STUDIES OVER THE GROWING FOREST VEGETATION ON THE MINING FIELDS IN MOLDOVA NOUĂ

CERCETĂRI PRIVIND OCUPAREA HALDELOR DE STERIL DE LA MOLDOVA NOUĂ CU VEGETAȚIE. FLORA.

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Abstract: *In this paper we studied the installation of vegetation on the mining fields from Moldova Noua.*

Rezumat: *În această lucrare este studiată instalarea vegetației pe haldele de steril de la Moldova Nouă.*

Key words**:** *powder industrial residues, mining slag, fertilizing resources, environmental protection*
Cuvinte cheie: *deşeuri industriale praf, zgura de mina, resurse fertilizante, protejarea mediului*

INTRODUCTION

Coal residue areas are the result of 30 years in mining activity at Moldova Nouă. They may become biotope areas throughout a long period of time (DIHORU GH. AND CHISALITA I., 2000). In Moldova Noua the "biocenozare" process began by woody plants, which means the partial existence of forest vegetation on the coal residue areas (in the presence of improved soil).

Figure 1. – General view of mining fields

MATERIALS AND METHODS

Studies target.

The studies have been conducted on the coal residue areas in Moldova Noua, places with white-yellow sand, very different from the green vegetation. They are about 20-22, 5 m higher than the plain, and look like pyramids.

Table 1

Nr. Proba	Substante (elemente) chimice, in % din total											
	Ca	Fe	TiO_2	Va	Pb	Zn	Cd	Ra	CaO	SiO_2	Al_2O_3	Total
1	0.11	7.23	0.15	0.017	1.0	0.09	0.001	0.104	20	31.61		61.275
2	0.12	5.47	0.23	0.030	1.0	0.05	1.0		24	31.56		63.460
3	0.13	5.56	0.77			0.12	1.0	1.0	18	33.75		60.330
4	0.09	6.40	0.37	0.020	urme	0.01	0.001	0.002	15	32.65		54.543
5	0.07	3.83	0.31	0.020	0.01	0.06	urme	0.003	24	32.70		61.003
6	0.09	4.40	0.24		0.001	0.06	1.0		4	30.39		40.181
7		5.28	0.36							32.12	5.67	43.430
8		4.40	0.24							30.39	4.32	39.350
Media	0.08	5.32	0.33	0.01	0.25	0.05	0.25	0.14	13.13	35.67	1.25	57.90

For now we can say there is a certain stability of the coal residue areas, but we can not neglect a possible unforeseen situation during their exploitation, which can produce dangerous values for the environment.

Nr. crt.	SPECIA
1	*Achillea pannonica Scheele: Xer, H, Cont, Festuco-Brometea*
2	*Acinos arvensis (Lam.) Dandy: Xer, Th-TH, Submed, Festuco-Brometea*
3	*Aegilops cylindrical Host: Xer, Th, Cont, Chenopodietea*
4	*Alyssum alyssoides (L.) Nath: Xeromez, Th,-TH, Eur (Cont), Festuco-Brometea*
5	*Ambrosia artemisiifolia L.: Xeromez, Th, Adv, Chenopodietea*
6	*Anthemis austriaca Jacq.: Xre, Th, Eur (Cont), Secalietea*
7	*Anthemis tinctoria L.: Xeromez, H, Cont, Festucetalia valesiacae*
8	*Aspera spica-venti (L.) Beauv. Subsp. Spica-venti: Xer. Th, Eua, Aphanion*
9	*Arenaria serpyllifolia L.: Xeromez, Th, Eua, Festuco-Brometea*
10	*Artemisia absinthium L.: Xeromez, Ch-H, Eua, Artemisietea, Chenopodietea*
11	*Artemisia scoparia Waldst. Et Kit.: Xeromez, TH, Eua, Festucion rupicolae, Sisymbrion*
12	*Artemisia vulgaris L.: Mez, H-Ch, Cp, Artemisietea*
13	*Atriplex patula L.: Mez, Th, Cp, Chenopodietea*
14	*Ballota nigra L. subsp. Nigra: Mez, H (Ch), Submed, Chenopodietea*
15	*Bilderdykia convolvulus (L.) Dumort.: Mez, Th, Cp, Chenopodietea, Secaliatea (1)*
16	*Bromus arvensis L. subsp. Arvensis: Xeromez, Th-TH, Eua, Secaliatea*
17	*Bromus hordeaceus L. subsp. Hordeaceus: Mez, Th, Cosm, Festuco-Brometea, Sisymbrion*
18	*Bromus sterilis L.: Xer, Th, Eua, Chenopodietea*
19	*Bromus tectorum L.: Xer, Th, Eua, Thero-Airion*
20	*Calamagrostis epigeios (L.) Roth: Xeromez, H (G), Eua, Epilobietea*
21	*Cardaria draba (L.) Desv.: Xeromez, H, Eua, Chenopodietea (2)*
22	*Carduus acanthoides L.: Mez, TH, Eur, Chenopodietea*
23	*Carex hirta L.: Mezohydr, G, Eua, Agropyro-Rumicion*
24	*Castanea sativa Miller (Cultivat)*
25	*Centaurea micranthos S.G.Gmelin: Xer, TH-H, Eur, Festucetalia valesiacae etc.*
26	*Centaurea solstitialis L.: Xeromez, TH, Med, Chenopodietea*

27	*Chondrilla juncea L.: Xer, H, Eua, Festucetalia valesiacae, Chemopodietea*
28	*Cichorium intybus L.: Mez, H-TH, Eua, Arrenatheretea*
29	*Cirsium arvense (L.) Scop.: Xeromez, G, Eua, Chenopodietea, Secalietea*
30	*Cirsium vulgare (Savi) Ten.: Mez, TH, Eua, Chenopodietea, Artemisietea*
31	*Clematis viralba L.: Mez, N-E, Eur (Submed), Querco-Fagetea*
32	*Consolida regalis S. F. Gray subsp regalis: Xeromez, Th, Eua, Secalietea (3)*
33	*Convolvulus arvensis L.: Xeromez, H-G, Cosm, Chemopodietea, Secalietea*
34	*Conyza Canadensis (L.) Cronq.: Xeromez, Th, Cosm, Chenopodietea (4)*
35	*Cornus sanguinea L.: Mez, M, Eua, Querco-Fagetea, Prunetalia*
36	*Coronilla varia L.: Mez, H, Ec, Quercetea pubescenti-petraeae*
37	*Cotinus coggygria Jacq. (Cultivat)*
38	*Crataegus monogyna Scop. (Cultivat)*
39	*Crepis foetida L. subsp. Rhoeadifolia (Bieb.) Fiori et Paoletti: Mez, Th, P-Med, Festuco-Brom.*
40	*Crepis setosa Haller: Xer, Th, Med, Sisymbrion*
41	*Cynodon dactylon (L.) Pers.: Xeromez, G (H), Cosm, Polygonion avicularis*
42	*Cynoglossum officinale L.: Mez, TH, Eua, Onopordion*
43	*Dactylis glomerata L. subsp. Glomerata: Mez, H, Eua, Arrhenatheretea*
44	*Dasypyrum villosum (L.) P. Candargy: Xer, Th, Med, Chenopodietea, Thero-Airion (5)*
45	*Daucus carota L. subsp. Carota: Mez, TH, Eua, Arrhenatheretea*
46	*Dichathium ischaemum (L.) Roberty: Xer, H, Cosm, Festuco-Brometea (6)*
47	*Diplotaxis muralis (L.) DC.: Xer, TH, Submed, Chemopodietea, Secalietea*
48	*Dorycnium herbaceum Vill.:Xer, H-Ch, Submed, Festucetalia valesiacae*
49	*Echium vulgare L.: Xer, TH, Eua, Chenopodietea*
50	*Elaeagnus angustifolia L. (Cultivat)*
51	*Elymus repens Xeromez, G, Eua, Festuco-Brometea (7)*
52	*Equisetum variegatum Schleicher: Mezohydr, G-Ch, Cp, Molinio-Juncetea*
53	*Erigeron annuus (L.) Pers. Subsp. Annuus: Mez, Th, Adv, Calystegion sepium (8)*
54	*Eryngium campestre L.: Xer, H, Cont, Festuco-Brometea*
55	*Erysimum diffusum Ehrh.: Xer, TH-H, Eua, Festucetalia vaginatae*
56	*Eupatorium cannabinum L.: Hydr, H, Eua, Molinio-Juncetea*
57	*Euphorbia cyparissias L.: Xeromez, H (G), Eua, Chenopodietea*
58	*Euphorbia virgata Waldst. et Kit.: Xer, H, Cont, Chenopodietea*
59	*Festuca pratensis Hudson: Mez, H, Eua, Arrhenatheretea*
60	*Festuca rupicola Heuffel subsp. Rupicola: Xer, H, Eua, Feastucetalia valesiacae*
61	*Festuca valesiaca Schleicher: Xer, H, Cont, Festucetalia valesiacae*
62	*Galium glaucum L.: Xer, H, Cont, Festucetalia valesiacae*
63	*Galium mollugo L.: Mez, H, Eua, Arrhenatheretea*
64	*Galium tenuissimum Bieb.: Xer, Th, Cont, Festuco-Brometea*
65	*Galium verum L. subsp. Verum: Xer, H, Eua, Festuco-Brometea*
66	*Genista avata Waldst. et Kit.: Xeromez, Ch-N, Alpi-Balcani, Quercetea pubescenti-petraeae*
67	*Genarium columbinum L.: Xeromez, Th, Eua, Festucetalia valesiacae*
68	*Gleditsia triacanthos L. (Cultivat)*
69	*Hippophae rhamnoides L. (Cultivat)*
70	*Hordeum murinum L.: Mez, Th, Eua, Sisymbrion*
71	*Hypericum perforatum L.: Mez, H, Eua, Origanetalia*
72	*Juglans nigra L. (Cultivat)*
73	*Lathyrus tuberosus L.: Mez, H, Submed, Secalietea*
74	*Leontondon hispidus L. subsp. Hispidus: Mez, H, Eua, Molinio-Juncetea*
75	*Lepidium campestre (L.) R. Br.: Zeromez, Th, Eur, Chenopodietea*
76	*Leucanthemum vulgare Lam.: Mez, H, Eua, Arrhenatheretea (9)*
77	*Ligustrum vulgare L.: Mez, M, Eur, Querco-Fagetea*
78	*Linaria vulgaris Miller: Mez, H, Eua, Onopordion*
79	*Lolium perenne L.: Mez, H, Cosm, Plantaginetea*
80	*Lotus corniculatus L.: Mez, H, Eua, arrhenatheretea*
81	*Malus silvestris (L.) Miller: Mez, M, Eur, Quercetea pubescenti-petraeae*

82	*Malva silvestris L.: Xeromez, H, Cosm, Chenopodietea*
83	*Matricarea perforata Merat: Mez, Th-TH, Eua, Chenopodietea, Secalietea (10)*
84	*Madicago falcate L.: Xer, H, Eua, Festuco-Brometea*
85	*Medicago lupulina L.: Xeromez, Th, Eua, Chenopodietea, Festuco-Brometea*
86	*Medicago sativa L. (Cultivat)*
87	*Medica transsylvanica Schur: subsp. Transsylvanica: Xer, H, Eua, Festucetalia valesiacae*
88	*Melilotus officinalis (L.) Pallas: Xeromez, Th-TH, Eua, Chenopodietea, Secalietea*
89	*Morus alba L.: Xeromez, MM, Adv, Chenopodietea, Secalietea*
90	*Oenothera biennis L.: Mez, TH, Adv, Sisymbrion*
91	*Ononis arvensis L.: Mez, H-Ch, eua, Arrhenatheretea*
92	*Onopordum acanthium L.: Xeromez, Th, Eua, Onopordetalia*
93	*Orlaya grandiloflora (L.) Hoffm.: Xer, Th, Submed, Festucetalia valesiacae*
94	*Papaver dubium L. subsp. Dubium: Xeromez, Th, Submed, Secalietea*
95	*Papaver rhoeas L.: Xeromez, Th, Eua, Secalietea*
96	*Petrorhagia prolifera (L.) R. W. Ball et Heywood: Xer, Th, P-Med, Festuco-Brometea (11)*
97	*Petrorhagia saxifraga (L.) Link: Xer, H, Submed, Alysso-Sedion (12)*
98	*Phragmites australis (Cav) Trin. Et Steudel: Hydr, HH, Cosm, Phragmitetea (13)*
99	*Picris hieracioides L.: Xeromez, TH, Eua, Festuco-Brometea*
100	*Plantago lanceolata L.: Mez, H, Eua, Festuco -Brometea*
101	*Plantago major L.: Mez, H, Cosm, Plantaginetalia*
102	*Poa angustifolia L.: Xeromez, H, Eua, Festuco-Brometea, Quercetea pubescenti-petraea*
103	*Poa compressa L.: Xer, H, Cosm, Festuco-Brometea*
104	*Poa trivialis L.: Mezohidr, H, Cosm, Molinio-Juncetea, Arrhenatheretea*
105	*Polygonum aviculare L.: Xeromez, Th, Cosm, Polygonion avicularis*
106	*Polygonum persicaria L.: Hydr, Th, Eua, Chenopodietea*
107	*Populus alba L.: Mezohydr, MM, Eua, Salicion albae*
108	*Populus nigra L.: Mezohydr, MM, Eua, Salicetalia*
109	*Potentilla argentea L.: Xer, H, Cp, Festuco-Brometea*
110	*Prunus avium L.: Mez, MM, Ec, Querco-Fagetea*
111	*Prunus serotina Ehrh. (Cultivat)*
112	*Prunus spinosa L.: Xeromez, M, Eua, (Med), Prinetalia*
113	*Pulicaria dysenterica (L.) Bernh.: Mezohydr, H, Eur, Molinio-Juncetea*
114	*Quercus rubra L.: (Cultivat)*
115	*Reseda lutaea L.: Xeromez, TH-H, Eua, Chenopodietea, Secalietea*
116	*Robinia pseudacacia (Cultivat)*
117	*Rosa canina L.: Mez, M, Eua, Prunetalia*
118	*Rubus caesius L.: Mezohydr, H-N, Eua, Salicetea, Alno-Padion*
119	*Rubus candicans Weihe: Xeromez, H-N, Atl-Submed, Epilobietea*
120	*Rubus canescens DC.: Xeromez, H-N, Med, Epilobietea*
121	*Rumex acestosa L.: Mez, H, Cosm, Arrhenatheretea*
122	*Rumex acetosella L. subsp. Acetosella: Xeromez, H, Cosm, Festuco-Sedetalia*
123	*Rumex crispus L.: Mez, H, Eua, Agropyro-Rumicion*
124	*Rumex abtusifolius L. subsp. Abtusifolius: Mez, H, Eur, Arction*
125	*Salix alba L.: Hydr, MM, Eua, Salicion albae*
126	*Salix viminalis L. (Cultivat)*
127	*Salsolan kali subsp. Ruthenica (Iljin) Soo: Xer, Th, Eua, Tribulo-Eragrostion*
128	*Salvia nemorosa L. subsp. Nemorosa: Xeromez, H, Ec, Festuco-Brometea, Onopordetalia*
129	*Sambucus abulus L.: Mez, H, Eua, Chenopodietea*
130	*Sanguisorba minor Scop. Subsp. Minor: Xeromez, H, Eua, Festuco-Brometea*
131	*Scirpus holoschoenus L.: Mezohydr, G, Eua, Festucetalia vaginatae (14)*
132	*Setaria viridis (L.) Beauv.: Mez, Th, Eua, Chenopodietea, Secalietea*
133	*Silene latifolia Poiret: Mez, Th-TH, Eua, Chenopodietea (15)*
134	*Silene vulgaria (Moench) Garcke: Xer, H, Eua, Festucion rupicolae*
135	*Sinapis arvensis L.: Mez, Th, Cosm, Secalietea*
136	*Sonchus asper (L.) Hill subsp. Asper: Mez, Th, Cosm, Chenopodietea, secalietea*

137	*Sonchus oleraceus L.: Mez, Th, Cosm, Chenopodietea, Secalietea*
138	*Sorghum halepense (L.) Pers.: Xeromez, G (H), Eua, Secalietea*
139	*Stachys germanica L.: Xer, H, Med, Sisymbrion*
140	*Syringa vulgaris L. (Cultivat)*
141	*Taraxacum officinale Weber: Mez, H, Eua, Arrhenatheretea*
142	*Teucrium chamaedrys L.: Xeromez, Ch, Submed, Quercetea pubescenti- petraeae*
143	*Torilis arvensis (Hudson) Link: Xeromez, Th, Sunmed, Onopordion*
144	*Trapopogon dubius Scop.: Xer, TH, Ec, Festuco-Brometea*
145	*Trifolium echinatum Bieb.: Xeromez, Th, Med, Festucion pseudovinae*
146	*Trifolium pratense L. (Cultivat)*
147	*Trifolium repens L. subsp. Repens: Mez, H, Cosm, Planaginetea, Molino-Arrhenatheretea*
148	*Tussilago farfara L.: Mez, G, Eua, Chenopodietea*
149	*Verbascum speciosum Scherader: Xeromez, TH, P-Pan, Festuco-Brometea*
150	*Verbena officnalis L.: Mez, H, Cosm, Agropyro-Rumicion*
151	*Vicia cracca L.: Mez, H, Eua, Arrhenatheretalia, Onopordion*
152	*Vicia hirsute (L.) S.F. Gray: Mez, Th, Eua, Secalietea*
153	*Viola arvensis Murray: Xeromez, Th, Eua, Secalietea*
154	*Xanthium italicum Moretti: Mezhydr, Th, Adv, Bidentetalia*
155	*Xerantheum annum L.: Xer, Th, P-Med, Festucetalia valesiacae*

That is why it is necessary to supervise and consolidate works that had already been done by the forest vegetation.

The sand over these areas comes from the mining industry (complex processes) and it is very fine, determining a large compact layer which can be washed only by a large amount of water. The water is mixed with sand lime in order to stabilize the ore (Cu, Pb, Mb, Mn, Zn, Fe, Ra) then the water and sand are poured into the special basins/areas.

Methodology

At the beginning the studies had a sporadic character aiming to measure the dendrometric elements of the forest vegetation. The researches had been conducted over elements such as:

- Comparative studies of the microclimate
- Studies over soil
- Ecophysiologic researches
- Auxologic studies.

Depending on the soil geography, there have been conducted researches on:

- plan soil without forest vegetation
- plan soil with *Eleagnus angustifolia* or mixed with other species
- slope with forest vegetation in three characteristic positions.

Researches on flora

They have been done through direct observation and plants gathering in order to verify the systemic identity.

In order to study the vegetation, we used the geobotanic noticing.

After characterizing the surface, the species have been registered and we added species from neighbourhood.

The structure and the vegetation on this kind of area are to be calculated using abundant indicators.

Flora analysis

On the three areas there have been identified 155 species, 14 cultivated, 141 spontaneous (9 woody, 4 under woody, 18 herbaceous with yellow flowers such as *Melilotus officinalis* and *Erysimum difusum*).

Concerning the span of life, there are mostly annual and biannual species (Th, TH) which avoid dryness in July and august.

24% are *Festuco-Brometea* type, 50% weed like *Chenopodietea, Secalietea*. Less are the Silvis species (11%), the most important of them being *Calamagostris epigeios*.

CONCLUSIONS

At the same time with the woody species, we noticed growing *Festuca pratensis*, *Festuca valesiaca*, *Prunus spinosa*, *Rubus candican*s etc.

If we notice the complexity of vegetation, we can say "fitocenozarea" process of the soil is increasing. The plants will diversify especially in areas where Eleagnus angustifolia because it is able to fertilize the soil.

We can notice that spontaneous vegetation on the coal residue areas increases fast. We must highlight the protection provided by the cultivated forest vegetation.

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