

CONTRIBUTIONS TO THE GRASSLANDS PRODUCTIVITY ASSESSMENT FROM THE SUCEAVA RIVER HYDROGRAPHIC BASIN

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Abstract

Permanent grasslands from the Suceava river basin, located from 280 m to 1260 m altitude, in terms of vegetation mainly belong to 18 phytosociological associations grouped into 10 alliances and 7 orders, classified into 3 large classes: *Juncetea trifidi*, *Molinio - Arrhenatheretea* and *Festuco - Brometea*. The grassy carpet has an average of 112 species of cormophytes in which the associations *Festucetum rubrae - Agrostietum capillaris* and *Filipendula vulgaris - Arrhenatheretum elatioris* exceed 200 species. The species with fodder value participate in the grasslands grassy carpet in a proportion of more than 70% and the harmful ones in a proportion of more than 20%. The highest pastoral value (PV) was evaluated for *Trifolio - Lolietum perenne* (80.5 PV) located on fertile soils and the lowest for *Taraxaco serotinae - Festucetum valesiaca* (18 PV) located on poorer, eroded soils. The average green mass production (GMP) of 10.22 t/ha is quite high compared to other hydrographic basins with very large fluctuations, from 1.43 t/ha GMP in *Deschampsietum caespitosae* to 18.8 t/ha GMP in *Pastinaco - Arrhenatheretum*. At the alliances (habitats) level, the most productive were *Phyteumo - Trisetion* and *Arrhenatherion* with 74 - 64 PV and 16 t/ha GMP in hay regime and *Potentillion* with *Cynosurion* with 61- 62 PV and 12-13 t/ha GMP, which allow just over 1 large livestock unit (LU) per hectare. Grasslands with *Deschampsion* and *Festucion valesiaca* alliances, with degraded grass carpet, have a very low grazing capacity of 0.14-0.26 LU/ha in 160 - 185 days.

Keywords: permanent grasslands, pastoral value, green mass production, grazing capacity, Suceava River hydrographic basin.

INTRODUCTION

In addition to the classification of grassland vegetation carried out by geobotanists, knowledge of their productivity is necessary for optimal management with biodiversity conservation of pastoral landscapes and other economic, ecological and aesthetic measures.

Evaluating the productivity of grasslands based on floristic survey makes it possible to complete older or recent studies on the vegetation of this mode of agricultural use (Marușca 2019).

The data obtained on the grasslands productivity further serve to draw up pastoral arrangements and other intervention measures on

the grassy carpet, such as the ecological reconstruction of the degraded ones.

To date, many studies have been conducted on grassland vegetation and their classification

with less reference to green mass production and forage quality.

In the present work, productivity evaluations are continued based on floristic survey, this time in the Suceava River hydrographic basin.

MATERIAL AND METHOD

The evaluation of the grasslands' productivity was based on the data regarding their vegetation from the paper entitled "**Biodiversity of the flora and vegetation of the natural ecosystems of the Suceava River**

Basin" prepared by Cezar Valentin Tomescu, published in 2016 by Casa Cărții de Știință Publishing House Cluj - Napoca.

The author of the paper established the following phytocenotaxons:

JUNCETEA TRIFIDI Hadač 1946

syn. *Caricetea curvulae* Br. Bl. 1948

FESTUCETALIA SPADICEAE Barbero 1970 em. Grabherr 1993

Potentillo ternatae-Nardion strictae Simon 1957

1. As. *Scorzonero roseae-Festucetum nigricantis* (Pușcaru et al.1956) Coldea 1987

MOLINIO-ARRHENATHERETEA R. Tx. 1937

syn. *Agrostietea stoloniferae* Görs 1968

MOLINIETALIA CAERULEAE Koch 1926

syn. *Deschampsietalia caespitosae* Horvatič 1958

Alopecurion pratensis Passarge 1964

2. As. *Holcetum lanati* Issler 1936 em. Passarge 1964

Deschampsion Horvatič 1930

3. As. *Deschampsietum caespitosae* Hayek ex Horvatič 1930

ARRHENATHERETALIA R. Tx. 1931

Arrhenatherion Koch 1926

4. As. *Pastinaco-Arrhenatheretum* Passarge 1964

5. As. *Filipendulo vulgaris-Arrhenatheretum elatioris* Hundt et Hübl 1983

Cynosurion cristati R. Tx. 1947

6. As. *Anthoxantho-Agrostietum capillaris* Sillinger 1933

7. As. *Festuco rubrae-Agrostietum capillaris* Horvat 1951

8. As. *Lolio-Cynosuretum* Br.-Bl. et De Leeuw 1936

9. As. *Trifolio-Lolietum perennis* Krippelová 1967

10. As. *Agrostio-Festucetum rupicola* Csürös-Kaptalan 1964

11. As. *Lolio-Festucetum pratensis* ass. nova.

- Phyteumo-Trisetion*** (Passarge 1969) Ellmauer et Mucina in Mucina et al. 1993
12. As. *Poo pratensis-Trisetetum flavescens* Knapp ex Oberd. 1957
POTENTILLO-POLYGONETALIA R. Tx. 1947
syn. *Agrostietalia stoloniferae* Oberd in Oberd et al. 1967
Potentillion anserinae R. Tx. 1947
13. As. *Agrostietum stoloniferae* Burduja et al. 1956
PLANTAGINETALIA MAJORIS R. Tx. et Preising in R. Tx. 1950
Lolio-Plantaginion R. Tx. 1947
14. As. *Sclerochloa-Polygonetum avicularis* Soó ex Korneck 1969
- FESTUCO-BROMETEA Br.-Bl. et R. Tx. in Br.-Bl. 1949**
FESTUCETALIA VALESIACAE Br.-Bl. et R. Tx. ex Br.-Bl. 1949
Festucion valesiaca Klika 1931
15. As. *Taraxaco serotinae-Festucetum valesiaca* (Burduja et al. 1956, Răvăruț et al. 1956) Sârbu, Coldea et Chifu 1999
16. As. *Agrostio-Festucetum valesiaca* Borisavljevič et al. 1955
17. As. *Potentillo arenarie-Festucetum pseudovinae* Soó 1960
BROMETALIA ERECTI Br.-Bl. 1936
Cirsio-Brachypodium pinnati Hadač et Klika in Klika et Hadač 1944
18. As. *Carici humilis-Brachypodietum pinnati* Soó 1947

The floristic surveys were the basis of the evaluation of these grasslands' productivity according to the new method presented in detail in this journal (Marușca 2019).

The grasslands taken in the study are spread over an altitudinal difference of almost 1000 m (230 - 1260), from riverside to the spruce floor, on flat surfaces and slopes with an inclination of up to 35 degrees, on all predominantly sunny exposures (Table 1).

Vegetation cover of the grass carpet averaged 91.4%, less on moisture-deficient slopes and denser in riverside grasslands.

The average phytodiversity with 112 species of cormophytes is very good, with two associations *Festuco rubrae - Agrostietum capillaris* (214) and *Filipendula vulgaris - Arrhenatheretum elatioris* (206 sp), exceeding 200 species.

For the pastoral value and production of green forage mass evaluated at the grassland association level, where it was the case, averages were made for phytosociological alliances, in which some are completely confused with grassland habitats, according to the EU classification.

Table 1

General data on stationary conditions and phytodiversity of grassland associations

No.	Vegetal association	Altitude (m)	Exposition	Inclination (grade)	Vegetation covering %	No. of surveys	No. of species
1	<i>Scorzonero roseae-Festucetum nigricantis</i>	970-1260	S, E, W, SE, SW, N, NW	2-30	92,2	9	90
2	<i>Holcetum lanati</i>	440-780	S, E, W, SE, SW, NW	1-30	99,2	6	96
3	<i>Deschampsietum caespitosae</i>	370-980	Flat	0-3	94,5	11	128
4	<i>Pastinaco-Arrhenatheretum</i>	680-760	S, E, SW, SE	5-15	96,6	6	96
5	<i>Filipendulo vulgaris-Arrhenatheretum elatioris</i>	340-400	Flat, S, E, W, N	2-20	96,6	18	206
6	<i>Anthoxantho-Agrostietum capillaris</i>	700-1040	Flat, S, E, SE, NE, NW	0-10	96,1	14	162
7	<i>Festuco rubrae-Agrostietum capillaris</i>	320-1100	Flat, S, E, W, N	0-35	94,7	15	214
8	<i>Lolio-Cynosuretum</i>	310-410	Flat, S, E, W, SE, NE	0-15	97,5	12	81
9	<i>Trifolio-Lolietum perennis</i>	280-460	Flat, W	0-5	97,3	13	96
10	<i>Agrostio-Festucetum rupicolae</i>	400-520	Flat, W, SW, NE, NW	0-15	88,8	16	158
11	<i>Lolio-Festucetum pratensis</i>	320-580	Flat, NW	0-20	95,5	10	131
12	<i>Poo pratensis-Trisetetum flavescens</i>	380-400	Flat, S	0-10	100,0	5	84
13	<i>Agrostietum stoloniferae</i>	280-450	Flat	0-3	99,4	9	106
14	<i>Sclerochloo-Polygonetum avicularis</i>	380-420	Flat	0-3	98,0	5	19
15	<i>Taraxaco serotinae-Festucetum valesiaca</i>	280-450	Flat, S, EW, SE, SW	1-50	54,2	6	64
16	<i>Agrostio-Festucetum valesiaca</i>	280-400	S, W, SW, NE, NW	5-15	90,0	5	117
17	<i>Potentillo arenarie-Festucetum pseudovinae</i>	290-370	Flat, SW	0-25	56,7	3	54
18	<i>Carici humilis-Brachypodietum pinnati</i>	340-750	S, E, SE, N, NE	5-30	97,5	8	105
AVERAGE - LIMITS		280-1260	All	0-35	91,4	171	112

Finally, the optimal load with animals per hectare was calculated, taking into account grass

production and the duration of the optimal grazing season (Marușca et al. 2014, 2018).

RESULTS AND DISCUSSIONS

A first analysis was carried out on the degree of participation of forage species in relation to those harmful to the grass carpet, toxic to animals or harmful to animal products (milk, meat, wool, etc.) (Kovacs 1987, Păcurar, Rotar 2014, Marușca 2016).

Suceva River basin grasslands taken into study have on average more than 70% participation of forage species and over 20% harmful species, a fairly good proportion compared to other areas (Table 2).

Table 2

Vegetation structure and grassland productivity in the Suceava River hydrographic basin

No.	Vegetal association	Species participation (%)		Pastoral value		Green mass production	
		Forager	Harmful	ind.	%	t/ha	%
Potentillo ternatae-Nardion strictae							
1	<i>Scorzonero roseae-Festucetum nigricantis</i>	48,0	44,2	38,8	66	4,80	47
Alopecurion pratensis							
2	<i>Holcetum lanati</i>	81,3	17,9	57,5	11,3	12,51	122
Deschampsion							
3	<i>Deschampsietum caespitosae</i>	15,1	79,4	40,5	21	1,43	14
Arrhenatherion							
4	<i>Pastinaco-Arrhenatheretum</i>	87,4	9,2	73,6	144	18,80	184
5	<i>Filipendulo vulgaris Arrhenatheretum elatioris</i>	67,9	28,7	55,5	109	13,20	129
Cynosurion cristati							
6	<i>Anthoxantho-Agrostietum capillaris</i>	78,2	17,9	39,3	77	10,50	103
7	<i>Festuco rubrae-Agrostietum capillaris</i>	72,1	22,6	54,2	106	9,50	93
8	<i>Lolio-Cynosuretum</i>	87,6	9,9	71,2	139	11,21	110
9	<i>Trifolio-Lolietum perennis</i>	88,1	9,2	80,5	158	16,62	163
10	<i>Agrostio-Festucetum rupicolae</i>	72,1	16,7	45,0	88	8,16	80
11	<i>Lolio-Festucetum pratensis</i>	83,5	12,0	73,6	144	16,09	157
Phyteumo-Trisetion							
12	<i>Poo pratensis-Trisetetum flavescens</i>	89,3	10,7	76,8	150	14,90	146
Potentillion anserinae							
13	<i>Agrostietum stoloniferae</i>	81,1	18,3	62,4	122	12,70	124
Lolio-Plantaginion							
14	<i>Sclerochloo-Polygonetum avicularis</i>	97,2	0,8	55,5	109	6,84	67
Festucion valesiacae							
15	<i>Taraxaco serotinae-Festucetum valesiacae</i>	32,0	22,2	18,0	35	1,90	19
16	<i>Agrostio-Festucetum valesiacae</i>	65,3	24,7	39,6	77	4,99	49
17	<i>Potentillo arenarie-Festucetum pseudovinae</i>	35,7	21,0	21,1	41	2,48	24
Cirsio-Brachypodium pinnati							
18	<i>Carici humilis-Brachypodium pinnati</i>	89,8	7,7	51,3	100	17,29	169
AVERAGE		70,7	20,7	51,1	100	10,22	100

Obviously, a higher proportion of forage species in the grass carpet directly influences the pastoral value (PV) in which *Trifolio - Lolietum perennis* (80.5 PV), *Lolio - Festucetum pratensis* (73.6 PV) and *Pastinaco - Arrhenatheretum* (73,6 PV) stand out.

The lowest forage quality was evaluated for *Taraxaco serotinae - Festucetum valesiaca* (18 PV), *Potentillo arenarie - Festucetum pseudovinae* (21.1 PV) and *Scorzonera rosae - Festucetum nigricantis* (38.8 PV), on eroded, saline or soils invaded by non-valuable species.

Regarding the production of green mass (GMP) on average it reached 10.22 t/ha with very large variations from 1.43 t/ha GMP in *Deschampsietum caespitosae* to 18.8 t/ha GMP in *Pastinaco - Arrhenatheretum*.

Productions higher than 16 t/ha GMP were evaluated for *Trifolio - Lolietum perennis* and *Lolio - Festucetum pratensis* and lower than 5 t/ha GMP for *Taraxaco serotinae - Festucetum valesiaca*, *Potentillo arenarie - Festucetum pseudovinae* and *Agrostio - Festucetum valesiaca*, where low PVs were also recorded.

The final productivity results are presented at the phytosociological alliances level,

which are closer to the last European habitat classification (Table 3).

Thus, in alliances with grasslands used mainly as hayfields, the average production was assessed at almost 15 t/ha GMP compared to 8.3 t/ha of the grasslands used by livestock grazing.

The most valuable grasslands used as hayfields were *Phyteumo - Trisetion* and *Arrhenatherion* with 73.6 - 64.6 PV and 16.09 - 16 t/ha GMP, and grasslands used as pasture *Potentillion* and *Cynosurion* stand out with 62.4 - 60.6 PV and 12.7 - 12.0 t/ha GMP, where the livestock load is 1.06 - 1.15 LU/ha in 160 - 185 days grazing season.

On grasslands with degraded grass carpet from the *Deschampsion*, and *Festucion valesiaca* alliances, the grazing capacity is much lower by only 0.14 - 0.26 LU/ha during the same period of 160-185 days grazing season. As a final assessment, in the Suceava River Basin, the average optimal grazing capacity at the level of 0.77 LU/ha is considered to be mediocre to medium, compared to 0.99 LU/ha in the Timiș basin in the west of the country (Marușca, Nicolin 2020); 0.61 LU/ha in the Văii Sadului basin (Marușca et al. 2022) and 0.62 LU/ha in the Orăștie River basin (Marușca, Vințan 2022).

Table 3

The productivity of phytosociological alliances and grazing capacity in the
Suceava River hydrographic basin

No.	Vegetal association	Pastoral value		Green mass production		Grazing season (days)	Animal loading LU/ha
		ind.	%	t/ha	%		
A. Mainly used as hayfield							
1	<i>Alopecurion pratensis</i>	57,2	88	12,51	84	x	x
2	<i>Arrhenatherion</i>	64,6	99	16,00	108	x	x
3	<i>Phyteumo - Trisetion</i>	73,6	113	16,09	108	x	x
	Hayfield average	65,1	100	14,87	100	x	x
B. Main use as pasture (through grazing)							
1	<i>Potentillo ternatae-Nardion strictae</i>	38,8	81	4,80	58	125	0,59
2	<i>Deschampsion</i>	40,5	85	1,43	17	160	0,14
3	<i>Cynosurion cristati</i>	60,6	127	12,01	145	160	1,15
4	<i>Potentillion anserinae</i>	62,4	130	12,70	153	185	1,06
5	<i>Lolio - Plantaginion</i>	55,5	116	6,84	82	185	0,57
6	<i>Festucion valesiacae</i>	26,3	55	3,12	48	185	0,26
7	<i>Cirsio - Brachypodion pinnati</i>	51,3	107	17,29	208	170	1,56
	Pasture average	47,9	100	8,31	100	165	0,77
	Difference A - B	+, -	+ 17,2	x	+ 6,56	x	x
		%	136	x	179	x	x

CONCLUSIONS

Grasslands from the Suceava River hydrographic basin have a medium phytodiversity and productivity compared to other basins in the Romanian Carpathians.

The phytosociological alliances used as hayfields have on average over 65 PV and almost 15 t/ha GMP and those exploited by grazing almost 48 PV and 8.3 t/ha

GMP which allow an animal load of 0.77 LU/ha in 165 days grazing season.

Evaluation of the grasslands' productivity based on floristic survey is sufficiently accurate for the preparation of pastoral arrangements, biodiversity conservation and environmental protection.

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