

## CONTRIBUTIONS TO THE PRODUCTIVITY ASSESSMENT OF THE IEZER - PĂPUȘA MASSIVE MOUNTAIN GRASSLANDS

Teodor MARUȘCA<sup>1</sup>, Cristina I. PORR<sup>2</sup>, Marcela M. M. DRAGOȘ<sup>3</sup>,  
Cristina C. COMȘIA<sup>4</sup>

**Abstract.** *Mountain grasslands in the subalpine and alpine levels of the Carpathians have been less studied in terms of green mass production (GMP) and pastoral value (PV) due to their isolation and accessibility. In the Iezer - Păpușa massif of the Southern Carpathians, 8 grassland associations belonging to 4 phytosociological alliances, orders and classes were studied, located at an average altitude of 2,075 m (1,600-2,400 m), especially on sunny exposures. The number of cormophyte species averages 26 and the vegetation cover 55% due to stony soil and rain and wind erosion. In these extreme conditions, the average productivity of the grasslands is quite low due to the 21% participation in the grassy carpet of species with fodder value. The average GM production was rated at 1.21 and a PV index of 13 (very poor), which allows a loading of 0.4 LU/ha for a 65-day grazing season with young sheep in particular. The most valuable association is Scorzonero roseae - Festucetum nigrescentis with 3.1 t/ha GM and 23.3 PV index. Productivity data are used to determine optimal grazing capacity, conserve biodiversity and avoid degradation.*

**Keywords:** Iezer-Păpușa massif, alpine and subalpine grasslands, green mass production, pastoral value, grazing capacity

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### 1. Introduction

In the high mountains above the expansion limits of the spruce forest and juniper thickets are extensive areas of perennial grasses on soils with surface rocks.

In these extreme climatic conditions, a primary and secondary grassland vegetation develops, poor in species and with low productivity. Using these areas with sheep, especially young ones, is an ancient practice in the Carpathian Mountains.

In order to better know the grazing capacity, in order to preserve biodiversity and avoid rain and wind erosion through overgrazing, studies were continued on the

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<sup>1</sup>PhD Teodor MARUȘCA, Grassland Research-Development Institute-Brașov, Romania, Full member of the Academy of Romanian Scientists (E-mail: maruscat@yahoo.com).

<sup>2</sup>Eng. Cristina I. PORR, Grassland Research-Development Institute-Brașov, Romania, (E-mail: cristina.porr@pajisti-grassland.ro).

<sup>3</sup>PhD. Marcela M. M. DRAGOȘ, Grassland Research-Development Institute-Brașov, Romania, (E-mail: marcela.dragos@pajisti-grassland.ro)

<sup>4</sup>Eng. Cristina C. COMȘIA, Grassland Research-Development Institute-Brașov, Romania, (E-mail: cristina.comsia@pajisti-grassland.ro).

real productivity of the grasslands from subalpine and alpine floors of the Iezer - Păpușa Massif, a component of the Southern Carpathians.

## 2. Materials and Methods

In order to complete the knowledge on the productivity of subalpine and alpine grasslands, the work "Vegetation of the Iezer - Păpușa Massif, phytocenological study" by Valeriu Alexiu, published in 1998 in Cultura Publishing House, Pitești, was taken into analysis [1].

The overview of grassland associations was as follows:

### CI. *SALICETEA HERBACEAE* Br-BI 1947

Ord. *SALICETALIA HERBACEAE* Br-BI 1926

Orchards and hayfields

#### Al. *Salicion herbaceae* Br-BI 1926

1. As. *Soldanello pusillae* - *Ranunculetum crenati* (Boeza 31), Boșcaiu 1971
2. As. *Poo supinae*-*Cerastietum cerastoidis* (Söry 1954), Oberd 1957
3. As. *Salicetum herbaceae* Br-BI 1913

### CI. *JUNCETEA TRIFIDI* Klika et Hadač 1944

Ord. *CARICETALIA CURVULAE* Br-BI 1926

#### Al. *Caricion curvulae* Br-BI 1925

4. As. *Primulo* - *Caricetum curvulae* Br-BI 1926 em. Oberd 1957
5. As. *Potentillo crysocraspedae* - *Festucetum airoidis* Boșcaiu 1971

### CI. *NARDO - CALLUNETEA* Prsg.1949

Ord. *NARDETALIA* Oberd 1949

#### Al. *Potentillo - Nardion* Simion 1957

6. As. *Scorzonero roseae* - *Festucetum nigrescentis* (Pușcaru et al.1956) Coldea 1987
7. As. *Violo declinatae* - *Nardetum strictae* Simion 1966

### CI. *ARTEMISIETEA VULGARIS* Loh.,Prsg. et Tx 1950

Ord. *GLECHOMETALIA HEDERACEAE* Tx.in Tx.et Brun-Hool 1975

#### Al. *Rumicion alpini* Rübél 1933 1957

8. As. *Senecioni* - *Rumicetum alpini* Horv. 1949 em. Coldea(1986) 1990

The working method for productivity evaluation was based on the floristic surveys showing the participation in the grassy carpet of forage and harmful species using quality and fodder mass indices from the Carpathians upper floors grasslands [2].

Statistical calculations have been extensively presented in other works [3,5] some in the journal annals [4,6,7,9].

### 3. Results and Discussions

For the 8 associations belonging to 4 phytosociological alliances, 75 surveys were carried out (Table 1).

**Table 1.** General data on the season and vegetation of grassland phytocenoses

No.	Association	No. of surveys	Altitude (m)	Exposition	Slope (degree)	Cormophyte (nr)	Cover %
<b>Al. <i>Salicion herbaceae</i></b>							
1	<i>Soldanello pusillae</i> - <i>Ranunculetum crenati</i>	10	2,110 (1,800-2,200)	E, NE, N, SE	37 (10-70)	23	38
2	<i>Poo supinae</i> - <i>Cerastietum cerastoidis</i>	10	1,955 (1700-2300)	E, SE, NE, N, W	13 (0-40)	23	35
3	<i>Salicetum herbaceae</i>	5	2,310 (2,250-2,400)	N, NE	13 (10-20)	15	40
<b>Al. <i>Caricion curvulae</i></b>							
4	<i>Primulo</i> - <i>Caricetum curvulae</i>	10	2,225 (1,800-2,400)	Plane, E, ES, EW	7 (0-15)	20	66
5	<i>Potentillo crysocraspedae</i> - <i>Festucetum airoidis</i>	10	2,210 (1,900-2,400)	Plane, E, SE, N		40	62
<b>Al. <i>Potentillo</i> - <i>Nardion</i></b>							
6	<i>Scorzonero roseae</i> - <i>Festucetum nigrescentis</i>	10	1,990 (1,800-2,200)	Plane, E, SE, S, N	19 (0-30)	28	46
7	<i>Violo declinatae</i> - <i>Nardetum strictae</i>	10	2,105 (1,900-2,300)	Plane, E, SE, N	14 (0-45)	34	67
<b>Al. <i>Rumicion alpine</i></b>							
8	<i>Senecioni</i> - <i>Rumicetum alpini</i>	10	1,700 (1,600-1,850)	SW, NE, N, SE	10 (0-20)	27	85
	<b>TOTAL AVERAGE</b>	<b>75</b>	<b>2,075</b> <b>(1,600-2,400)</b>	<b>All</b>	<b>16 (0--70)</b>	<b>26</b>	<b>55</b>

These phytocenoses are located on average at 2,075 m altitude, from 1,600 to 2,400 m, on sunny exposures and slopes up to 70 degrees, on cliffs.

The average number of cormophytes is 26, the highest in the association *Potentillo crysocraspedae* - *Festucetum airoidis* with 40 species and the lowest in *Salicetum herbaceae* with 15 species.

The average degree of ground cover is very low at only 55% with differences from 35% for *Poo supinae*-*Cerastietum cerastoidis* to 85 for *Senecioni* - *Rumicetum alpini*.

Grasslands at these altitudes have numerous gaps in vegetation caused by the presence of rock fragments and surface erosion.

In these extreme climate and soil conditions, the participation of forage species is barely 21% and harmful ones 34%, finally influencing the average green mass production (GMP) of 1.21 t/ha and the pastoral value (PV) with index 13 (very weak) (Table 2).

**Table 2.** Forage species participation, pastoral value and green mass production of mountain grassland associations

No.	Grassland association	Species participation (%)		Pastoral value		Green mass production	
		Forager	Harmful	ind.	%	t/ha	%
<b>Al. <i>Salicion herbaceae</i></b>							
1	<i>Soldanello pusillae - Ranunculetum crenati</i>	6	32	3.1	24	0.11	9
2	<i>Poo supinae - Cerastietum cerastoidis</i>	1	34	0.3	2	0.02	2
3	<i>Salicetum herbaceae</i>	1	39	0.4	3	0.01	1
<b>Al. <i>Caricion curvulae</i></b>							
4	<i>Primulo - Caricetum curvulae</i>	57	9	31.7	244	1.15	95
5	<i>Potentillo crysocraspedae - Festucetum airoidis</i>	23	39	12.7	98	0.80	66
<b>Al. <i>Potentillo - Nardion</i></b>							
6	<i>Scorzonero roseae - Festucetum nigrescentis</i>	32	14	23.9	184	3.16	261
7	<i>Violo declinatae - Nardetum strictae</i>	11	56	7.1	55	0.30	25
<b>Al. <i>Rumicion alpina</i></b>							
8	<i>Senecioni - Rumicetum alpini</i>	36	49	24.4	188	4.10	339
<b>TOTAL AVERAGE</b>		21	34	13.0	100	1.21	100

The highest productivity was assessed in the *Senecioni - Rumicetum alpini* association, located on lower lands (1,600-1,850 m), excessively fertilized by plowing, with 4.1 t/ha and 24.4 PV index, followed by *Scorzonero roseae - Festucetum nigrescentis* with 3.16 t/ha GM and 23.9 PV index located at higher altitude (1,800-2,200 m) under normal conditions without fertilization.

The lowest productivity was assessed in the associations of the *Salicion heraceae* alliance located on average at 1,950-2,400 m altitude with 0.02 - 0.11 t/ha GM and 0.3 - 0.32 PV index, extremely low.

Finally, the average support capacity (optimal load with animals) of these grasslands was established, which is 0.4 LU/ha for an average period of 65 days of the grazing season (Table 3).

**Table 3.** Grazing season duration and animal loading at phytosociological alliance (habitat) level

Alliance	Average pastoral value (ind)	Average green mass production (t/ha)	Optimal grazing season (days)	Optimal loading LU/ha	
				LU/ha	%
<i>Salicion herbaceae</i>	1.3	0.05	55	0.01	3
<i>Caricion curvulae</i>	22.2	0.98	55	0.27	68
<i>Potentillo - Nardion</i>	15.5	1.70	60	0.43	108
<i>Rumicion alpine</i>	24.4	4.10	85	0.74	185
<b>AVERAGE</b>	15.8	1.71	65	0.40	100

The lowest, virtually non-existent animal load of 0.01 LU/ha was evaluated in *Salicion herbaceae* alliance and the highest of 0.74 LU/ha in *Rumicion alpine* due to organic fertilization by excess animal folding.

Similar results were also achieved in the first approximation regarding the productivity of mountain grasslands in the alpine subalpine floors [8].

For example, on average in the *Potentillo - Nardion* alliance from Rărau, Făgăraș, Bucegi and Vlădeasa, the PV index of 18.9 is slightly higher than the area under study and the production was 1.70 t/ha GM identical to that of *Iezer - Păpușa*, which allows a load of 0.35 LU/ha in 75 days compared to 0.43 LU/ha in 60 days optimal grazing season.

## Conclusions

- (1) The alpine and subalpine grasslands of the *Iezer - Păpușa* massif have a very low productivity.
- (2) The average production of green fodder mass was evaluated at 1.21 t/ha and the pastoral value index of 13, which allow a loading of 0.4 LU/ha in 65 days of grazing with especially young sheep.
- (3) Knowing and respecting grazing capacity is mandatory for the conservation of biodiversity and the protection against erosion of these fragile practical ecosystems.

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