

CONTRIBUTIONS TO THE EVALUATION OF GRASSLAND FROM SOUTH BARAOLT MOUNTAINS IN TERMS OF PRODUCTIVITY

Teodor MARUȘCA¹, Marius DANCIU², Dan Marian GUREAN³

Abstract. *The permanent grasslands found in the Southern Baraolt Mountains are spread between 460-840 m altitude, from the Olt riverside up to the oak and beech floor, on flat lands up to 45 degrees. The vegetation belongs to 4 classes, 5 orders, 9 alliances and 17 associations, with an average of 77 phytotaxa. In the Olt riverside and its tributaries, grasslands are being harvested mainly for hay, having a pastoral value of 60 (average - good) and a green mass production of over 16,4 t/ha being evaluated as good. The highest production of over 27 t/ha was evaluated at the association *Typhoidetum arundinacea* and the lowest green mass production of 2 t/ha was recorded by the association *Deschampsietum caespitosae*. Very good production values of 19-20 t/ha were evaluated for *Alopecuretum pratensis*, *Festucetum pratensis* and *Arrhenatheretum elatioris*. The grasslands used for grazing recorded an average production of 7 t/ha, which allows a loading with animals of 0.63 LU/ha in 165 days grazing season. The highest production was evaluated at the association *Lolio - Plantaginetum majoris* (16.44 t/ha) with a loading with animals of 1.53 LU/ha and the lowest at *Stipetum capillatae* and *Botriochloetum ischaemi* that allow a loading with animals ten times smaller. The evaluation of the productivity of grasslands based on floristic surveys made by geobotanists could continue to be used for the preparation of pastoral arrangements and forage balance on large geographical areas or zootechnical units.*

Keywords: permanent grasslands, phytocoenosis, pastoral value, forage green mass production

1. Introduction

Grassland productivity has become an extremely important economic indicator used for the preparation of pastoral arrangements and their optimum management.

The optimal animal loading and the contribution of hayfields to the forage balance can be established based on the pastoral value and especially on the green mass production capitalizable by animals.

The most accurate method for determining grassland productivity includes fenced land, with mowing, weighing and laboratory analysis of grass harvested several times in a year, assessments performed for several years [2].

¹Ph.D. Eng. Senior Researcher, Research-Development Institute for Grasslands Brasov, Romania, Corresponding member of the Academy of the Romanian Scientists, (e-mail: maruscat@yahoo.com).

²Prof., Ph.D., University "Transylvania from Brasov", Braşov, Romania.

³Prof., Ph.D., University "Transylvania from Brasov", Braşov, Romania.

This expensive method is more difficult to apply in isolated areas such as mountain areas or on pastures where animals are grazing.

Therefore, a more expeditious and sufficiently precise method for assessing grassland productivity was developed, a method based on floristic survey [4].

The application of this method generated good results so far and it is expected to be further used for the evaluation of grassland productivity based on floristic survey for both older and current geobotanical studies on grassland vegetation [5, 6, 7, 8, 9, 10].

In addition, a dynamic analysis concerning the evolution of productivity of a grassland located in a certain area can be made [3].

This paper is a continuation of the productivity assessment of grasslands found in the South of Baraolt Mountains, located in the Curvature Carpathians.

2. Materials and methods

In order to further evaluate the productivity of grasslands, the floristic surveys from the doctoral thesis “Geobotanical studies in the South of the Baraolt Mountains”, prepared by biologist Marius Danciu in 1974 under the guidance of Prof. Dr. doc. Ion Popescu Zeletin and Prof. dr. Doc. Iuliu Morariu were considered [1].

The vegetation of the permanent grasslands was classified in 4 classes, 5 orders, 9 alliances and 17 more important phytosociological associations, as follows:

Class ***PHRAGMITETEA AUSTRALIS***, Tüxen et Preising 1942

Ord. ***MAGNOCARICETALIA***, Pignatti 1953

Al. ***Caricion rostratae***, Bal. - Tul. 1963

1. As. *Typhoidetum arundinaceae*, Egger 1933

2. As. *Caricetum vulpinae*, Tx. 1947

Class ***MOLINIO - ARRHENATHERETEA***, Tüxen 1937

Ord. ***MOLINIETALIA***, W.Koch 1926

Al. ***Agrostion stoloniferae***, Soó 1933

3. As. *Deschampsietum caespitosae*, Horvatic 1930

4. As. *Alopecuretum pratensis*, Soó 1936

5. As. *Festucetum pratensis*, Soó 1928

Ord. ***ARRHENATHERETALIA***, Pawl. 1928

- Al. *Arrhenatherion elatioris*, (Br.-Bl1925) W.Koch 1926
6. As. *Arrhenatheretum medio europaeum*, (Br.-Bl1919) Oberd. 1952
- Al. *Cynosurion*, Tx1947
7. As. *Festuco - Agrostietum*, Horv. 1951
- Class **FESTUCO – BROMETEA**, Br.- Bl. et Tx. 1943
- Ord. **FESTUCETALIA VALESIIACAE**, Br.-Bl. et Tx. 1943
- Al. *Seslerio - Festucion pallentis*, Klika 1931
8. As. *Caricetum humilis transsilvanicum*, Zólyomi 1939
9. As. *Festucetum rupicolae calcophyllum*, Csűrös 1959
- Al. *Festucion rupicolae*, Soó(1929) 1940
10. As. *Stipetum capillatae*, Huek 1931
- Al. *Cirsio-Brachipodion*, Hadač et Klika 1944
11. As. *Carici humilis-Brachipodietum pinnati transilvanicum*, Soó1942
12. As. *Botriochloetum ischaemi*, Krist. 1937
- Class **PLANTAGINETEA MAJORIS**,Tx. et Prsg.1950
- Ord. PLANTAGINETALIA MAJORIS**, Tx 1950
- Al. *Polygonion avicularis*, Br.- Bl. 1931
13. As. *Lolio – Plantaginetum majoris* (Linkola1921) Berger1930
14. As. *Sclerochloo - Polygonatum avicularis*,(Gams 1927) Soó1970
- Al. *Agropyro - Rumicion crispi* Nordh 1940
15. As. *Lolio – Potentilletum anserinae* (Rapcs.1927) Knapp 1946
16. As. *Rorippo austriacae-Agropyretum repentis*, (Timár 1947)Tx.1950
17. As. *Rorippo silvestri-Agrostidetum stoloniferae*, Moor1958

The actual method of evaluating grassland productivity was extensively described by Marușca (2019) and exemplified in these Annals of the Romanian Academy of Scientists, Vol. 9, No.1 [6], therefore we won't present it again.

3. Results and discussions

The description of the grassland vegetation is preceded by the characterization of the seasonal conditions where they were encountered (Table 1).

The grasslands found in the studied area are located at 460 - 840 m altitude, on flat or sloping land with different exposures and inclinations up to 45 degrees. The average vegetation cover is very good of 94%.

A total number of 186 surveys were performed comprising an average number of 77 cormophytes species, a minimum of 39 species belonging to the nitrophilic association *Sclerochloa - Polygonetum avicularis* and 124 species in the xerophilous association *Caricetum humilis transilvanicum*.

Table 1) General data comprising the natural conditions and phytodiversity of grassland associations found in South Baraolt Mountains

No. crt.	Phytocoenosis (association)	Alt. (m)	Exposure	Ind. Degrees (°)	Coverage with vegetation (%)	No. of surveys	Species no.
1.	<i>Typhoidetum arundinaceae</i>	460-480	Flat	0	100	14	60
2.	<i>Caricetum vulpinae</i>	465-535	Flat	0	95	11	56
3.	<i>Deschampsietum caespitosae</i>	470-500	Flat	0	97	15	89
4.	<i>Alopecuretum pratensis</i>	460-465	Flat	0	100	9	63
5.	<i>Festucetum pratensis</i>	535-660	Flat	0	100	17	110
6.	<i>Arrenatheretum medio europaeum</i>	470-620	Flat	0	100	11	120
7.	<i>Festuco-Agrostietum</i>	600-840	Flat, S, V, SV, NV, N	0-10	100	15	116
8.	<i>Caricetum humilis transilvanicum</i>	520-640	S, SE, SV, E	20-45	83	19	124
9.	<i>Festucetum rupicola calcophyllum</i>	540-640	S, E, SE	10-25	87	7	64
10.	<i>Stipetum capillatae</i>	480-590	S, SV	25-45	76	10	71
11.	<i>Carici humilis-Brachipodietum pinnati transilvanicum</i>	560-580	S	15-35	99	10	86

Continuation Table 1

No. crt.	Phytocoenosis (association)	Alt. (m)	Exposure	Ind. Degrees (°)	Coverage with vegetation (%)	No. of surveys	Species no.
12.	<i>Botriochloetum ischaemi</i>	510-670	S, SE, SV	15-30	95	10	114
13.	<i>Lolio – Plantaginetum majoris</i>	460-480	Flat	0	93	10	58
14.	<i>Sclerochloo - Polygonatum avicularis</i>	470-500	Flat	0	87	6	39
15.	<i>Lolio – Potentilletum anserinae</i>	470-480	Flat	0	98	7	45
16.	<i>Rorippo austriacae-Agropyretum repentis</i>	465	Flat	0	89	6	36
17.	<i>Rorippo silvestri-Agrostidetum stoloniferae</i>	460-465	Flat	0	100	9	60
	TOTAL-AVERAGE	460-840	ALL	0-45	94	186	77

Source: Own results.

These grasslands were used as hayfield in Lunca Oltului and other tributaries or near the localities and by grazing with animals in areas located far away from these sites.

The grasslands harvested for hay belong to the alliances *Caricion rostratae*, *Agrostion stoloniferae* and *Arrhenatherion elatioris* (Table 2).

On average, the participation of forage species in the vegetation cover is 76% with a minimum of 17% in the association *Deschampsietum caespitosae* and a maximum of 91% in *Arrhenatheretum elatioris* and *Typhoidetum arundinacea*, a proportion that has a great influence on the pastoral value of the degraded areas (13) as well as of the most productive grasslands (70 – 80).

The highest production, of over 27 t/ha green forage, was evaluated for *Typhoidetum arundinacea* and the lowest of only 2 t/ha for *Dechampsietum caespitosae*. The associations *Alopecuretum pratense*, *Festucetum pratense* and *Arrhenatheretum elatioris* with 19-20 t/ha, are also very valuable.

The largest area of grasslands belonging to 6 alliances and 11 plant associations is used for grazing with animals (Table 3).

Table 2) The productivity of hay meadows located in South Baraolt Mountains

No. Crt.	Phytocoenosis (association)	Coverage with species (%)		Pastoral value		Green mass production		Evaluation
		Harmfull	Forage	Ind.	%	t/ha	%	
Al. <i>Caricion rostratae</i>								
1.	<i>Typhoidetum arundinaceae</i>	9	91	70.3	117	27.37	167	Excellent
2.	<i>Caricetum vulpinae</i>	16	79	37.0	62	10.61	65	Average

Continuation Table 2

No. Crt.	Phytocoenosis (association)	Coverage with species (%)		Pastoral value		Green mass production		Evaluation
		Harmfull	Forage	Ind.	%	t/ha	%	
Al. <i>Agrostion stoloniferae</i>								
3.	<i>Deschampsietum caespitosae</i>	80	17	13.2	22	2.00	12	Weak
4.	<i>Alopecuretum pratensis</i>	12	88	76.4	128	18.95	115	Good
5.	<i>Festucetum pratensis</i>	10	90	82.8	138	19.20	117	Good
Al. <i>Arrhenatherion elatioris</i>								
6.	<i>Arrhenatheretum medio europaeum</i>	9	91	79.8	133	20.37	124	Very good
	AVERAGE	23	76	59.9	100	16.42	100	Good

Source: Own results.

Table 3) The productivity and optimal loading with animals in a 165 grazing days season of grasslands found in South Baraolt Mountains

No. Crt.	Phytocoenosis (association)	Coverage with species (%)		Pastoral value		Green mass production		Loading with animals LU/ha	Evaluation
		Harmful	Forage	Ind.	%	t/ha	%		
Al. <i>Cynosurion</i>									
1.	<i>Festuco - Agrostietum</i>	24	76	56.5	155	10.43	155	0.97	Average
Al. <i>Seslerio - Festucion pallentis</i>									
2.	<i>Caricetum humilis transsilvanicum</i>	34	49	22.5	62	1.25	19	0.12	Degraded
3.	<i>Festucetum rupicolae calcophyllum</i>	15	72	38.4	105	6.07	90	0.57	Weak
Al. <i>Festucion rupicolae</i>									
4.	<i>Stipetum capillatae</i>	68	8	4.6	13	0.70	10	0.07	Degraded

Continuation Table 3

No. Crt.	Phytocoenosis (association)	Coverage with species (%)		Pastoral value		Green mass production		Loading with animals LU/ha	Evaluation
		Harmful	Forage	Ind.	%	t/ha	%		
<i>Al. Cirsio-Brachipodion</i>									
5.	<i>Carici humilis-Brachipodietum pinnati transilvanicum</i>	22	77	36.5	100	6.83	101	0.64	Weak
6.	<i>Botriochloetum ischaemi</i>	76	19	10.6	29	1.44	21	0.13	Degraded
<i>Al. Polygonion avicularis</i>									
7.	<i>Lolio – Plantaginetum majoris</i>	3	90	78.2	215	16.44	244	1.53	Good
8.	<i>Sclerochloo - Polygonatum avicularis</i>	19	68	39.1	107	4.62	69	0.43	Weak
<i>Al. Agropyro - Rumicion crispi</i>									
9.	<i>Lolio – Potentilletum anserinae</i>	86	12	8.6	24	0.60	9	0.06	Degraded
10.	<i>Rorippo austriacae-Agropyretum repentis</i>	22	77	38.9	107	10.66	158	0.99	Average
11.	<i>Rorippo silvestri-Agrostidetum stoloniferae</i>	7	93	66.1	182	14.95	222	1.39	Good
	AVERAGE	34	58	36.4	100	6.73	100	0.63	Mediocre

Source: Own results.

The meadows are generally more degraded compared to hay meadows, recording an average of only 58% participation of forage species in the vegetation cover, compared to hay meadows where a participation of 76% was reached.

The most degraded grasslands from economical point of view belong to the associations *Stipetum capillaris*, *Lolio-Potentilletum anserinae* and *Botriochloetum ischaemi* with 8-19% participation of forage species which results in a lower pastoral value indices of only 5-11.

The most valuable grasslands belong to the associations *Festuco-Agrostietum* and *Lolio- Plantaginetum majoris* with 76-90% participation of forage species and 56-78 for pastoral value.

Productions between 10 and 16 t/ha green forage mass was evaluated on the associations *Festuco - Agrostetum*, *Rorippo austriacae - Agropyretum repentis*, *Rorippo silvestri - Agrostetum stoloniferae* and *Lolio - Plantaginetum majoris* with an optimal grazing capacity between 1-1.5 LU/ha in a 165 days season.

The lowest green forage mass productions were reached on the associations *Lolio - Potentilletum anserinae*, *Stipetum capillatae*, *Caricetum humilis* and *Botriochloetum ischaemi* which showed an optimal loading with animals of only 0.06-0.13 LU/ha in the same grazing season.

The grasslands found in South Baraolt recorded, on average, a production of 6.73 t/ha green forage mass which support 0.63 LU/ha in a 165 days grazing season, being evaluated as mediocre from productivity point of view.

Conclusions

- (1) The geobotanical studies performed on permanent grassland vegetation could be further used for evaluating grassland productivity assessments.
- (2) The highest pastoral value of 70-80 was evaluated for the associations: *Festucetum pratensis*, *Arrhenatheretum elatioris*, *Alopecuretum pratense* and *Typhoidetum arundinacea* where we reached productions between 19-27 t/ha green forage mass, harvested as hay meadow.
- (3) Grasslands used for grazing with animals reached a lower and variable green forage mass production which allow an optimal loading with animals of 0,06 LU/ha, being evaluated as degraded for the association *Lolio - Potentilletum anserinae* and up to 1.54 LU/ha on the association *Lolio - Plantaginetum majoris* which was evaluated as good.
- (4) Data concerning the economical indices of productivity for grassland could be further used for the preparation of pastoral arrangements and for determining the forage balance required for animal growing.

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