RESEARCH ON THE ACTUAL STATE OF SOME MEADOWS INSTALLED ON THE PROTECTION DYKE OF THE RIVER MURES IN THE AREA OF RESERVATION "FOREST CENAD"

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Abstract: *Necessity for knowing which types of grassland are accompanying constantly flood protection dike in the lower Mureş river, follows from high complexity of these plant formations and their remarkable floristic richness. Researches conducted are based on the principles largely applied in phytocenologic and floristic studyes of natural pastures, and generaly, on vegetation cover in Europe. Following research shows significant differences between meadows installed on the slope with northern exposition with mesophytic character where dominant genus is Arrhenatherum elatius, and meadows on the slope with southern exposition with xerophytic character where dominant genus is Festuca rupicola. Also, on the southern slope is observed greater diversity of types of meadows, where there are large sectors dominated by Haynaldia villosa and relatively large patches of Aegilops cylindrica, while on the northern slope meadow of Arrhenatherum elatius is forming a continuous band. By floristic composition and structure, these meadows can provide basic samples of natural grassland vegetation of the Banat plain. For conservation of these meadows, is recommended to extend the protection measures implemented throughout the lower meadow of river Mures on the protection dam. Main protection measure does not require additional material costs, and is to continue the current traditional mode of exploitation, as meadows*

Key words: *grasslands, natural reserve „Forest Cenad", flood protection dike*

INTRODUCTION

This paper is the result of my own researches and observations made in different season times durring period of two years. This paper presents some results from studies conducted in the natural reserve "Cenad Forest" where I studied all kinds of vegetation. For this paper I focused exclusively on grassland vegetation covering the slopes of flood protection dyke accompanying the lower Mureş River. On this dyke grows mesoxerophilic meadows with thermophilic character and mesophilic pastures remarkable for their floristic richness. The dyke was built in the late nineteenth century and since thean vegetation have evolved naturaly to grassland characteristic vegetation in present.

MATERIAL AND METHODS

Natural reserve " Forest Cenad" is located in Western Romania, in Low Mures Plain, near the place where the river Mures leaves Romania. The landscape is characteristic for lowlands, land configuration is flat, with very small irregularities and inclinations. Altitude ranges from 85 to 95 m. The climate is temperate continental with mediterranean influences.

Area is under influence of the Mures valley, the mesophilic meadows on the slope facing Mures river are reflecting slightly higher air humidity of the dammed zone.

Vegetation has been studied in spirit of central – european phytosociological school, applied for the first time in our country by AL. BORZA in 1934. During field trips I chosed portions of vegetation cover, with homogeneous physiognomy and similar ecological

conditions. I conducted field observations in different vegetation seasons, noting in phytosocilogical sheets for vegetation, biotope conditions accompanied by notes on species abundance - dominance and local frequency. Phytosocilogical sheets for vegetation have been included in the synthetic tables on which is based identification and analysis of plant associations. In synthetic tables I introduced values for ecological parameters for each species and I calculated average abundance - dominance and constancy (K) of species.

RESULTS AND DISCUSSIONS

Grasslands of the studied territory are the result of natural evolution due to environmental conditions and continuous human actions. The most important change in the biotope conditions is the impoundment of holme of river Mures, limiting within the area with relative higher humidity. The dike creates specific types of biotopes and increase biodiversity of the region.

Grasslands identified were placed in the appropriate plant associations. The most representative are:

1. Association *Arrhenatheretum elatioris* (Braun - Blanquet 1919) Scherer 1925

- oatgrass grasslands –

Oatgrass grasslands (table 1) constantly occupy dike slope with northern exhibition facing Mures river. These grasslands are installed on alluvial and chernozem soils, from upper slope to the base, indicating clearly by its character, significant differences between northern exhibition with mesophilic character and southern exhibition with xerophilic character erected by *Festuca rupicola* grasslands.

This association shows a remarkable uniformity from one sampling area to another, next to the edifying species are present with high frequency, species: *Centaurea banatica, Veronica chamaedrys, Astragalus glycyphyllos, Galium album, Dactylis glomerata, Daucus carota* and *Vicia hirsuta.* Other species have low frequencies, although in terms of flora, this association is the richest.

Association is shown as a uniform hayfield height of 120 to 140 cm. Dominating layer edifyed by *Arrhenatherum elatius* is very thick and other species, with low abundance - dominance but variable local frequency, ranging up to 50%. Lower layers, in structure of this

association, are not obvious delimitated, existing species at maturity of dominant species, have different heights.

The association has been described in broad sense, in early years of the century (Br. – Bl. 1919) and subsequently were distinguished geographical variations corresponding to Atlantic, Subatlantic, Central - European and Subcontinental regions. Overall, the association is one of the most stable taxa accepted by phytocenological literature, thanks to her homogeneous and characteristic manifestation.

Oatgrass grasslands was installed after the land has become overgrown with grass and the annual species are replaced. She keeps a long time by exploiting as hayfield. In conditions of grazing, this grassland degrades trending to become arid, and replaced by association of *Festuca rupicola.*

Oatgrass grasslands is one of the best natural hayfield, which can produce up to 25000 kg. of biomass/ha. of high quality, due to the conformation of the dominant species with many leaves and legume presence.

Table 1

As. *Arrhenatheretum elatioris* (BRAUN – BLANQUET 1919) Scherer 1925

			Number of sampling area	1	2	3	4	5	6	K
			Altitude (m)	90	91	90	90	91	91	
			Exhibition	N	N-E	N-E	N-E	N-E	N-E	
			Slope inclination	40^0	40^0	40^0	40^0	40^0	40^0	
			Vegetation height (cm)	140	120	120	120	120	120	
			Coverage (%)	25	25	25	25	25	25	
			Surface size of sampling area (m^2)	100	100	100	100	100	100	
U	T	R	Number of species	21	20	13	20	19	20	
3	3	4	*Arrhenatherum elatius*	4.5	5.5	5.5	5.5	5.5	5.5	V
3,5	3	0	*Centaurea banatica*	+.1	+.3	+.2	+.2	+.3	+.3	V
3	0	0	*Veronica chamaedrys*	+.3	+.3	+.3	-	+.2	+.2	V
0	0	0	*Convolvulus arvensis*	+.4	+.3	+.3	+.2	+.3	-	V
3	3	4	*Astragalus glycyphylos*	+	+.2	+	+	+	+	V
2,5	2,5	3	*Galium album*	+.2	+.1	+.2	+.1	-	+	V
3	0	4	*Dactylis glomerata*	-	+.4	+.3	+.2	+.3	+.2	V
2,5	3,5	4	*Vicia hirsuta*	-	+.2	+.2	+.1	+.4	+	V
3,5	2	3	*Melandrium album*	+.2	-	-	+	+	+.2	IV
2,5	3	0	*Daucus carota*	+.1	+.2	+	-	+	-	IV
2,5	3	3	*Galium cruciata*	-	+	+	+.2	-	+	IV
3	0	0	*Achillea millefolium*	-	+.1	-	-	+.2	+.1	III
3	3	0	*Vicia grandiflora*	-	+	-	+	+	-	III
2,5	4	3	*Salvia nemorosa*	-	-	-	+.1	+	+	III
2,5	3,5	5	*Aristolochia clematitis*	-	-	-	+	+.3	+.3	III
3,5	0	0	*Festuca pratensis*	+.2	+	-	-	-	-	II
3	0	0	*Chrysanthemum leucanthemum*	+.3	+	-	-	-	-	II
3	0	0	*Cerastium caespitosum*	+.2	-	-	-	-	+	II
3	3	4,5	*Sambucus ebulus*	1.4	-	-	+	-	-	II
4	3	0	*Alopecurus pratensis*	-	+	-	-	-	+	II
2,5	3,5	4,5	*Cychorium inthybus*	-	+	-	+	-	-	II
3	3,5	4	*Euphorbia amygdaloides*	-	+	-	-	+	-	II
0	3	0	*Vicia sativa*	-	-	+.2	+.3	-	-	II
2	3,5	3	*Myosotis colina*	-	-	+	-	-	+	II
3	3	0	*Trifolium campestre*	-	-	-	+.2	-	+	II
4	2,5	3	*Carex leporina*	+.2	-	-	-	+	-	II
2	3	5	*Medicago sativa*	-	-	+	-	+	-	II
3,5	3	4	*Lathyrus pratensis*	+	-	-	-	-	+.2	II
3	0	4	*Lamium purpureum*	+	-	-	-	-	-	I
3	0	0	*Poa pratensis*	+.1	-	-	-	-	-	I
2,5	3,5	0	*Galium tricomutum*	+	-	-	-	-	-	I
4	3	3	*Lysimachia numularia*	+	-	-	-	-	-	I
3,5	3	0	*Glechoma hederacea*	+	-	-	-	-	-	I
4	3	4	*Cardamine flexuosa*	+	-	-	-	-	-	I
4	4	4,5	*Viola elatior*	+	-	-	-	-	-	I
3	0	3	*Vicia cracca*	-	+	-	-	-	-	I
0	0	0	*Agropyron repens*	-	+	-	-	-	-	I
2,5	4	4	*Bromus inermis*	-	+	-	-	-	-	I
2	3	3	*Carex praecox*	-	-	-	+	-	-	I
2	4	3	*Fragaria viridis*	-	-	-	+	-	-	I
2	4	2	*Potentilla argentea*	-	-	-	+	-	-	I
1	5	4	*Eryngium campestre*	-	-	-	+	-	-	I
2	3	4	*Euphorbia cyparissias*	-	-	-	-	+	-	I
4	3	0	*Succisa pratensis*	-	-	-	-	+	-	I
3	3	0	*Saponaria officinalis*	-	-	-	-	+	-	I
4,5	3	4	*Rubus caesius*	-	-	-	-	-	+.1	I
4	3	0	*Rumex crispus*	-	-	-	-	-	+	I
2	4	4	*Lathyrus tuberosus*	-	-	-	-	-	+	I

2. Association *Salvio - Festucetum rupicolae* Zólyomi 1939

Festuca rupicola grassland (table 2) is present on the slope with south, south-east and south-west exhibition of the dike, with slope inclination between 25^o and 40^o. Its occupying

large areas on alluvial soils and chernozem with light texture, with deficit of moisture in summer.

Table 2

As. *Salvio – Festucetum rupicolae* ZOLYOMI 1939

			Number of sampling area	1	2	3	4	5	K
			Altitude (m)	89	88	88	88	89	
			Exhibition	E	E	S	S	S	
			Slope inclination	25^0	25^0	40^0	40^0	40^0	
			Vegetation height (cm)	70	70	50	40	40	
			Coverage (%)	100	100	100	100	100	
			Surface size of sampling area (m^2)	25	25	25	25	25	
U	T	R	Number of species	26	18	18	9	12	
1,5	4	4	*Festuca rupicola*	5.5	5.5	5.5	5.5	4.5	V
2,5	4	3	*Salvia nemorosa*	1.4	1.5	1.4	1.4	+.3	V
2	2,5	4,5	*Haynaldia villosa*	+.3	+	+	+	+	V
2	3,5	4	*Salvia austriaca*	+	+.3	+.1	-	+.3	IV
0	3	0	*Bromus mollis*	+.2	+.1	+.2	-	+.4	IV
2	4	4,5	*Agropyron pectiniforme*	+.2	-	+.2	+.2	1.4	IV
2,5	0	0	*Erodium cicutarium*	+	-	+	-	+.3	III
3,5	2	3	*Melandrium album*	+.2	+.2	-	+	-	III
1	5	4	*Eryngium campestre*	+	+.2	+.3	-	-	III
3	3	0	*Vicia grandiflora*	+.1	+.3	-	-	+.1	III
3	0	0	*Capsella bursa-pastoris*	+	-	-	+.1	+.1	III
2	3	3	*Carex praecox*	+.2	+.3	+.2	-	-	III
2	2,5	0	*Arenaria serpyllifolia*	-	-	+	+	+	III
3	0	4	*Dactylis glomerata*	+.4	+.3	-	-	-	II
3,5	0	0	*Festuca pratensis*	+.2	+.2	-	-	-	II
0	3	0	*Vicia sativa*	+.1	-	+	-	-	II
0	0	0	*Convolvulus arvensis*	+.3	+.3	-	-	-	II
3	3	4,5	*Sambucus ebulus*	+.1	-	-	+	-	II
2,5	3,5	4	*Vicia hirsuta*	+.2	+.2	-	-	-	II
3	3	0	*Trifolium campestre*	+	+.3	-	-	-	II
3	3	4	*Astragalus glycyphylos*	+	-	-	+	-	II
4	0	4	*Erigeron annuus*	+.2	+.3	-	-	-	II
2	3,5	3	*Myosotis collina*	+	+	-	-	-	II
3	0	0	*Poa pratensis ssp. angustifolia*	+.4	-	-	-	-	I
3	3	4	*Arrhenatherum elatius*	-	+	-	-	-	I
2	4	4	*Bromus sterilis*	-	+	-	-	-	I
2	3	5	*Medicago sativa*	+	-	-	-	-	I
2	3	4	*Euphorbia cyparissias*	+.2	-	-	-	-	I
4	2,5	3	*Carex leporina*	+	-	-	-	-	I
2	4	4	*Cardaria draba*	-	-	-	-	+	I
1,5	3	0	*Aegilops cylindrica*	-	-	-	-	+.1	I

This grassland has a relatively homogeneous floristic composition, the *Festuca rupicola* edifying the association is accompanied with high frequencies by the *Salvia nemorosa, Salvia Austrian, Bromus mollis, Agropyron pectiniforme, Eryngium campestre* and *Carex praecox.*

This grassland often forms a relatively thick cover, edificated by *Festuca rupicola* with a height of 30 to 35 cm. Above this thick cover rises species with high growth such as *Salvia nemorosa, Salvia austriaca, Melandrium album* and *Agropyron pectiniforme*, which gives to these grasslands a heterogeneous appearance. Some of these species may grow as hearts, heterogeneity character is accentuated during the flowering of these species.

Festuca rupicola grasslands in the west of our country were described by Hungarian authors with accepted name and for the ones identified at Cenad. In specialized Romanian literature, these grasslands are described and with the name of *Festucetum sulcatae (Festucetum rupicolae)* Burduja et all. 1959.

Association installs gradually replacing pioneer vegetation of the dike. The presence of species *Haynaldia villosa* with high constancy suggests its possible evolution by replacing phytocoenosis of this species. This type of grassland is resistant to mowing and moderate grazing, demonstrating high stability. Is exploited as hayfield for mowing (I) and grazing in the second half of the growing season.

3. Association *Haynaldietum villosae* Buia et all. 1959

This association (tab. 3) is present on slopes with southern exposition of the dike accompanying the Mureş River. The soil of these slopes is alluvial with sandy texture. This biotope is sunny and well drained.

Table 3

As. *Haynaldietum villosae* BUIA et all. 1959

			Number of sampling area	1	2	3	4	5	6	K
			Altitude (m)	89	90	90	89	90	90	
			Exhibition	E	E	S-V	S-V	S-V	S-V	
			Slope inclination	15^0	15^0	40^0	40^0	40^0	40^0	
			Vegetation height (cm)	100	100	80	60	60	120	
			Coverage (%)	100	95	100	95	100	100	
			Surface size of sampling area (m^2)	15	8	25	20	20	25	
U	T	R	Number of species	15	8	9	12	12	16	
2	2,5	4,5	*Haynaldia villosa*	5.5	5.5	5.5	5.5	3.5	5.5	V
2,5	4	3	*Salvia nemorosa*	+.3	+	+.2	1.4	2.4	+.2	V
3	0	0	*Capsella bursa-pastoris*	+.5	-	+.3	+.2	+.3	+.2	V
0	0	0	*Convolvulus arvensis*	+	-	+.3	+.3	+.2	+.5	V
2	4	4	*Cardaria draba*	-	1.4	+.3	+.2	1.4	+.3	V
2	3,5	4	*Salvia austriaca*	-	+	+	+	+	-	IV
3,5	2	3	*Melandrium album*	-	-	+.3	+.1	+.3	+.2	IV
3	3,5	4	*Papaver rhoeas*	-	-	+	-	+.3	+.3	III
3	3	0	*Viola arvensis*	-	-	-	+	+.2	+	III
2,5	3,5	4	*Vicia hirsuta*	-	-	-	+	+.3	+	III
2,5	0	0	*Erodium cicutarium*	+.3	+	-	-	-	-	II
3,5	0	0	*Festuca pratensis*	+	+	-	-	-	-	II
2	3	0	*Carduus acanthoides*	+	-	-	-	-	+	II
0	3	0	*Bromus mollis*	+.1	+.3	-	-	-	-	II
4	0	0	*Poa pratensis ssp. angustifolia*	+	-	-	-	-	+.4	II
2,5	4	4,5	*Consolida orientalis*	-	-	+	+	-	-	II
1,5	4	4	*Festuca rupicola*	-	-	-	+	-	+.2	II
3	3	4	*Arrhenatherum elatius*	-	-	-	+	-	+.2	II
1,5	3,5	0	*Bromus tectorum*	-	-	-	-	+.4	+.4	II
0	0	0	*Agropyron repens*	-	-	-	-	+.2	+	II
2,5	4	0	*Hordeum murinum*	1.5	-	-	-	-	-	I
4	0	4	*Erigeron annuus*	+	-	-	-	-	-	I
3	0	4	*Dactylis glomerata*	+	-	-	-	-	-	I
3	3	0	*Vicia grandiflora*	+	-	-	-	-	-	I
3	3,5	0	*Euphorbia villosa*	+	-	-	-	-	-	I
2,5	4	4,5	*Lolium perenne*	+	-	-	-	-	-	I
1,5	3	0	*Aegilops cylindrica*	-	+	-	-	-	-	I
3	0	0	*Achillea millefolium*	-	-	-	-	-	+	I

This association is dominated by species *Haynaldia villosa* giving the appearance of agricultural crop that is annually regenerated. Is noted the presence with high frequency and reduced abundance - dominance of species *Salvia nemorosa, Capsella bursa-pastoris, Convolvulus arvensis, Cardaria draba, Melandrium album* and *Salvia austriaca.*

It is remarkable edification of this association by mediterranean species *Haynaldia villosa* favored by sandy soil, southern exhibition and sharp drainage of biotope.

This association was first described by Buia et all. 1959 in Oltenia, assigned to grassland cenotaxones. Is an annual association, pioneer on sandy soils or chernozem slopes and he maintains long time in conditions in which is practiced the late mowing of dominant species. This mode of exploitaition provides its annual passage and perpetuation, despite the pressure from other species to become overgrown with grass. If is early mowed before ensures self-seeding this association tends to evolve towards the grassland of *Festuca rupicola.*

This association provides a high yield up to 15000 kg of biomass/ha. for phytocoenosis in Oltenia. But this biomass have poor quality because of lack of legumes and abundant awns of dominant species.

In addition to these types of grasslands, I have identified clusters of vegetation belonging to associations:

• ***Aegilopsietum cylindricae* Buia et all. 1959**. identified in in the form of patches on top of the dike, with strong drainage. Association has reduced forage importance, productivity up to 3000 kg.of biomass/ha of poor quality. However, it presents anti-erosional importance by effect that he shows.

• ***Schlerochloo - Polygonetum aviculare* Soó 1969** features on moderately trampled roadsides on top of the dike. Occupies a well-drained biotope, with strong sunlight, on degraded chernozem soil or silts with increased permeability. Has trends to evolve to become overgrown with grass from species *Lolium perenne* and *Trifolium repens*. Shows only anti-erosional character.

CONCLUSIONS

Grassland associations identified in the area of natural reserve "Forest Cenad" on the slopes of flood protection dike accompanying Mureş River, are important by their complex phytocenotic character and are representative for this area of the country. By their floristic composition and structure, associations *Arrhenatheretum elatioris, Salvio - Festucetum rupicolae* and *Haynaldietum villosae* can constitute basic types of natural grassland vegetation for Banat Plain. For conservation of these types of grasslands, is recomented to extend protective measures, implemented to reserve "Cenad Forest" and "Mures Floodplain Natural Park" of witch belongs, and to the protection dike. The measure does not require additional costs, only maintaing the current traditional mode of exploitation as meadows.

Data from these surveys can be useful in detailed analysis of bioform and geoelement spectrum and ecological indices, which would help to understand the complexity of these types of grassland. These reviews will be the subject of subsequent works. Detailed research on diversity of fauna are required that could be highlighted by the involvement of specialists in this field.

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