III	IV	V	E1	E2	N…m	FS	S	M	R	FR
Growing factors														
Total N content (Nt)			○		●						○	●		
Mobile P content (P_2O_5)				○	●							○●		
K assimilation (K_2O)				○		●						○	●	
Ecological climate factors														
Annual average temperature (T°C)					○●									○●
Annual average precipitations (Pmm)				○●								○●		
Winds (Vt)				○●								○●		
Summer precipitations (Pe)			○●								○●			
Summer relative humidity (Uer)			○●								○●			
Ecological factors: the space and the time														
Edaphic volume (Ve)						○●							○●	
The bioactive length period (LPB)						○●								○●
The negative ecological factors														
Alkalinity and acidity (Alc-Ac)				○●								○●		
The summer consistency (Con)							○●			●	○			
The ecological determinants														
The humus content (H)				○●								○●		
The soil texture (Tx)				○●								○●		
The the air porosity (Pa)			○●							●	○			
The soil reaction (pH)		●		○							○		●	
The base saturation level (V%)				○	●							○	●	
The synthetic biological indexes														
The biological activity (Bio)			○	●							○	●		
The synthetic pedological indexes														
The potential trophicity (Tp)					○	●						○	●	
The effective trophicity (Te)				○	●							○	●	

CONCLUSIONS

- the complete ecological study of soil shows the biotope the qualities and the imperfections in the zonal and the local ecological context;
- through specific ecological criteria it shows the main factors and ecological edapho-climatic stressing determinants through their absence or their excess: the summer drought, the fine texture of soil, the hard summer consistency, the low porosity of aeration, the low to medium biological activity from the forest ecosystems;
- ecological diagnosis of soil shows a medium value trophic background into the Copalau – Botosani forest and a higher trophic background into the Rascani – Iasi forest, which couldn't fully capitalized during the droughty summer season and during the moistly seasons when the rain water stagnates at the level of the Bt and Bv horizons, due to the fine texture of their soil.

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