High Nature Value Grasslands from Arrhenatherion Alliance Identified in Mureş County

Silvia OROIAN¹, Mihaela SĂMĂRGHIȚAN², Mariana HIRIȚIU¹, Sanda COȘARCĂ¹, Corneliu TANASE^{1*}

¹ University of Medicine and Pharmacy, Faculty of Pharmacy, 38 Gh. Marinescu Street, RO-540139 Târgu Mureş

² Mureş County Museum, Department of Natural Sciences, 24 Horea Street, RO-540036 Târgu Mureş, Romania

*corresponding author: tanase.corneliu@yahoo.com

Bulletin UASVM series Agriculture 73(2)/2016
Print ISSN 1843-5246; Electronic ISSN 1843-5386
DOI 10.15835/buasvmcn-agr: 12419

ABSTRACT

Arrhenatherion alliance meadows are recognized to be among the best pastures in our country due to high productivity and good nutrition value. The research was conducted in several areas of Mureş County. The studied grasslands were classified into two types of Natura 2000 habitats: 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) and 6520 Mountain hay meadows. The identified phytocoenosis belong to two plant associations: *Arrhenatheretum elatioris* Br.-Bl. Ex Scherrer 1925 and *Poa Trisetetum flavescens* (Knapp 1951) Oberd. 1957. The analysis of data collected in the field reveals that the current state of conservation of the two types of habitat is good and very good. Habitats in a good and very good state of preservation is distinguished by a great floristic composition: approx. 100-150 cormophyte species with good and very good forage value. As habitats are more susceptible to the management applied and any changes to land use can affect habitat quality (eg abandoning mowing and turning the land into pasture), the ecological functions of this habitat will be satisfied as long as they are mowed after Poaceae species matured.

Keywords: grasslands, habitats, Mureş County, Transylvania.

INTRODUCTION

High natural value farmland comprises those areas in Europe where agriculture is a major (usually dominant) land use and where that agriculture supports or is associated with either a high species or habitat diversity or the presence of species of European conservation concern or both. (Andersen *et al.* 2003)

A precise delimitation of High Nature Value (HNV) grasslands is particularly important, because it leads to a more effective framework of measures for the maintenance of habitats and species that depend on agricultural management (Halada *et al.* 2011).

The research was conducted in several localities in Mureş county, this research identified

grasslands rich in species which produce good and very good quality hay. These grasslands were also classified in varying types of Natura 2000 habitats

Establishing and implementing stronger measures for maintenance of habitats and species dependent on agricultural management by providing accurate knowledge of grasslands with a high natural value in the Mureş county, their location and their floristic composition.

MATERIALS AND METHODS

To identify, describe and classify the plant associations from *Arrhenatherion* Koch 1926 alliance we used the system of Coldea (2012). To establish the Natura 2000 habitats that these phytocoenosis belong the researchers used A

handbook for interpreting NATURA 2000 habitats in Romania (Gafta and Mountford, 2008) and *Habitats in Romania*, (Doniță et al., 2005). In order to describe and analyze the plant associations, some phytosociological indexes (Cristea et al., 2004) were taken into consideration (Constance and Frequency). Using these resources a quantitative estimation of the plant species was made, including those species having indicators of high natural value grasslands. Statistical analyse was also carried out.

The phytosociological index used, and their values are:

Constancy (K) phytocoenotic index

I – the species is found in less than 20% of the surveys

II – 21-40%

III - 41-60%

IV – 61-80%

V – 81-100%

Frequency: quantitative phyto-populational index

$$F = \frac{n \times 100}{N}$$

n = the number of areas in which the certain species is present

N = total number of surveys

The parameters used to determine the conservation status of habitats were: the area of natural spread, the area of the habitat, the structure and specific functionality of the habitat, the future prospect associated with it. (Directiva Habitate, 1992)

RESULTS AND DISCUSSION

The studied phytocoenosis were framed in two plant associations: *Arrhenatheretum elatioris* Br.-Bl. ex Scherrer 1925, belonging to the habitat 6510 Low land meadows (*Alopecurus pratensis*,

Fig. 1. The spread of studied associations in Mures county

Sanguisorba officinalis) and *Poo-Trisetum flavescens* (Knapp 1951) Oberd. 1957 included in 6520 Mountain hay meadows Natura 2000 habitat.

With 201 taxa being identified in the 21 phytosociological surveys a wealth of species exhibiting a rich floristic composition of phytocoenosis. These plants included many medicinal and fodder varieties a rich floristic composition of phytocoenoses was observed. These meadows are considered to be among the best pastures in the country, with a very high productivity and very good nutritional value.

The phytocoenosis of *Arrhenatheretum elatioris* Br.-Bl. ex Scherrer 1925 association were identify in the vicinity of several localities in Mures county: Șilea Nirajului dl. Beheci, Stejăreni, Mihai Viteazu, Saschiz, Archita, Apold, Beica de Sus, Herghelia (Fig. 1).

The *Poo-Trisetum flavescens* (Knapp 1951) Oberd. 1957 association was encountered to: Androneasa, Neagra, Ciobotani, Stânceni-

Mermezeu; Răstolița, Bistra Mureșului, Beica de Sus and Archita (Fig. 1).

Syntaxonomical interpretation of these associations (Coldea, 2012) shows that they belong to Molinio-Arrhenatheretea class as below:

Cls. **Molinio-Arrhenatheretea** R.Tx.1937
em.R.Tx.1970

Ord. Arrhenatheretalia

All. Arrhenatherion

Arrhenatheretum elatioris Br.-Bl. Ex Scherrer

Poo-Trisetum flavescens (Knapp 1951)

Oberd. 1957

Characterization of the plant associations

Ass. *Arrhenatheretum elatioris* Br.-Bl. Ex Scherrer

Regions of hills and mountains at altitudes

Tab. 1. Characteristic species for the coenotaxa that subordinated association *Arrhenatheretum elatioris* Br.-Bl. Ex Scherrer

Arrenatherion	K		K		K
<i>Arrhenatherum elatius</i>	V	<i>Daucus carota</i>	III	<i>Rhinanthus angustifolius</i>	III
<i>Campanula patula</i>	V	<i>Tragopogon pratensis</i> ssp. <i>orientalis</i>	III	<i>Stellaria graminea</i>	III
<i>Crepis biennis</i>	II	<i>Trifolium hybridum</i>	III	<i>Holcus lanatus</i>	II
<i>Centaurea nigrescens</i>	I	<i>Carum carvi</i>	II	<i>Melilotus officinalis</i>	II
Cynosurion		<i>Rorippa pyrenaica</i>	II	<i>Eryngium planum</i>	II
<i>Cynosurus cristatus</i>	III	<i>Veronica chamaedrys</i>	II	<i>Euphrasia rostkoviana</i>	II
<i>Leontodon autumnalis</i>	II	<i>Vicia sepium</i>	II	<i>Festuca pratensis</i>	II
<i>Phleum pratense</i>	II	<i>Anthriscus sylvestris</i>	I	<i>Festuca rubra</i>	II
<i>Trifolium repens</i>	II	<i>Carex flacca</i>	I	<i>Phleum pratense</i>	II
Arrhenatheretalia		<i>Heracleum sphondylium</i>	I	<i>Trisetum flavescens</i>	II
<i>Briza media</i>	V	<i>Trifolium dubium</i>	I	<i>Alopecurus pratensis</i>	I
<i>Campanula patula</i>	V	Molinio-Arrhenatheretea		<i>Galium mollugo</i>	I
<i>Dactylis glomerata</i>	V	<i>Anthoxanthum odoratum</i>	IV	<i>Gladiolus imbricatus</i>	I
<i>Knautia arvensis</i>	V	<i>Prunella vulgaris</i>	IV	<i>Gymnadenia conopsea</i>	I
<i>Leucanthemum vulgare</i>	V	<i>Cerastium holosteoides</i>	III	<i>Lathyrus pratensis</i>	I
<i>Achillea millefolium</i>	V	<i>Trifolium pratense</i>	III	<i>Poa trivialis</i>	I
<i>Lotus corniculatus</i>	V	<i>Plantago lanceolata</i>	III	<i>Silene vulgaris</i>	I
<i>Agrostis capillaris</i>	IV	<i>Ranunculus acris</i>	III	<i>Vicia cracca</i>	I
<i>Plantago media</i>	III	<i>Rumex acetosa</i>	III		

Tab. 2. Species of *Arrhenatheretum elatioris* Br.-Bl. Ex Scherrer association with forage value: Very good (VG), Good (G) and Average (A)

Species	FV	Species	FV	Species	FV
<i>Arrhenatherum elatius</i>	VG	<i>Agrostis capillaris</i>	G	<i>Briza media</i>	A
<i>Dactylis glomerata</i>	VG	<i>Cynosurus cristatus</i>	G	<i>Anthyllis vulneraria</i>	A
<i>Festuca pratensis</i>	VG	<i>Festuca rubra</i>	G	<i>Elymus repens</i>	A
<i>Medicago falcata</i>	VG	<i>Poa trivialis</i>	G	<i>Festuca rupicola</i>	A
<i>Medicago sativa</i>	VG	<i>Trisetum flavescens</i>	G	<i>Lathyrus pratensis</i>	A
<i>Onobrychis viciifolia</i>	VG	<i>Trifolium hybridum</i>	G	<i>Melilotus officinalis</i>	A
<i>Phleum pratense</i>	VG	<i>Medicago lupulina</i>	G	<i>Trifolium montanum</i>	A
<i>Trifolium pratense</i>	VG	<i>Lotus corniculatus</i>	G		
<i>Trifolium repens</i>	VG	<i>Trifolium alpestre</i>	G		
		<i>Trifolium campestre</i>	G		
		<i>Vicia cracca</i>	G		

between 350-675 m provide an ideal environment for phytocoenosis dominated by the tall oatgrass. These semi-natural grasslands, maintained by mowing or grazing, prefer deep soils, brown luvic and brown mountain soils, fertile, slightly acidic, a very balanced level of moisture, with rainfall between 600 mm and 800 mm / year in climates with average annual temperature between 6.5 ° C and 9 ° C. Floristic composition reveals great wealth, 169 taxa being identified in the 11 phytosociological surveys.

The association description reveal the characteristic species of coenotaxa that subordinate the association (Tab. 1). These species are quantitative dominant. Phytosociological table reveals that the indicative value of a species grows in direct proportion to its abundance and dominance (Cristea *et al.*, 2004).

The characteristic and dominant species for association are: *Arrhenatherum elatius*, *Trisetum flavescens*, *Crepis biennis*, *Knautia arvensis*, *Tragopogon pratensis*, *Daucus carota*, *Leucanthemum vulgare*, *Campanula patula* *etc.* We mention that in this association's composition were identified numerous medicinal and forage plant species (Tab. 2).

The productivity of green matter per hectare is average (15000-25000 kg/ha) and give a good quality hay (Maruşca *et al.*, 2010).

We note the presence in the composition of this association of species belonging to different zoological categories that are listed in National Red Lists (Boşcaiu *et al.*, 1994; Oltean *et al.*, 1994):

Dictamnus albus L., *Gymnadenia conopsea* (L.) R. Br. and *Salvia transsilvanica* (Schur ex Griseb. et Schenk) Schur. In the association composition stands also the presence of invasive species *Erigeron annuus*, which should be monitored to prevent its extension to the detriment of native species.

Ass. *Poo-Trisetum flavescens* (Knapp 1951) Oberd. 1957

Southeast Carpathian meadows of *Trisetum flavescens* prefer less inclined slopes with northern or northeastern orientation at altitudes of 650-800 m in climate with average annual temperature of 6 ° C and 7 ° C and rainfall between 700 mm and 800 mm / year. They grow on Eutricambosols which are rich in nutrients and moderately moist, neutral to slightly acidic.

The floristical composition reveals the presence of edifying and characteristic species: *Trisetum flavescens*, *Cerastium holosteoides*, *Anthoxanthum odoratum*, *Briza media*, *Dactylis glomerata*, *Festuca pratensis*. Other important species are: *Agrostis capillaris*, *Poa pratensis*, *Arrhenatherum elatius*, *Trifolium pratensis*, *Ononis arvensis*, *Lotus corniculatus*, *Rumex acetosa*, *Polygonum bistorta*, *Holcus lanatus*, *Leucanthemum vulgare*, *Daucus carota*, *Achillea millefolium*, *Silene vulgaris*, *Dianthus carthusianorum*.

Regarding the affiliation to different coenotic groups one can notice a high proportion of species belonging to Arrhenatherion

Tab. 3. Characteristic species for the coenotaxa that subordinated association *Poo-Trisetetum flavescens* (Knapp, 1951) Oberd. 1957

Arrenatherion	K		K		K
<i>Trisetum flavescens</i>	V	<i>Briza media</i>	III	<i>Prunella vulgaris</i>	IV
<i>Arrhenatherum elatior</i>	V	<i>Knautia arvensis</i>	III	<i>Stellaria graminea</i>	IV
<i>Crepis biennis</i>	III	<i>Rhinanthus rumelicus</i>	III	<i>Plantago lanceolata</i>	IV
<i>Campanula patula</i>	II	<i>Carum carvi</i>	III	<i>Agrostis capillaris</i>	III
<i>Centaurea phrygia</i>	II	<i>Daucus carota</i>	II	<i>Festuca pratensis</i>	III
<i>Centaurea nigrescens</i>	I	<i>Leontodon hispidus</i>	II	<i>Holcus lanatus</i>	III
<i>Geranium pratense</i>	I	<i>Galium mollugo</i>	II	<i>Trifolium pratense</i>	III
Cynosurion		<i>Lotus corniculatus</i>	II	<i>Vicia cracca</i>	III
<i>Trifolium repens</i>	IV	<i>Tragopogon pratensis</i> ssp. orientale	II	<i>Ranunculus acris</i>	III
<i>Cynosurus cristatus</i>	IV	<i>Veronica chamaedrys</i>	II	<i>Cerastium holosteoides</i>	II
<i>Phleum pratense</i>	II	<i>Ajuga reptans</i>	II	<i>Euphrasia rostkoviana</i>	II
<i>Veronica serpyllifolia</i>	1	<i>Plantago media</i>	II	<i>Lathyrus pratensis</i>	II
Polygono-Trisetion		<i>Taraxacum officinale</i>	I	<i>Rumex acetosa</i>	II
<i>Centaurea pseudophrygia</i>	I	<i>Trifolium hybridum</i>	I	<i>Viola tricolor</i>	II
<i>Polygonum bistorta</i>	I	<i>Campanula glomerata</i>	I	<i>Festuca rubra</i>	I
<i>Trollius europaeus</i>	1	<i>Eryngium planum</i>	I	<i>Centaurea jacea</i>	I
Arrhenatheretalia		<i>Rorippa pyrenaica</i>	I	<i>Pastinaca sativa</i>	I
<i>Poa pratensis</i>	V	<i>Trifolium dubium</i>	I	<i>Poa trivialis</i>	I
<i>Dactylis glomerata</i>	V	<i>Vicia sepium</i>	I	<i>Rhinanthus angustifolius</i>	I
<i>Achillea millefolium</i>	IV	Molinio-Arrhenatheretea		<i>Alopecurus pratensis</i>	I
<i>Leucanthemum vulgare</i>	IV	<i>Anthoxanthum odoratum</i>	V	<i>Danthonia decumbens</i>	I

alliance, Arrhenatheretalia order and Molinio-Arrhenatheretea class (Tab. 3).

In this association can be noticed also rare, endangered, species listed in National Red Lists:

Epipactis helleborine (L.) Crantz, *Gymnadenia conopsea* (L.) R. Br., *Trollius europaeus* L. Due the proximity of human settlements and crops the ruderalisation process is favorised. Also, be aware

Tab. 4. Species of *Poo -Trisetetum flavescens* (Knapp 1951) Oberd. 1957 association with forage value: Very good (VG), Good (G) and Average (A)

Species	FV	Species	FV	Species	FV
<i>Arrhenatherum elatius</i>	VG	<i>Agrostis capillaris</i>	G	<i>Anthyllis vulneraria</i>	A
<i>Dactylis glomerata</i>	VG	<i>Alopecurus pratensis</i>	G	<i>Briza media</i>	A
<i>Festuca pratensis</i>	VG	<i>Cynosurus cristatus</i>	G	<i>Lathyrus pratensis</i>	A
<i>Medicago falcata</i>	VG	<i>Festuca rubra</i>	G	<i>Melilotus officinalis</i>	A
<i>Onobrychis viciifolia</i>	VG	<i>Lotus corniculatus</i>	G	<i>Trifolium montanum</i>	A
<i>Phleum pratense</i>	VG	<i>Medicago lupulina</i>	G		
<i>Poa pratensis</i>	VG	<i>Poa trivialis</i>	G		
<i>Trifolium pratense</i>	VG	<i>Trifolium alpestre</i>	G		
<i>Trifolium repens</i>	VG	<i>Trifolium campestre</i>	G		
		<i>Trifolium hybridum</i>	G		
		<i>Trisetum flavescens</i>	G		

Tab.5. Evaluation matrix for conservation status of habitats on basis of occupied area, structure and specific functions of the habitat

Habitat type	Conservation status	
	in terms of occupied area	in terms of structure and specific functions of the habitat
6510 Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)	F	U-I
6520 Mountain hay meadows (Fig. 2)	F	U-I

of the invasive species *Erigeron annuus* which, while not spread on large territories, must be kept under control to prevent its development to the detriment of native species.

The productivity of green matter per hectare is average (15000 kg/ha) and give a good quality hay (Maruşca *et al.*, 2010). The studied phytocoenosis belong to two types of Natura 2000 habitats: **6510** Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) and **6520** Mountain hay meadows (Fig. 2).

Analysing the field data it can be appreciated that the present state of conservation status of 6510 habitat is favorable; in over 50% of surveys recorded habitat conservation status is good and very good (Tab. 4).

Following the field observations it was found that both habitats are in an unfavorable-inadequate conservation status (Tab. 5). The habitats have a current trend of occupied area stable and the specific structure and functions necessary for the further preservation, including its typical species not in good conservation condition. Many areas

occupied of the identified habitats are damaged in terms of their structure and functions. The probability of maintaining them in the foreseeable future is high in terms of applying appropriate management measures.

Management measures proposed:

- Keeping mowing as the primary activity of management of these meadows; rational grazing, using species and number of animals allowed, depending on the carrying capacity of the pasture.
- Restrict the use of fertilizers, particularly those chemical that can induce sequence to another type of habitat.
- Control of invasive species, including woody ones: this prevent expansion of alien invasive species or the wood by manual or mechanical removal thereof. It is recommended especially for abandoned or undergrazed grasslands.
- Arson solids control. This measure will apply only with the approval of the environmental authorities and only in special cases, as a last resort and under strict control.

CONCLUSION

- The grasslands edified by *Arrhenatherum elatior* and *Trisetum flavescens* were studied in different places in Mureş County;
- The results identified two types of habitats: 6510 and 6520;
- Associations reported in the two habitat types are *Arrhenatheretum elatioris* Br.-Bl. Ex Scherrer and *Poo-Trisetum flavescens* (Knapp 1951) Oberd. 1957
- In the floristic composition of phytocoenoses there were identified rare or endemic species: *Dictamnus albus* L., *Epipactis helleborine* (L.) Crantz, *Gymnadenia conopsea* (L.) R. Br., *Salvia*

Fig. 2. 6520 habitat, grasslands with *Trisetum flavescens* and *Poa pratensis* (foto M. Sămărghiţan)

transsilvanica (Schur ex Griseb. et Schenk) Schur, R. Br. and *Trollius europaeus* L.

- The conservation status of habitats is unfavorable- inadequate.
- The probability of maintaining habitats in the foreseeable future is great in terms of applying appropriate management measures.

REFERENCES

1. Andersen E, Baldock D, Bennet H, Beaufoy G, Bignal E, Brower F, Elbersen B, Eiden G, Godeschalk F, Jones G, McCracken DI, Nieuwenhuizen W, van Eupen M, Hennekes S, Zervas G (2003). Developing a high nature value indicator. Report for the European Environment Agency, Report for the European Environment Agency, Copenhagen.
2. Boşcaiu N, Coldea Gh, Horeanu Cl (1994). Lista roşie a plantelor vasculare dispărute, periclitare, vulnerabile şi rare din flora României. Ocrot.Nat. Med.Înconj., 38 (1):45-56.
3. Coldea G (2012). Les associations végétales de Roumanie, tom 2. Les associations herbacées anthropogène. Presses Universitaires de Cluj, Cluj-Napoca.
4. Cristea V, Gafta D, Pedrotti F (2004). Fitosociologie. Edit. Presa Universitară Clujeană, Cluj-Napoca.
5. Doniţă N, Popescu A, Paucă-Comănescu M, Mihăilescu S, Biriş IA (2005). Habitate din România. Edit. Tehnică Silvică Bucureşti.
6. Gafta D, Mountford O (coord.) (2008). Manual de interpretare a habitatelor Natura 2000 din România. Ed. Risoprint, Cluj-Napoca.
7. Halada L, Evans D, Romão C, Petersen JE (2011). Which habitats of European importance depend on agricultural practices? Biodiversity and Conservation. 20:2365-2378.
8. Maruşca T (coord.), Mocanu V, Cardaşol V, Hermenean I (2010). Ghid de producere ecologică a furajelor de pajişti montane. Ed. Universităţii "Transilvania" Braşov. 8-25.
9. Oltean M, Negrean G, Popescu A, Roman N, Dihoru G, Sanda V, Mihăilescu S (1994). Listă roşie a plantelor superioare din România, Studii, sinteze, documentaţii de ecologie, Acad. Română, Instit. de Biologie, Bucureşti. 1:1-52.
10. *** Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora