PRODUCTIVITY EVALUATION OF THE MAIN GRASSLAND HABITATS, NATURA 2000, FROM THE RARĂU MASSIVE (EASTERN CARPATHIANS)

TEODOR MARUȘCA[1]

Abstract. *Grassland types of Rarău Massif with soils formed on a calcareous geological substrate (dolomite) have a very high phytodiversity, on average 91 species of plants on a floristic survey. The overall vegetation cover was almost 90% of which over 60% forage species and almost 30% harmful species. Of the 12 main grassland types, 3 are xerophilous, 2 mesoxerophilous and 7 mesophilous. The most species-rich mesophilous grasslands are Festuca rubra and Festuca nigrescens with 135-154 taxones per survey. The highest pastoral value (PV) was assessed at Habitat 6510 of almost 68 PV where the highest production of 13.6 t/ha of green mass production (GMP) was estimated when using the grassland as hayfield. At Habitat 6520, where the grassland was grazed with animals, it was estimated 51.5 PV, over 7 t/ha GMP that supports 0.84 LU/ha in 130 days grazing season. In the same Habitat 6520 there are grasslands with grassy carpet degraded by Nardus stricta and Deschampsia caespitosa, where we have 20 PV and 2 t/ha GMP with 0.30 LU/ha. The rest of the habitats have a lower productivity, respectively habitat 6170, due to the altitude and a colder climate and habitat 6210 with a drier climate. On average, the productivity of the habitats is quite good with 42 PV, 6.4 t/ha GMP and 0.6 LU/ha in 120 days of grazing.*

Keywords: mountain grasslands, types and habitats, pastoral value, green mass production, grazing capacity

DOI https://doi.org/10.56082/annalsarsciagr.2022.1.45

1. Introduction

Knowledge of the productivity of permanent grasslands at the level of grassland habitats registered in Natura 2000 is an urgent need if we are to be able to compare and develop joint projects in this field with other countries in the European Union [2, 6].

For this purpose, a method has been developed to evaluate the productivity of grasslands based on a floristic survey [4, 5, 7].

All productivity assessments so far have been carried out according to surveys drafted using the phytosociological method Braun - Blanquet, with the main purpose of classifying vegetation into associations, alliances, orders and classes [1].

This is the first work in which surveys have been made to determine the types of grasslands based on dominant species in the grassy carpet.

[1]Dr.ing. MARUȘCA Teodor, Research and Development Institute for Grasslands – Brașov, Romania, Corresponding member of the Academy of the Romanian Scientists, (e-mail: maruscat@yahoo.com).

Regardless of the method in which the floristic observations were made, a well-drafted survey with the notation of the abundance - dominance of the species or the direct appreciation in percentages of their participation in the grass carpet, are sufficient for the further assessment of grassland productivity.

2. Materials and Methods

For reference, the work "Vegetation of the grasslands from the Rarău Massif" was studied, belonging to P. Raclaru, where the classification of the grassland associations took into account the typological principle of species dominance in the grassy carpet [8].

At the higher level, the grasslands were classified according to the humidity factor, being noted 3 types of xerophilous grasslands, 2 types of mesoxerophilous grasslands and 9 types of mesophilous grasslands (Table 1).

Table 3. General data on the vegetation and phytodiversity of the grasslands from Rarău Massif

Type (association)	*Altitude (m)*	*Veg. cover (%)*	*Species (no.)*	*Species participation (%)*	
				Forage	*Harmful*
Xerophilous grasslands					
Festuca saxatilis	1,400-1,600	82	111	55	27
Festuca amethystina	1,400-1,600	82	73	59	23
Carex sempervirens	1,400-1,600	78	37	75	3
Mesoxerophilous grasslands					
Festuca ovina	600-1,200	88	130	62	26
Festuca rupicola	600-1,000	82	61	65	17
Mesophilous grasslands					
Festuca nigrescens	1,300-1,600	90	135	59	31
Nardus stricta	1,300-1,600	92	80	20	72
Deschampsia caespitosa	1,300-1,600	88	52	37	54
Festuca rubra	600-1,200	95	154	65	30
Agrostis capillaris	600-1,200	92	87	72	20
Trisetum flavescens	600-1,000	100	96	86	14
Arrhenatherum elatius	600-800	100	78	85	15
AVERAGE	600-1,600	89	91	62	27

The average phytodiversity of these mountain grasslands is very high, having a number of 91 plant species. By number of species, the richest types were *Festuca*

rubra with 154 taxons and *F. nigrescens* with 135 taxons. The lowest phytodiversity was on types *Carex sempervirens* and *Nardus stricta* with 37-52 taxons.

The vegetation cover is 88%, of which 62 with forage species and 27 species harmful to grassy carpet or animal products.

Recorded data on the types of grassland with vegetation cover, phytodiversity, species participation in floristic surveys continued to be used to calculate pastoral value, green mass production and grazing capacity according to the new method widely described in our annals [5] and other specialized publications [4, 7], so I will not describe it again.

3. Results and Discussions

Calculations on grassland productivity as types determined by dominant species have been introduced in Grassland Habitats Natura 2000, according to our latest classification [3].

The actual results of pastoral value (PV) and green mass production (GMP), components of a grassland's productivity were summarized at Natura 2000 habitat level (Table 2).

Table 4. Productivity of the main grassland habitats in the Rarău Massif

Association Habitat *)	Pastoral value		Green mass production		Grazing season duration	Animal loading LU/ha
	ind.	%	t/ha	%		
1. 6170 Alpine and subalpine calcareous grasslands						
Carex sempervirens	34.9		3.44		100	0.53
Festuca amethystina	31.7		5.04		100	0.78
Festuca saxatilis	30.6		5.32		100	0.82
AVERAGE	32.4	77	4.60	72	100	0.71
2. 6210 Semi-natural dry grasslands and scrubland facies on calcareous substratea (*Festuco-Brometea*) (*important orchid sites) (Al. *Festucion valesiacae*)						
Festuca ovina	37.0		5.13		145	0.54
Festuca rupicola	38.4		3.91		150	0.40
AVERAGE	37.7	90	4.52	71	150	0.47
3. 6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis)*						
Arrhenatherum elatius	67.0		14.42		x	x
Trisetum flavescens	68.3		12.74		x	x

Association Habitat *)	Pastoral value		Green mass production		Grazing season duration	Animal loading LU/ha
	ind.	%	t/ha	%		
AVERAGE	67.7	162	13.58	214	Fâneață	
4. 6520 Mountain grasslands (Syn. Mountain hay meadows) (Al. *Cynosurion cristati*)						
Festuca nigrescens	42.9		6.14		105	0.90
Festuca rubra	45.9		6.35		145	0.67
Agrostis capillaris	65.8		8.78		145	0.93
AVERAGE	51.5	123	7.09	111	130	0.84
5. 6520 Mountain degraded grasslands						
Nardus stricta	13.1		1.35		105	0.20
Deschampsia caespitosa	27.1		2.68		105	0.39
AVERAGE	20.1	48	2.02	32	105	0.30
Habitat Rarău AVERAGE	41.9	100	6.36	100	120	0.58

*) Habitats according to EU, Natura 2000

The average pastoral value of these mountain grasslands was evaluated at 41.9 PV with a production of 6.36 t/ha GMP and an optimal capacity of 0.58 LU/ha in 120 days grazing season.

The highest productivity is in the *Arrhenatherum elatius* and *Trisetum flavescens* grasslands type belonging to Habitat 6510, where 67.7 PV and 13.58 t/ha GMP were evaluated.

The lowest productivity was assessed in the grassland types invaded by the harmful species *Nardus stricta* and *Deschampsia caespitosa*, which were included in the degraded Habitat 6520, where 20.1 PV and 2.02 t/ha GMP were assessed, which can only sustain 0.30 LU/ha in 105 days, grazing period.

Closer to the average were Habitat 6170 at high altitude, with colder climate, and Habitat 6210 at lower altitude, with drier climate.

Conclusions

(1) When evaluating productivity, floristic surveys can be used to determine the types of grasslands, provided they are well drafted;

(2) The phytodiversity is very high, being on average 91 species on a floristic survey, the vegetation cover was 90% of which over 60% forage species and 30% harmful species;

(3) The highest productivity was evaluated in Habitat 6510 with 68 pastoral value (PV) and 13.6 t/ha green mass production (GMP), harvested as hay for the grassland types *Arrhenatherum elatius* and *Trisetum flavescens*;

(4) Habitat 6520 has the lowest productivity, being degraded by the invasion of *Nardus stricta* and *Deschampsia caespitosa* species where 20 PV and 2 t/ha GMP were evaluated, with 0.30 LU/ha animal loading, 2.5 times less than the normal variant of Habitat 6520 where 51.5 PV, over 7 t/ha GMP was registered, with a capacity of 0.84 LU/ha in 130 days grazing season;

(5) The average productivity of these mountain grasslands, located between 600 - 1600 m altitude, with 42 PV, 6.4 t/ha GMP and 0.6 LU/ha in 120 days of grazing, is considered to be quite good.

R E F E R E N C E S

[1] Cristea, V., Gafta, D., Pedrotti, F., Fitosociologie (Phytosociology), Presa Universitară Clujeană Publishing House (2004).

[2] Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihăilescu, S., Biriș I.A., Habitats of Romania (Habitatele din România), Tehnică și silvică Publishing House, București (2005).

[3] Gafta, D., Mountford, O. (coord.), Textbook for interpreting the Natura 200 habitats of Romania (Manual de interpretare a habitatelor Natura 2000 din România), Risoprint Publishing House, Cluj-Napoca (2008).

[4] Marușca, T., Contributions to the evaluation of pasture productivity using the floristic releve, Romanian Journal of Grassland and Forage Crops, vol. 19, pp. 33- 47 (2019).

[5] Marușca, T., Arsene, G. G., Taulescu, E., Assessment of permanent grassland productivity in Poiana Ruscă Mountains (South-West Romanian Carpathians), Annals of the Academy of Romanian Scientists Series Agriculture, Silviculture and Veterinary Medicine Sciences Volume 9, Number 1/2020, pp. 62-69 (2020).

[6] Marușca, T., Contributions to the assessment of Natura 2000 Habitat productivity of mountain pastures in Padurea Craiului (Southern-Eastern Carpathians), Romanian Journal of Grassland and Forage Crops, Cluj Napoca, nr.23 pp. 99-104, (2021).

[7] Marușca, T., Roman, A., Taulescu, E., Ursu, T.M., Popa, R. D., Detecting trends in the quality and productivity of grasslands by analyzing the historical vegetation relevés: A case study from Southeastern Carpathians, Vlădeasa Mountains (Romania), Notulae Botanicae Horti Agrobotanici Cluj-Napoca, Volume 49, Issue 3, Article number 12378, (2021).

[8] Raclaru, P., Grasslands vegetation in the Rarau Massive (Vegetația pajistilor din Masivul Rarău), Comunicări de Botanică, A- V-a Consfătuire de Geobotanică, București, pp.143-177, (1967).