

VEGETATION AND THE PRODUCTIVE POTENTIAL OF PERMANENT GRASSLANDS DOMINATED BY *Festuca rupicola* Heuff. IN BIHOR COUNTY (NORTH-WESTERN ROMANIA)

Călin Gheorghe PĂȘCUȚ, Octavian BERCHEZ, Sorin DOROG, Valeriu Adrian ȘTEF

University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru Street,
410048, Oradea, Romania

Corresponding author email: pascutcalin@yahoo.com

Abstract

The present study proposed two main objectives, the first was to investigate *Festuca rupicola* Heuff. grasslands in Bihor County in terms of productivity and biodiversity. The second main objective involves analyzing the floristic composition and comparing the productivity of *Festuca rupicola* Heuff. grasslands in Bihor County with similar phytocoenoses from nine locations elsewhere in Romania. To study the productive potential of *Festuca rupicola* Heuff. grasslands, two plant associations were studied: *Festucetum rupicolae* Burduja et al. 1956 and *Thymo comosi-Festucetum rupicolae* (Csűrös et Gergely 1959) Pop et Hodișan 1985, from seven locations in Bihor County. *Festuca rupicola* Heuff. grasslands are characteristic of the plains and hilly zones of Bihor County, occurring on moderately sloping terrain with generally sunny exposures. Due to less pronounced xerothermic ecological conditions, these grasslands exhibit a complex floristic composition, consisting mainly of xerophilous species, as well as mesoxerophilous ones. The pastoral value and productivity of these grasslands in Bihor County are weak-medium to middle-good, with a yield of 6.07-11.80 t/ha of green mass and a capacity of 0.57-0.98 LU/ha. To obtain a clearer understanding of the pastoral value, green mass production and livestock carrying capacity of these grasslands in Bihor County, a correlation analysis was conducted on *Festuca rupicola* Heuff. dominated grasslands originating from nine distinct regions of Romania.

Key words: grasslands, pastoral value, green mass production, carrying capacity.

INTRODUCTION

The socio-economic development of human communities has, over time, been influenced and shaped by the way natural resources are utilized at the local and/or regional level. In this context, grasslands have been used as important renewable natural resources.

Permanent grasslands natural and/or semi-natural constitute an essential component of natural heritage and, through their use for grazing, represent the most accessible source of forage. At the same time, grasslands are characterized by a pronounced multifunctional nature, fulfilling a wide range of roles, such as: forage production, conservation of plant and animal biodiversity, prevention of soil erosion, water storage, maintenance of groundwater quality, preservation of landscape quality, carbon sequestration (Bernués et al., 2015).

Within agricultural systems, soil and water quality are correlated with productivity levels. Maintaining healthy perennial vegetation contributes significantly to soil formation,

improvement, and protection, and also plays an essential role in preserving water quality.

Pastoral Value (PV) is an integrative synthetic index used in vegetation studies, which combines forage yield, grassland quality, and the degree of palatability for animals, being determined through floristic assessment methods (Marușca, 2019).

This indicator allows for the estimation of the grassland's carrying capacity, in relation to the maximum livestock load corresponding to a specific grazing system. In general, studies and research on grassland vegetation in Romania contain limited or, in some cases, no information regarding forage yield and quality.

Such data on grassland productivity are essential for underpinning optimal decisions related to their improvement, the assessment of grazing capacity, and the establishment of other measures necessary for the rational management of this important form of agricultural land use dedicated to livestock production (Marușca et al., 2020; Pășcuț et al., 2025; Marușca & Pășcuț, 2022).

Furthermore, this evaluation method, characterized by an adequate level of precision, can substitute the direct determination of biomass production through mowing in enclosed experimental plots, a procedure that is difficult to implement and, in certain situations, impracticable under real-world conditions (Pășcuț et al., 2025; Pășcuț et al., 2022; Pășcuț & Marușca, 2020).

The newly developed method for assessing the productive potential of grasslands dominated by *Festuca rupicola* Heuff., was applied in the present study, with the following main objectives:

1. To determine the pastoral value, green biomass production, and livestock carrying capacity of *Festuca rupicola* Heuff. grasslands located in Bihor County;
2. To conduct a comparative analysis of the main pastoral indicators, namely pastoral value, green biomass production, and livestock carrying capacity, characteristic of grasslands dominated by *Festuca rupicola* Heuff. in Bihor County, in relation to ten other distinct regions of Romania.

The method for assessing grassland productivity based on floristic relevés enables the correlation and comparability of vegetation studies, irrespective of the period in which they were conducted, while also facilitating the integration of economic information related to yield and quality.

The estimation of species abundance-dominance is commonly performed using the Braun-Blanquet scale (1964), which is characterized by unequal variation intervals between classes, namely: 4.5% between classes +1, 12.5% between classes 1-2, 20% between classes 2-3, and 25% between classes 3-4 and 4-5 (Pășcuț et al., 2025).

The pronounced discontinuities among these intervals, particularly the 25% gaps between classes 3-4 and 4-5, as well as the 20% gap between classes 2-3, lead to less reliable estimates in the quantitative assessment of biomass (Marușca, 2019; Pășcuț et al., 2025).

In order to reduce these estimation errors, an alternative scale for evaluating the quantitative contribution of species has been developed, based on their constancy (K) (Marușca, 2019; Pășcuț et al., 2025).

Grasslands play a significant role in rural

development and in maintaining ecological balance, as evidenced by their contribution to biodiversity conservation, improvement of soil fertility, regulation of the hydrological regime, and preservation of landscape quality (Wick et al., 2016).

Plant biomass production and the forage quality of plant species constitute key determinants of the performance of grazing animals, as well as of the carrying capacity of grasslands (Novák, 2004; Soder et al., 2007).

The impact of grazing intensity on forage value and floristic diversity varies depending on the type of animal species involved and on specific ecological conditions (Liu et al., 2015).

Some studies indicate that the abandonment of grazing may lead to a decline in floristic diversity (Janišová et al., 2020), while other research highlights an increase in plant species richness (Ford et al., 2012).

Methods for assessing grassland productivity based on the harvesting and weighing of phytomass provide a high degree of accuracy; however, they involve considerable time investment and financial resources (Peratoner & Pötsch, 2019).

In the hilly regions of our country, there are groves or sparse stands of oak, sessile oak, or other tree species on grasslands dominated by *Festuca rupicola* Heuff., which exhibit the characteristics of silvopastoral systems (Marușca 2006; Sicoe et al., 2023; Crainic et al., 2023b).

Pastoral systems in our country, particularly tree-based pastures, operate empirically, according to the needs of local communities that use them for grazing (Crainic et al., 2023a).

MATERIALS AND METHODS

The assessment of the productive potential of grasslands dominated by *Festuca rupicola* Heuff. was conducted in Bihor County, based on seven phytocoenological studies carried out in the following locations:

- 1 - Crișurilor Plain;
- 2 - Ierului Valley;
- 3 - Tășnadului Hills;
- 4 - Middle and lower basin of the Crișul Negru River;
- 5 - Lăzărenilor Hills;
- 6 - Pădurea Craiului Mountains;
- 7 - Codru-Moma Mountains (Figure 1).

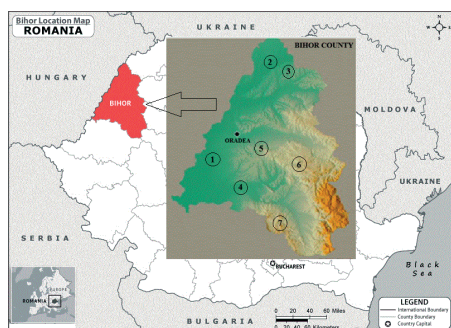


Figure 1. The geographical location of the grasslands dominated by *Festuca rupicola* Heuff. investigated in Bihor County (processed after <https://www.mapsofindia.com>)

The scientific nomenclature of the identified species was adopted in accordance with the works published by Ciocârlan (2009). To assess the degree of floristic similarity among the phytocoenoses of the studied grasslands, the Jaccard index was employed, calculated using the statistical software PAST 5.

The scientific naming of the plant associations was established in compliance with the provisions of the International Code of Phytosociological Nomenclature, 3rd edition (Weber et al., 2000).

The classification of grassland plant associations into higher syntaxonomic units (alliance, order, class) was carried out in accordance with the specialized literature, particularly Mucina (1997) and Chifu (2004-2006). The assessment of species abundance-dominance (AD) in the herbaceous layer of the grasslands was performed using the Braun-Blanquet scale, following the methodology described by Cristea et al. (2004).

After converting the scale of phytosociological ratings in percentage of participation, for each species in the floristic relevé, organized into three major forage groups (*Poaceae*, *Fabaceae*, and other families) the forage quality indicators (F4-F9) and those corresponding to harmful species (F1-F3) are recorded, together with the indicators of useful forage phytomass (M1-M9) and harmful phytomass (M0, associated with categories F1-F3) (Marușca, 2019; Pășcuț et al., 2025).

The conversion of AD values into percentages (Table 1), according to constancy classes (K), was conducted based on the models proposed by Marușca (2019) and Pășcuț et al. (2025).

Table 1. Appreciation of participation (P%) from synthetic floristic relevés, depending on the abundance-dominance scale intervals (AD) and average constancy (K%) for phytocoenoses of permanent grasslands (Marușca, 2019; Pășcuț et al., 2025)

AD Scale Br.-Bl.	AD according to K (%)				
	V (81-100)	IV (61-80)	III (41-60)	II (21-40)	I (<20)
5	87.5*	61.3	43.8	26.3	8.8
4-5	75.0	52.5	37.5	22.5	7.5
3-5	62.5	43.8	31.3	18.8	6.3
2-5	52.5	36.8	26.3	15.8	5.3
1-5	46.3	32.4	23.2	13.9	4.6
+ - 5	44.0	30.8	22.0	13.2	4.4
4	62.5*	43.8	31.3	18.8	6.3
3-4	50.0	35.0	25.0	15.0	5.0
2-4	40.0	28.0	20.0	12.0	4.0
1-4	33.8	23.7	16.9	10.1	3.4
+ - 4	31.5	22.1	15.8	9.5	3.2
3	37.5*	26.3	18.9	11.3	3.8
2-3	27.5	19.3	13.8	8.3	2.8
1-3	21.3	14.9	10.7	6.4	2.1
+ - 3	19.0	13.3	9.5	5.7	1.9
2	17.5*	12.3	8.8	5.3	1.8
1-2	11.3	7.9	5.7	3.4	1.1
+ - 2	9.0	6.3	4.5	2.7	0.9
1	5.0*	3.5	2.5	1.5	0.5
+ - 1	2.8	2.0	1.4	0.8	0.3
+	0.5*	0.4	0.3	0.2	0.1

*Appreciation scale transformation A+D, Braun-Blanquet in percentage, after Cristea et al. (2004).

The forage value indices (F), according to Kovacs (1979), Păcurar & Rotar (2014), and Marușca (2019), are classified as follows: F1 - toxic to animals and humans, F2 - harmful to animal products, F3 - harmful to the grass carpet, F4 - weak fodder (ballast), F5 - mediocre fodder, F6 - forage mediums, F7 - good fodder, F8 - very good fodder, F9 - excellent fodder, X - species of unknown feed value.

The floristic relevés thus developed, which include the percentage participation of species within the vegetation layer, as well as the forage quality indices (F) and the useful phytomass indices (M), enable the determination of pastoral value (PV) based on a specific calculation formula:

$$PV = \sum P(\%) \frac{F}{9}$$

in which: pastoral value (PV), expressed on a scale from 0 to 100, is interpreted as follows: 0-5 (degraded grassland); 5-15 (very poor); 15-25 (poor); 25-40 (mediocre); 40-60 (average); 60-80 (good); 80-100 (very good). Within this calculation, the F index takes values ranging from 4 to 9.

To assess net forage production, an indirect method was used, based on floristic relevés and on the production indices (M) of forage species (F4-F9) within the vegetation layer of grasslands, according to the approach described

by Marușca (2019). The average green biomass production index (IM) of permanent grassland phytocoenoses is determined using a specific formula:

$$IM = \sum P(\%) \frac{M}{100}$$

in which: M - has values between 1-9 only for values of F between 4 - and 9.

After determining the average green biomass index (IM), the corresponding value range is identified according to Table 2 and subsequently multiplied by the conversion coefficient for green biomass production (CMV). Thus, the production is obtained, expressed in tonnes per hectare, along with the corresponding assessment coefficient for this indicator, in accordance with the methodology developed by Marușca (2019) (Table 2).

Table 2. Production indices for feed species and estimating the useful yield per hectare of permanent unfertilized grasslands (Marușca, 2019; Pășcuț et al., 2025)

Average production indices green biomass forage species (IM)	Coefficients of transformation in green biomass production (CMV)	Green biomass production estimate (MV) (t/ha)	Appreciation of production value
0.1 – 0.5	x 1.8	0.18 – 0.90	Very poor
0.6 – 1.0	x 1.9	1.14 – 1.90	
1.1 – 1.5	x 2.0	2.20 – 3.00	Poor
1.6 – 2.0	x 2.1	3.36 – 4.20	
2.1 – 2.5	x 2.2	4.62 – 5.50	Poor-average
2.6 – 3.0	x 2.3	5.98 – 6.90	
3.1 – 3.5	x 2.4	7.44 – 8.40	Average
3.6 – 4.0	x 2.5	9.00 – 10.00	
4.1 – 4.5	x 2.6	10.66 – 11.70	Average - Good
4.6 – 5.0	x 2.7	12.42 – 13.50	
5.1 – 5.5	x 2.8	14.28 – 15.40	Good
5.6 – 6.0	x 2.9	16.24 – 17.40	
6.1 – 6.5	x 3.0	18.30 – 19.50	Good - Very good
6.6 – 7.0	x 3.1	20.46 – 21.70	
7.1 – 7.5	x 3.2	22.72 – 24.00	Very good
7.6 – 8.0	x 3.3	25.08 – 26.40	
8.1 – 8.5	x 3.4	27.54 – 28.90	Excellent
8.6 – 9.0	x 3.5	30.10 – 31.50	

Based on these determinations, the optimal livestock stocking rate, respectively grazing capacity (GC), expressed in livestock units (LU) per hectare, is established using a specific calculation formula:

$$GC(LU/ha) = \frac{MV(kg/ha)}{Nz \times Zp}$$

in which: Nz - the daily requirement of grass for 1 livestock unit (LU), 65 kg (50 kg + 30% (15 kg) seasonal climate fluctuations and unconsumed debris)

Zp = number of grazing days (season)

The grazing season duration in the studied

grasslands of Bihor County averages approximately 180 days, being shorter in the Pădurea Craiului Mountains (175 days) and the Codru-Moma Mountains (165 days).

The indirect estimation of biomass based on floristic relevés offers significant logistical advantages; however, its accuracy is influenced by the degree of observer subjectivity, as visual assessments of vegetation cover may vary among researchers, as well as by the phenological dynamics of vegetation, given that actual biomass changes rapidly depending on the season during which the data are collected.

RESULTS AND DISCUSSIONS

In order to assess the productive potential of permanent grasslands dominated by *Festuca rupicola* Heuff. in Bihor County, two types of grassland associations were analysed, namely *Festucetum rupicolae* Burduja et al. 1956 (Figure 2) and *Thymo comosi-Festucetum rupicolae* (Csűrös et Gergely 1959) Pop and Hodișan 1985, which were phytocoenologically described in seven locations, as follows: Crișurilor Plain (Pop, 1968), Ierului Valley (Czirjak, 2014), Tășnadului Hills (Karacsonyi, 2011), Middle and lower basin of the Crișul Negru River (Gavra, 2014), Lăzărenilor Hills (Herman, 2012), Pădurea Craiului Mountains (Groza, 2008), Codru-Moma Mountains (Pășcuț, 2012).



Figure 2. *Festucetum rupicolae* Burduja et al. 1956, near Cărăsău (Crișul Negru River basin)

These grasslands develop on flat or gently sloping, well-drained surfaces, on a variety of soil types with a reaction ranging from neutral to slightly acidic. Under moderately xerothermic ecological conditions, they exhibit a relatively complex floristic composition, predominantly dominated by xerophilous species, along with mesoxerophilous elements.

From a cenotaxonomic perspective, the two analysed grassland associations are classified as follows:

Festuco-Brometea class (Br.-Bl. et R. Tüxen in Br.-Bl. 1949)

Stipio pulcherrimae-Festucetalia pallentis order (I. Pop 1968)

Thymio comosi-Festucion rupicolae alliance (Pop 1968)

Thymo comosi-Festucetum rupicolae association ((Csűrös et Gergely 1959) Pop et Hodişan 1985)

Festucetalia valesiaca order (Br.-Bl. et R. Tüxen ex Br.-Bl. 1949)

Festucion valesiaca alliance (Klika 1931)

Festucetum rupicolae association (Burduja et al. 1956)

A total of 35 floristic relevés belonging to the grasslands of the association *Festucetum rupicolae* Burduja et al. (1956) were included in the study, originating from six locations in Bihor County: Crişurilor Plain (3 relevés), Ierului Valley (8 relevés), Tăşnadului Hills (3 relevés), Middle and lower basin of the Crişul Negru River (5 relevés), Lăzărenilor Hills (10 relevés), Pădurea Craiului Mountains (6 relevés) (Table 3). These grasslands are characterized by high biodiversity, comprising a total of 183 species, predominantly xeromesophilous. They are distributed across slopes with varied exposures, with inclinations ranging between 0 and 25°, at altitudes between 90 and 995 m.

The physiognomy of these grasslands is determined by *Festuca rupicola* Heuff., with a cover ranging from 46.3% to 87.5% and maximum constancy ($K = V$). Of the total number of species, 23 belong to the family *Poaceae*, among which those with the highest frequency include: *Festuca valesiaca* Schleich. Ex Gaudin, *Agrostis capillaris* L., *Anthoxanthum odoratum* L., *Festuca pseudovina* Hack. ex Wiesb., *Lolium perenne* L., *Koeleria macrantha* (Ledeb.) Schult., *Alopecurus pratensis* L. (Table 3). *Fabaceae* exhibit low cover (0.1-5%), with the most representative species being: *Lotus corniculatus* L., *Trifolium repens* L., *Trifolium pratense* L., *Trifolium campestre* Schreber, *Medicago falcata* L., *Vicia grandiflora* Scop.

Among the species of forage value from other families present in these grasslands, the greatest proportion is held by: *Luzula campestris* (L.) DC., *Achillea collina* (Wirtg.) Heimerl,

Centaurea jacea L., *Daucus carota* L., *Fragaria viridis* Duchesne, *Galium verum* L., *Hieracium pilosella* L., *Leontodon hispidus* L., *Plantago lanceolata* L., *Thymus pulegioides* L., *Potentilla argentea* L., *Prunella laciniata* (L.) L.

In these grasslands, a number of plant species occur that are detrimental to animal products, such as: *Artemisia absinthium* L., *Carduus acanthoides* L., *Carduus nutans* L., *Eryngium campestre* L. and toxic and harmful plants *Euphorbia cyparissias* L., *Hypericum perforatum* L., *Verbascum nigrum* L.

The xeromesophilous phytocoenoses of the grasslands belonging to the association *Thymo comosi-Festucetum rupicolae* occur in the Codru-Moma Mountains on sun-exposed calcareous substrates, on southern, south-eastern, and south-western slopes with inclinations ranging from 5 to 25°. The soils on which they develop are rendzinas, rich in humus and with a neutral reaction. The edificatory and characteristic species are *Festuca rupicola*, with a cover of 40%, and *Thymus comosus*, with a cover of 21.3% and maximum constancy ($K = V$) (Table 3). In the Codru-Moma Mountains region, these grasslands have been identified in seven localities, exhibiting a rich floristic composition totaling 112 species.

The physiognomy of these grasslands is given by *Poaceae* species (45%), with *Fabaceae* species having a reduced presence (3.1%). The useful phytomass of these grasslands is represented by species with medium forage value such as *Festuca rubra* L., *Brachypodium pinnatum* (L.) P. Beauv., *Anthoxanthum odoratum* L., *Lotus corniculatus* L., *Anthyllis vulneraria* L., *Trifolium repens* L., *Galium verum* L., *Fragaria viridis* Duchesne, *Plantago lanceolata* L., *Hieracium pilosella* L.

Among the harmful, toxic, and noxious plants occurring in this type of grassland, we list: *Carduus acanthoides* L., *Carduus nutans* L., *Euphorbia cyparissias* L., *Verbascum phlomoides* L., *Coronilla varia* L.

The dendrogram of *Festuca rupicola* Heuff. grasslands in Bihor County suggests a relatively uniform floristic composition, with the highest similarity occurring between phytocoenoses from the Pădurea Craiului Mountains and the Codru-Moma Mountains (Figure 3).

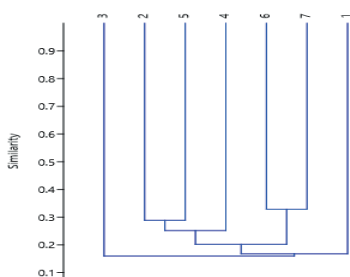


Figure 3. Jaccard similarity index for *Festuca rupicola* grasslands studied from Bihor County (where: 1 - Crișurilor Plain; 2 - Ierului Valley; 3 - Tașnadului Hills; 4 - Middle and lower basin of the Crișul Negru River; 5 - Lăzărenilor Hills; 6 - Pădurea Craiului Mountains; 7 - Codru-Moma Mountains)

The following table synthesizes information on the species composing the floristic structure of *Festuca rupicola* Heuff. grasslands in Bihor County, including study locations, number of relevés, altitude, herbaceous layer cover, exposure, slope, and relevé size. The vertical arrangement of the species presented in the table was based on taxonomic criteria (*Poaceae*, *Fabaceae*, and other botanical families), as well as on their degree of palatability, while also highlighting harmful, toxic, or noxious plants, all of which are listed in alphabetical order. In addition, fodder quality indicators (F) and useful forage phytomass indicators (M) were provided for each species.

Table 3. The floristic composition of *Festuca rupicola* Heuff. grasslands in the Bihor County (where: F - Fodder quality indicators; M - Indicators of useful forage phytomass; K - constancy)

Plant association	Festucetum rupicolae association																		Thymo comosi-Festucetum rupicolae association			Indicators	
Location in Bihor County	1			2			3			4			5			6			7				
	AD according to K (%)	ADm	K	AD according to K (%)	ADm	K	AD according to K (%)	ADm	K	AD according to K (%)	ADm	K	AD according to K (%)	ADm	K	AD according to K (%)	ADm	K	AD according to K (%)	ADm	K		
No. of relevés	3			8			3			5			10			6			7				
Altitude (m)	90-100			105-120			200-250			95-295			150-270			300-660			510-800				
The coverage of grass layer (%)	90.9			80.7			77.2			96.4			89.6			86.9			93.5				
Exposition	-			-			V			V, S, E, NE			S, E, N, V, NE			S, V, E, SV			S, SV, SE				
Slope (degree) (°)	-			-			10			3-6			1-9			4-25			5-25				
Area (m²)	100			100			100			100			100			100			100			F	M
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Poaceae																							
Agropyron repens	-	-	-	0.2	+	II	-	-	-	0.2	+	II	0.5	+	V	-	-	-	0.2	+	II	7	5
Agrostis capillaris	-	-	-	0.2	+	II	5	I	V	-	-	-	-	-	-	-	-	-	-	-	-	8	7
Alopecurus pratensis	5	1	V	2	+1	IV	-	-	-	-	-	-	2.8	+1	V	-	-	-	1.4	+1	III	5	3
Anthoxanthum odoratum	0.5	+	V	0.2	+	II	7.9	1-2	II	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brachypodium pinnatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	+	IV	5	7
Briza media	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	+	III	5	2
Bromus arvensis	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	6
Bromus inermis	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	8
Cynodon dactylon	-	-	-	0.2	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	2
Cynosurus cristatus	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	0.2	+	II	7	4
Dactylis glomerata	-	-	-	0.2	+	II	-	-	-	-	-	-	-	-	-	0.2	+	II	0.2	+	II	9	8
Danthonia decumbens	-	-	-	-	-	-	-	-	-	-	-	-	0.3	+	III	-	-	-	-	-	-	5	4
Festuca arundinacea	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	8	9
Festuca pratensis	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	9	8
Festuca pseudovina	9	+2	V	-	-	-	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	5	3
Festuca rubra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	+1	IV	1.4	+1	III	7	6
Festuca rupicola	50	3-4	V	62.5	3-5	V	50	3-4	V	87.5	5	V	62.5	3-5	V	46.3	1-5	V	40	2-4	V	5	5
Festuca valesiaca	-	-	-	0.2	+	II	0.8	+1	II	0.3	+	III	2	+1	IV	0.1	+	I	0.1	+	I	5	3
Holcus lanatus	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	6	6
Koeleria macrantha	2.8	+1	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3
Lolium perenne	0.5	+	V	0.1	+	I	-	-	-	0.2	+	II	0.1	+	I	-	-	-	0.1	+	I	9	8
Poa angustifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	7	5
Poa bulbosa	0.4	+	IV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1
Poa compressa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	+	IV	0.1	+	I	6	3
Phleum montanum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	6	5
Phleum pratense	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	9	8
Poa pratensis	0.5	+	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	8	6
Fabaceae																							
Anthyllis vulneraria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	+1	II	6	5
Lotus corniculatus	0.1	+	I	0.3	+	III	0.5	+	V	0.3	+	III	2	+1	IV	0.2	+	II	0.5	+	V	8	6
Lotus tenuis	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	3
Medicago falcata	0.1	+	I	0.3	+1	I	-	-	-	-	-	-	-	-	-	0.3	+	III	-	-	-	7	6
Medicago lupulina	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	0.3	+	III	0.2	+	II	8	3
Medicago minima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	+1	II	-	-	-	7	1
Trifolium alpestre	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	-	-	-	6	3
Trifolium arvense	-	-	-	-	-	-	0.3	+	III	-	-	-	0.2	+	II	-	-	-	-	-	-	4	2
Trifolium campestre	0.3	+	III	0.2	+	II	-	-	-	0.3	+	III	0.3	+	III	-	-	-	0.1	+	I	7	2
Trifolium fragiferum	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	3

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
<i>Trifolium hybridum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	8	6
<i>Trifolium medium</i>	-	-	-	0.1	+	I	-	-	-	0.1	+	I	-	-	-	-	-	-	0.2	+	II	6	4
<i>Trifolium pannonicum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	7	5
<i>Trifolium pratense</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	0.1	+	I	0.2	+	II	0.1	+	I	8	7
<i>Trifolium repens</i>	5	1	V	2	+1	II	-	-	-	-	-	-	-	-	-	-	-	-	0.8	+1	II	8	5
<i>Vicia cracca</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	-	-	7	6
<i>Vicia grandiflora</i>	-	-	-	0.4	+	IV	-	-	-	-	-	-	-	-	-	-	0.1	+	-	-	-	7	5
<i>Vicia tetrasperma</i>	-	-	-	0.2	+	II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3
Forage species from other botanical families																							
<i>Achillea collina</i>	0.2	+	II	0.1	+	I	0.4	+	IV	0.4	+	IV	0.4	+	IV	0.2	+	II	0.1	+	I	6	5
<i>Achillea millefolium</i>	-	-	-	0.3	+	III	-	-	-	-	-	-	-	-	-	-	-	-	0.3	+	III	6	4
<i>Achillea nobilis</i>	-	-	-	-	-	-	-	-	-	0.3	+	III	-	-	-	-	-	-	-	-	-	6	2
<i>Achillea setacea</i>	0.1	+	I	0.1	+	I	-	-	-	0.2	+	II	-	-	-	-	-	-	-	-	-	6	3
<i>Capsella bursa-pastoris</i>	-	-	-	0.2	+	II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3
<i>Carum carvi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	6	3
<i>Centaurea jacea</i>	0.1	+	I	0.2	+	II	-	-	-	0.2	+	II	0.3	+	III	-	-	-	-	-	-	4	6
<i>Cichorium intybus</i>	0.1	+	I	0.1	+	I	0.3	+	III	-	-	-	-	-	-	-	-	-	-	-	-	5	6
<i>Convolvulus arvensis</i>	-	-	-	0.3	+	III	-	-	-	0.1	+	I	0.2	+	II	-	-	-	0.1	+	I	7	6
<i>Daucus carota</i>	-	-	-	0.4	+	IV	0.4	+	IV	-	-	-	0.3	+	III	-	-	-	-	-	-	6	5
<i>Echium vulgare</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	0.2	+	II	4	3
<i>Filipendula vulgaris</i>	0.1	+	I	-	-	-	-	-	-	-	-	-	0.1	+	I	0.1	+	I	0.1	+	I	5	4
<i>Fragaria viridis</i>	0.3	+	III	0.1	+	I	0.2	+	II	-	-	-	0.8	+1	II	-	-	-	2.8	+1	V	4	1
<i>Galium verum</i>	0.2	+	II	0.4	+	IV	-	-	-	0.1	+	I	0.3	+	III	0.1	+	I	2	+1	IV	5	4
<i>Helianthemum nummularium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	+1	IV	0.1	+	I	4	2
<i>Hieracium baubini</i>	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	4	1
<i>Hieracium pilosella</i>	0.2	+	II	-	-	-	0.2	+	II	-	-	-	0.2	+	II	0.1	+	I	2	+1	IV	4	1
<i>Inula britannica</i>	0.1	+	I	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	4	4
<i>Inula hirta</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	4	4
<i>Knautia arvensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	0.2	+	II	4	4
<i>Leontodon autumnalis</i>	0.2	+	II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3
<i>Leontodon hispidus</i>	0.1	+	I	0.2	+	II	0.2	+	II	0.2	+	II	-	-	-	-	-	-	0.3	+	III	5	3
<i>Leucanthemum vulgare</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	0.3	+	III	5	5
<i>Lucula campestris</i>	2.8	+1	V	0.1	+	I	-	-	-	-	-	-	0.3	+	III	-	-	-	-	-	-	4	2
<i>Origanum vulgare</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	0.1	+	I	4	4
<i>Pimpinella saxifraga</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	5	3
<i>Plantago lanceolata</i>	0.5	1	V	0.2	+	II	-	-	-	0.1	+	I	0.3	+	III	0.4	+	IV	0.4	+	IV	6	1
<i>Plantago media</i>	-	-	-	-	-	-	0.1	+	I	-	-	-	-	-	-	0.1	+	I	0.1	+	I	6	2
<i>Polygala vulgaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	0.1	+	I	0.2	+	II	4	1
<i>Polygonum aviculare</i>	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	-	-	-	5	3
<i>Potentilla argentea</i>	0.1	+	I	0.3	+	III	-	-	-	-	-	-	0.4	+	IV	0.2	+	II	0.1	+	I	4	2
<i>Potentilla cinerea</i>	-	-	-	-	-	-	0.1	+	I	-	-	-	-	-	-	15	3-4	II	0.3	+	III	4	1
<i>Potentilla recta</i>	-	-	-	-	-	-	-	-	-	0.1	+	I	0.1	+	I	-	-	-	0.1	+	I	5	2
<i>Potentilla reptans</i>	0.1	+	I	-	-	-	-	-	-	-	-	-	0.2	+	II	0.1	+	I	-	-	-	4	1
<i>Prunella grandiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	4	2
<i>Prunella laciniata</i>	0.1	+	I	-	-	-	-	-	-	0.3	+	III	1.4	+1	III	0.1	+	I	-	-	-	4	2
<i>Prunella vulgaris</i>	0.1	+	I	-	-	-	-	-	-	-	-	-	0.2	+	II	0.1	+	I	0.1	+	I	4	2
<i>Ranunculus polyanthemos</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.3	+	III	-	-	-	-	-	-	4	4
<i>Rumex acetosa</i>	0.3	+	III	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	0.2	+	II	4	4
<i>Salvia pratensis</i>	0.5	+	V	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	0.4	+	IV	6	3
<i>Sanguisorba minor</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	0.1	+	I	0.3	+	III	0.4	+	IV	6	3
<i>Scabiosa ochroleuca</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	0.4	+	IV	4	4
<i>Taraxacum officinale</i>	0.1	+	I	0.2	+	II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	3
<i>Thymus glabrescens</i>	0.5	+	V	-	-	-	0.3	+	III	-	-	-	-	-	-	0.1	+	I	-	-	-	4	2
<i>Thymus pulegioides</i>	-	-	-	-	-	-	-	-	-	0.3	+	III	0.4	+	IV	-	-	-	-	-	-	4	2
<i>Tragopogon pratensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	0.2	+	II	5	5
<i>Urtica dioica</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	7
<i>Verbena officinalis</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	0.1	+	I	0.1	+	I	-	-	-	4	4
<i>Veronica chamaedrys</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.3	+	III	-	-	-	-	-	-	4	2
Plant species not consumed or with a low degree of consumability (F3), (M0)																							
<i>Acinos arvensis</i>	-	-	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0
<i>Agrimonia eupatoria</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	3	0
<i>Ajuga genevensis</i>	-	-	-	-	-	-	-	-	-	0.2	+	II	0.2	+	II	-	-	-	0.1	+	I	3	0
<i>Anthemis arvensis</i>	-	-	-	-	-	-	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	3	0
<i>Arabis hirsuta</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	0.1	+	I	3	0
<i>Arenaria serpyllifolia</i>	0.3	+	III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0
<i>Asperula cynanchica</i>	-	-	-	-	-	-	-	-	-	0.2	+	II	0.1	+	I	0.4	+	IV	0.3	+	III	3	0
<i>Bromus commutatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	3	0
<i>Bromus hordeaceus</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0
<i>Calamagrostis epigeios</i>	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	-	-	-	3	0
<i>Campanula glomerata</i>	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	-	-	-	0.1	+	I	3	0
<i>Campanula patula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	+	II	3	0	
<i>Campanula persicifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	3	0	
<i>Carex caryophylla</i>	2.8	+1	V	-	-	-	-	-	-	0.1	+	I	-	-	-	0.1	+	I	0.1	+	I	3	0
<i>Carex hirta</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	0.3	+	III	-	-	-	-	-	-	3	0
<i>Carex precox</i>	0.5	+	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0
<i>Carlina acaulis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	+	I	3	0
<i>Carlina biebersteinii</i>	-	-	-	-	-	-	-	-	-	0.3	+	III	0.3	+	III	-	-	-	0.2	+	II	3	0
<i>Carlina vulgaris</i>	-	-	-	0.1	+	I	-	-	-	-	-	-	-	-	-	0.1	+	I	0.1	+	I	3	0
<i>Centaurea micranthos</i>	-	-	-	-	-	-	-	-	-	0.2	+	II	-	-	-	0.1	+	I	-	-	-	3	0
<i>Centaurea scabiosa</i>	-	-																					

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
<i>Veronica arvensis</i>	2.8	+1	V																			3	0
<i>Veronica prostrata</i>	0.2	+	II																			3	0
<i>Veronica serpyllifolia</i>	0.1	+	I																			3	0
<i>Veronica spicata</i>										0.2	+	II										3	0
<i>Veronica teucrium</i>																0.1	+	I	0.1	+	I	3	0
<i>Viola arvensis</i>																			0.1	+	I	3	0
<i>Viola tricolor</i>																0.2	+	II	0.1	+	I	3	0
<i>Vinca herbacea</i>													0.2	+	II							3	0
<i>Xeranthemum cylindraceum</i>							2.7	+2	II													3	0
Plants that harm livestock products (F2), (M0)																							
<i>Artemisia absinthium</i>				0.1	+	I							0.2	+	II							2	0
<i>Carduus acanthoides</i>				0.3	+	III							2	+1	IV				0.2	+	II	2	0
<i>Carduus nutans</i>										0.4	+	IV				0.1	+	I	0.3	+	III	2	0
<i>Eryngium campestre</i>	0.1	+	I	0.2	+	II	0.5	+	V	0.3	+	III	0.2	+	II							2	0
<i>Rumex acetosella</i>	0.1	+	I																			2	0
<i>Thlapsi perfoliatum</i>	0.3	+	III																			2	0
Toxic and harmful plants (F1), (M0)																							
<i>Adonis vernalis</i>										0.3	+	III	0.3	+	III							1	0
<i>Colchicum autumnale</i>																0.1	+	I	0.1	+	I	1	0
<i>Coronilla varia</i>													0.1	+	I	0.1	+	I	0.2	+	II	1	0
<i>Euphorbia cyparissias</i>	0.3	+	III	0.3	+	III	0.3	+3	III	0.1	+	I	0.3	+	III	0.1	+	I	0.4	+	IV	1	0
<i>Euphorbia serrulata</i>													0.4	+	IV							1	0
<i>Hypericum perforatum</i>													0.3	+	III	0.1	+	I	0.1	+	I	1	0
<i>Stellaria graminea</i>				0.2	+	II							0.2	+	II				0.1	+	I	1	0
<i>Verbascum blattaria</i>				0.1	+	I													0.1	+	I	1	0
<i>Verbascum nigrum</i>										0.1	+	I	0.1	+	I				0.1	+	I	1	0
<i>Verbascum phlomoides</i>																0.1	+	I	0.1	+	I	1	0
<i>Verbascum phoenicum</i>	0.2	+	II																			1	0
<i>Verbascum speciosum</i>													0.4	+	IV							1	0

Locations in Bihor County taken into study: 1 - Crișurilor Plain; 2 - Ierului Valley; 3 - Tășnadului Hills; 4 - Middle and lower basin of the Crișul Negru River; 5 - Lăzărenilor Hills; 6 - Pădurea Craiului Mountains; 7 - Codru-Moma Mountains.

Following the analysis of the productive potential of grasslands dominated by *Festuca rupicola* Heuff. in Bihor County, it was found that the highest pastoral values are recorded in grasslands belonging to the *Festucetum rupicolae* association in the Crișul Negru Basin (PV=50.67), whereas the lowest values characterize the grasslands classified within the *Thymo comosi-Festucetum rupicolae* association in the Codru-Moma Mountains (PV=32.4) (Table 4).

Table 4. The productivity of *Festuca rupicola* associations in Bihor County

Location in Bihor County	Association	Pastoral value (PV)	Green biomass production (MV) (t/ha)	Livestock units LU/ha	Season duration (days)
Crișurilor Plain	<i>Festucetum rupicolae</i>	47.95 (average)	9.72	0.81	185
Ierului Valley	<i>Festucetum rupicolae</i>	42.48 (average)	9.15	0.76	185
Tășnadului Hills	<i>Festucetum rupicolae</i>	37.82 (mediocre)	7.56	0.63	185
Middle and lower basin of the Crișul Negru River	<i>Festucetum rupicolae</i>	50.67 (average)	11.80	0.98	185
Lăzărenilor Hills	<i>Festucetum rupicolae</i>	44.07 (average)	9.22	0.77	185
Pădurea Craiului Mountains	<i>Festucetum rupicolae</i>	38.29 (mediocre)	6.51	0.57	175
Codru Moma Mountains	<i>Thymo comosi-Festucetum rupicolae</i>	32.4 (mediocre)	6.07	0.57	165
Average of the value	-	41.95 (average)	8.57	0.73	180

Regarding grazing capacity, the highest values are recorded in the grasslands of the Crișul Negru Basin (0.98 LU/ha), while the lowest

values are found in the grasslands of the Pădurea Craiului Mountains (0.57 LU/ha) and the Codru-Moma Mountains (0.57 LU/ha) (Figure 4).

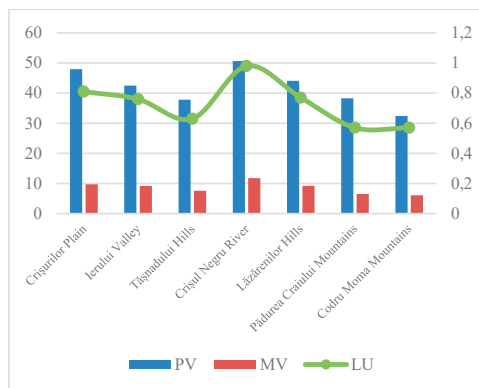


Figure 4. The grazing capacity (LU) of *Festuca rupicola* grasslands in Bihor County, based on pastoral value (PV) and green biomass production (MV).

It can be concluded that the *Festuca rupicola* grasslands in Bihor County exhibit a moderate pastoral value (PV=41.95), associated with an average green biomass production of 8.57 t/ha and a stocking rate of 0.73 LU/ha, for an average grazing period of approximately 180 days.

In order to provide a clearer overview of the productive potential of these grasslands in Bihor County, a comparative analysis was conducted based on similar pastoral studies carried out in nine distinct locations at national level, as

follows: Cașin-Onești Depression (Oituz Basin) (Marușca et al., 2023), Suceava River Basin (Marușca et al., 2022a), Bistrița Vâlcii Basin (Oltenia Region) (Marușca et al., 2025b), Arieș Valley (Apuseni Mountains) (Marușca et al., 2025a), Motru River Basin (Marușca et al., 2024), Orăștie River Basin (Marușca & Vințan, 2022), Timiș River Basin (Marușca & Nicolin), Baraolt Mountains (Marușca et al., 2021), the Mureș Gorge (Marușca et al., 2022b) (Table 5; Figure 5)

The comparative analysis of the data highlights significant variations in pastoral parameters among the studied geographical regions, reflecting differences driven by local ecological conditions, phytocoenotic structure, and the intensity of pastoral use.

Regarding pastoral value (PV), the highest values are recorded in the Suceava River Basin (45.00) and Bihor County (41.95), followed by the Timiș River Basin (39.10) and the Orăștie River Basin (38.80). These regions indicate a superior quality of grasslands, associated with a floristic composition favorable to valuable forage species. At the opposite end of the spectrum, the Mureș Gorge (16.00) and the Bistrița Vâlcii Basin (21.00) exhibit low pastoral values, suggesting a poor quality of the vegetation cover and a high proportion of species with low forage value (Table 5).

Table 5. Comparing the productivity of the *Festuca rupicola* grasslands in Bihor County with some areas of Romania

Geographical region	Pastoral value (PV)	Green biomass production (MV) (t/ha)	Livestock units (LU/ha)	Season duration (days)
Bihor County	41.95	8.57	0.73	180
Casin-Onești Depression (Oituz Basin)	35.40	4.84	0.41	180
Suceava River Basin	45.00	8.16	0.76	165
Basin of Bistrița Vâlcii (Oltenia Area)	21.00	3.20	0.34	145
Arieș Valley (Apuseni Mountains)	31.40	4.94	0.46	165
Basin of Motru River	34.50	4.77	0.46	160
Basin of Orăștie River	38.80	7.75	0.64	185
Basin of Timiș River	39.10	7.43	0.65	175
Baraolt Mountains	38.40	6.07	0.57	165
Mureș Gorge	16.00	2.37	0.22	165

For green biomass production (MV), the same general trends are observed, with maximum values in Bihor County (8.57 t/ha) and the Suceava Basin (8.16 t/ha), as well as comparable values in the Orăștie Basin (7.75 t/ha) and the Timiș Basin (7.43 t/ha). The lowest values are

recorded in the Mureș Gorge (2.37 t/ha) and the Bistrița Vâlcii Basin (3.20 t/ha), indicating a reduced productive capacity of grassland ecosystems in these regions.

Regarding livestock units (LU/ha), the distribution follows a similar pattern, with high values in Suceava Basin (0.76 LU/ha) and Bihor County (0.73 LU/ha), and intermediate values in Timiș Basin (0.65 LU/ha) and Orăștie Basin (0.64 LU/ha). The lowest values are found in the Mureș Gorge (0.22 LU/ha) and the Bistrița Vâlcii Basin (0.34 LU/ha), confirming the productive limitations of these areas (Figure 5).

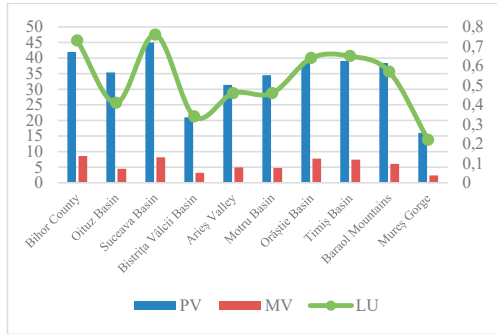


Figure 5. Comparison of the livestock stocking rate associated with *Festuca rupicola* grasslands in Bihor County with other regions of the country, based on pastoral value (PV) and green biomass production (MV).

Grasslands dominated by *Festuca rupicola* Heuff. exhibit significant variations in productivity (biomass yield) from one region to another, differences primarily determined by ecological factors, particularly climatic and edaphic conditions. As a xeromesophilous species, *Festuca rupicola* Heuff. demonstrates a high tolerance to moderate moisture deficit. Consequently, regions characterized by higher annual precipitation levels (500–600 mm) support the accumulation of substantially greater biomass compared with arid areas, where annual precipitation decreases below 400 mm. Maximum productivity levels are recorded on chernozem and humus-rich grey soils, which provide optimal conditions for vegetation development. In contrast, biomass production is significantly reduced on eroded, lithomorphic soils or on rendzinas developed over calcareous substrates. Furthermore, soil texture directly influences water availability: loamy soils, due to their superior water retention capacity, ensure relatively stable yields, whereas sandy or stony

soils intensify drought effects and contribute to reduced plant stature.

CONCLUSIONS

In order to assess the productive potential of grasslands dominated by *Festuca rupicola* Heuff. in Bihor County, two vegetation associations were analyzed, namely *Festucetum rupicolae* Burduja et al. 1956 and *Thymo comosi-Festucetum rupicolae* (Csűrös et Gergely 1959) Pop & Hodişan 1985, identified across seven distinct areas of the county.

These grasslands are distributed from the lowland zone to the lower montane belt, at altitudes ranging between 90 and 800 m, predominantly occurring on slopes with sunny exposures (S, SW, SE), with inclinations varying from 0 to 25°, and developed on a variety of soil types. For the assessment of pastoral value and grazing capacity, a total of 220 species were considered, among which, within the forage-relevant taxa, 25 belong to the *Poaceae* family, 18 to the *Fabaceae* family, and 49 to other botanical families. The *Festuca rupicola* Heuff. grasslands in Bihor County are characterized by a moderate productive potential, reflected by an intermediate pastoral value and grazing capacity, but by a higher green biomass production compared to other analyzed regions.

The internal variability of these parameters, determined by vegetation association type and local ecological conditions, indicates the presence of areas with high productive potential, such as the Crişul Negru Basin, as well as less favorable areas, such as the Codru-Moma and Pădurea Craiului Mountains. At the national level, the grasslands in Bihor County occupy an intermediate position in terms of pastoral value and grazing capacity, while standing out due to their high biomass productivity, which confers them significant importance for pastoral use.

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