ECOPEDOLOGICAL RESEARCHES CONCERNING THE ANTHROPIC IMPACT ON AGRICULTURAL ECOSYSTEMS FROM LOWER PRUT RIVER MEADOW

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The ecopedological researches done in the Lower Prut River area demonstrate both quantitatively and qualitatively two major characteristics of soils in this area, namely: the trophic potential and zone and local ecological characteristics.

These researches took place in the particle ecosystems of the Lower Brates ecopedotope, belonging to the lower Prut Meadow, at the confluence of the river Prut with the Danube and it was born from the former Brates Lake and riverside areas drainages.

The activities of land improvement performed in the Lower Brates area have determined major changes in vegetation. Originally there were vegetation species characteristic to floodable holms , later a steppe vegetation replaced it. At present hydrophilic and hygrophilous plant species are to be found only along drainage canals.

Soil profiles have been studied in the field, while their main physical, chemical and biological traces were determined in the lab which allowed the elaboration of ecological records/files, the values of soil trophic indicators and ecological soil diagnosis.

In order to fill in the ecological files 20 ecological factors and determinatives have been studied , quantitatively and qualitatively.

The data resulted from this complex analysis of all these factors showed that they might influence soil trophic potential under study in a positive or negative direction.

The meadows are formed on alluvial deposits made up of gravel and sands which were covered in time by sandy-clay formations.

Meadow biotope soils are generally regosols followed by hydromorphic soils. They are generally used as pasture lands or natural hay-fields , as well as arable lands.

The main negative ecological factors are: the dry season, extreme drought, excessive grazing, excessive humidity. The effects of these negative factors are: soil settling, ruderalization of the pasture , reduction of flower biodiversity and soil biological activity, salinization.

The negative ecological impact of all these factors' action lead to an inconsistent use of the trophic potential in the praticle ecosystems of the Lower Prut Meadow.

***Keywords**: characteristic, conservation, diagnosis, ecological factors, evaluation.*

The Lower Prut unit is placed at the confluence of the river Prut with the Danube and it was born from the former Brates Lake and riverside areas drainages, the pre-existent geomorphological units being represented by the lake which was 2.5 m in depth and the north-eastern and southern coastal levees with heights of 2.5 m. By leveling , the relief forms have been unified (lake bottom, pools, streams, levees).

MATERIAL AND METHOD

These researches shown in the present paper have evolved in the Lower Prut Meadow agricultural ecosystem, the County of Galati. The territory under study is placed at the confluence of the river Prut with the Danube, an area of about 11,449 ha.

Soil analysis was done in accordance with "the Romanian System of Soil Taxonomy" (SRTS, 2003) and with the Elaboration Methodology of Pedological Studies (ICPA, 1987). The ecological interpretation of soils was done after the methodology elaborated by Chirita in 1974.

The interaction and the correlation of ecological factors of biotope with the biocenosis and the environmental factors is given by soil diagnose which shows the trophic potential of soils in a zone and the global ecological context.

RESULTS AND DISCUSSIONS

As a result of dyking and drainage , which triggers off stopping of alluvia accumulation, sediments have turned into actual soils, bioaccumulation and leaching being the major pedogenetical processes. Dyking-drainage works have given two directions to the evolution of soils in the territory:

- an *automorphous direction*, from alluvial protisols with a weak profile development up to alluvial soils with mollic horizon and even chernozems, characteristic to well-drained areas and sandbanks, too. (soils from Protisol class).
- a *hydromorphous direction*, comprising soils of gleysol type with various subtypes (soils from Hydrosoil class).

1. Ecological Interpretation of Soils from the Ecopedotope Lower Prut Meadow

1.1 Alluviosol Physical, Chemical and Biological Characteristics

In this area the following Protisol type soils have been identified on an area of 7,832 ha, with its subdivisions: calcaic, mollic, gley and salinic alluviosols. They are to be found on an area of 7,832 ha.

Alluviosols belong to the Protisol class (SRTS-2003) and are defined by the presence of a horizon A (Am, Ao) followed by the parental material represented by river, leke and river-lake deposits with varied textures. The soil samples have been taken from the soil profile , on pedogenetic horizons , while the results of analyses are shown in Table 1.

Table 1

Biological, chemical and phisical properties of soil

Specification	Genetic Horizons	
	Am	C
Depth (cm)	0-35	35-50
Clay (%)	33.1	23.4
Textural Class	LL	LL
pH	7.5	8.41
Humus (%)	3.825	1.754
Total Nitrogen(%)	0.293	0.085
Mobile Phosphorous (ppm)	121	65
Mobile Potassium (ppm)	283	198
Change Base Sum (SB-me/100 g sol)	28	23
Total Capacity of Cationic Exchange (T-me/100 g sol)	28	23
Base Saturation Degree (V%)	100	100
Potential Trophicity (Tp-points)	134	26
Effective Trophicity (Te-points)	74	
Biological Activity (dehydrogenases- mg TPF)	22,15	11,21

The synthetic index of soil potential trophicity Tp is 160 points, the soil being considered as megatrophic , while the index for effective trophicity Te is 74 points due to the insufficient rainfall regime.

1.2 Soil profile record for ecological characteristics

In Table 2 we are shown the quantitative and qualitative evaluation of the main ecological indicators and their inclusion in size categories.

Table 2

Soil profile record for ecological characteristics

Ecological factors	Ecological factor favorability class													
	1	2	3	4	5	E_1	E_2	GR	OR	PB	FS	CT	SF	SO
Annual average temperature				•						▲	▲	▲		▲
Annual average rainfalls(P)	•							▲						
Winds(V)			•					▲			▲			
Seasonal rainfalls(Pe)	•													
Seasonal relative humidity	•													
Humus content			•					▲	▲	▲	▲	▲	▲	▲
Alkalinity		•												
Total nitrogen content			•					▲	▲	▲	▲			
Mobile phosphorous content		•						▲	▲	▲				▲
Assimilable potassium content	•							▲	▲	▲	▲			▲
Cationic exchange total capacity				•				▲	▲					
Saturation level in bases				•				▲	▲					▲
Dehydrogenate activity			•											
Alkalinity														
Seasonal consistency			•					▲	▲					
Soil aeration		•												▲
Edaphic volume					•			▲	▲	▲	▲	▲	▲	
Potential trophicity					•			▲	▲	▲	▲	▲	▲	▲
Period length Bioactives					•					▲	▲	▲	▲	▲

Analyzing all the 20 ecological determinatives and factors qualitatively as shown in this table , we may say: 5 factors and ecological, climatic and pedological determinatives enter the middle favorability class, 2 factors and ecological determinatives are included in the high favorability class, 3 ecological factors are

included in the very high favorability class, 3 ecological factors are in the very low favorability class.

1.3 Soil ecological diagnosis

By applying the formula of soil ecological diagnosis it results that the soil ensures a superior trophic fund to the biocenoses (the soil is mega trophic), but which is not entirely capitalized because of the excessively dry seasons. The formula is:

$DE = Tp_{160} x\ Te74 / (N_{III} x\ A_{I} x\ O_{II} x\ C_{III} x\ T_{IV} x\ D_{v})\ (H_{III} x\ t_{III} x\ V_{IV}\ xVev)$ [2]

2. Gleysol physical, chemical and biological characteristics

Gleysols belong to the Hydrosol class and comprise soils that have as diagnosis horizon *a reduction gley horizon* (Gr) or an intense stagnic horizon (W) starting from the first 50 cm associated with other horizons without having intense salsodic properties in the first 50 cm. Calcaric and mollic gleysols have been identified on 2, 792 ha of the area under study. As a result of soil analyses , taken from soil profile, on genetic horizons , the following physical, chemical and biological characteristics have been shown in Table 3.

Table 3

The main physical, chemical and biological characteristics of soils (gleysols)

Specification	Genetic horizons		
	Ao	AGo	Gr
Depth (cm)	0-15	15-30	30-50
Clay (%)	36,56	46,0	48,4
Texture class	Tt	Tt	Tt
pH	6,5	6,0	5,8
Humus (%)	2,924	1,285	0,66
Total nitrogen (%)	0,182	0,111	0,075
Mobile phosphorous l(ppm)	39	26	17
Mobile potassium (%)	219	182	196
Exchange base sum (me/100g sol)	31	27	20
Cationic exchange total capacity (me)	23	21	18
Base saturation level (V%)	73	79	89
Potential trophicity (Tp=points)	32,19	15,22	11,74
Effective trophicity (Te)	27,21		
Biological activity (dehydrogenase-mg TPF)	14,45	10,77	7,38

The synthetic index of potential trophicity has 73 points. The synthetic index of effective trophicity has 45 points (oligomezotrophic soil).

2.1 The profile record of soil ecological characteristics (gleysol)

In Table 4, we are shown a quantitative and qualitative evaluation of the main 20 factors and ecological determinatives.

All these data help us to qualitatively evaluate the 20 factors and ecological determinatives: 5 factors and ecological, climatic and pedological determinatives belong to the medium favorability class, 1 factor and ecological determinative belongs to the high favorability degree, 2 ecological factors are included in the very high favorability class, 6 ecological factors are included in the low favorability class, 5 ecological factors are included in the very low favorability class.

Table 4

The Profile Record of Lower Prut Ecopedotope

Ecological factors	Ecological factor favorability class													
	1	2	3	4	5	E_1	E_2	GR	OR	PB	FS	CT	SF	SO
Annual average temperature				•				▲	▲					
Annual average rainfalls	•							▲						
Winds			•					▲						
Seasonal rainfalls	•													
Seasonal relative humidity	•													
Humus content			•					▲	▲					
Alkalinity		•												
Total nitrogen content			•					▲	▲					
Mobile phosphorous content		•						▲	▲					
Assimilable potassium content	•							▲	▲					
Cationic exchange total capacity				•				▲	▲					
Saturation level in bases				•				▲	▲					
Dehydrogenate activity			•											
Alkalinity														
Seasonal consistency			•					▲	▲					
Soil aeration		•												
Edaphic volume					•			▲	▲					
Potential trophicity					•			▲	▲					
Period length Bioactives					•			▲	▲					

Soil ecological diagnosis

Applying the formula for soil ecological diagnosis we may conclude that the soil ensures a middle trophic fund (soil is mezotrophic) for the biocenoses, but which is not entirely used because of the extremely dry seasons. The formula is:

$DE = Tp59x\ Te27 / (N_{II} \times A_{I} \times O_{II} \times C_{III} \times T_{Iv} \times D_{v})\ (H_{I} \times t_{II} \times V_{III} \times Vev)$, [2].

Zone, local and global ecological impact matrix

The evaluation of the anthropic impact upon the environment was done with the help of the local and global ecological impact matrix (Table 5) inspired from the Leopold matrix which was adapted for studies of local, zone and global ecological impact (climatic, pedological and anthropic) from earth ecosystems[1].

Table 5

Matrix of global and local ecological impact in the Lower Prut Meadow agricultural ecosystems

Negative ecological effects	Negative ecological factors of global and local			
	Rainfall deficit during season	Small relative humidity during season	Soil hard consistency during season	Chemical over fertilization
Soil settlement	O	O	O	+
Biological activity reduction	O	O	O	O
Soil structure destruction	O	O	O	+
Insufficient aeration	O	O	X	O
Humidity deficit	X	X	O	+
Salinity	+	O	O	+
Soil reaction	+	O	O	O
Soil effective trophicity lessening	O	O	O	X

Note: + -Minor impact; O- Major impact ; X- Urgent measures

To evaluate the impact an estimation scale has been issued with three qualitative impact levels: minor, major impacts and urgent measures.

The ecological factors of impact we got from the soil ecological analysis are: the fine texture, the seasonal rainfall deficit, the hard seasonal consistency of the dry soil, the soil low aeration, the chemical overfertilization.

The main negative ecological effects of the disturbing ecological factors through lack or excess: soil settlement, soil structure destruction (through excessive work), soil biological activity reduction and soil effective trophicity reduction.

CONCLUSIONS

1. The soils of this ecopedotope are represented by soils from Regosol classes, represented by the following subtypes: calcaric, mollic, gleyc and salic alluviosols, used as arable lands, followed by soils from class hydrimorph, as mollic and calcaric gleysols. These soils are used as pastures and natural hay fields and arable lands, too.

2. The majority of factors and ecological determinatives under analysis can be included within the classes of medium and small high favorability for agricultural crops.

3. The dry season , the hard seasonal consistency, the soil inadequate use, the middle and fine texture are the main factors of negative ecological impact. The main ecological effects that lead to an inappropriate use of the high trophic potential from the Lower Prut meadow ecosystems.

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