PRELIMINARY RESEARCH CONCERNING THE CARRYING CAPACITY OF THE GRASSLANDS FROM BUILA-VÂNTURARIŢA MOUNTAINS

NEBLEA Monica

Abstract. The analysis of the vegetal layer of grasslands is very important for understanding and explaining the changes that occur under the influence of the natural factors and the works to improve their quality and uses. In this paper, there are presented the results of the research concerning grazing capacity of the grasslands from Buila-Vânturariţa Massif.

Keywords: grasslands, Buila-Vânturariţa Mountains, anthropozoogenic impact.

Rezumat. Cercetări preliminare privind capacitatea de suport a pajiştilor din Munţii Buila-Vânturariţa. Analiza covorului vegetal al pajiştilor este deosebit de importantă pentru cunoaşterea şi explicarea modificărilor care se produc în structura vegetaţiei sub influenţa factorilor naturali, a lucrărilor de îmbunătăţire a calităţii şi a modului lor de utilizare. În lucrarea de faţă sunt prezentate rezultatele cercetărilor privind capacitatea de suport a pajiştilor din Masivul Buila-Vânturariţa.

Cuvinte cheie: pajişti, Munţii Buila-Vânturariţa, impact antropozoogen.

INTRODUCTION

Buila-Vânturariţa Massif is part of the Căpăţânii Mountains, situated between the Bistriţa and the Olăneşti river valleys and descends as steep slopes up to Oltenia sub-Carpathian Depression (Fig. 1). The main ridge with a length of 14 km has a unitary character only between Costeşti Gorges and Cheia Gorges. The rest of the area is split by the rivers in two massifs: Arnota (south-west) and Stogu (north-east). The ridge has an steep aspect, only on small areas displaying gentle slopes. The soils on which vegetate the grasslands from Buila Vânturariţa Mountains are rendzina lythosoils and mollic eutricambosoils developed on limestones (BUIA & PĂUN, 1956).

The largest areas occupied by pastures present two types of habitats, one of them being of community importance: 6230 * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe) and 6520 Mountain hay meadows (GAFTA & MOUNTFORD, 2008).

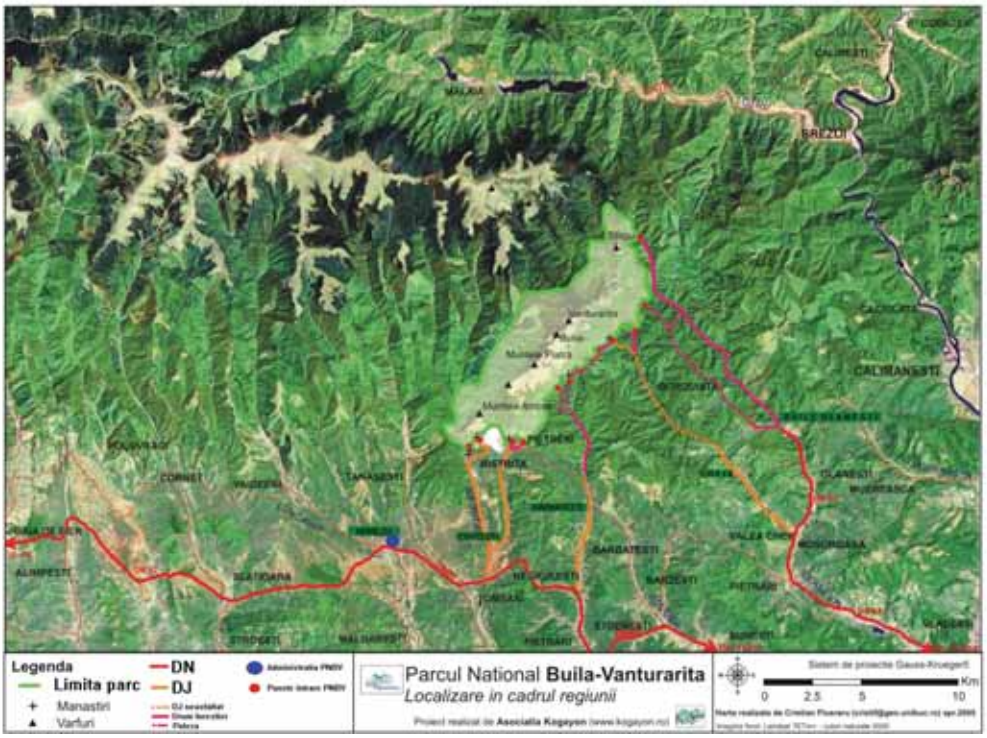

Figure 1. Buila-Vânturariţa Massif Map (http://www.buila.ro/index.pl/harta_turistica_ro).
Figura 1. Harta Masivului Buila-Vânturariţa (http://www.buila.ro/index.pl/harta_turistica_ro).

MATERIAL AND METHODS

The grasslands diagnosis from Buila-Vânturariţa Mountains was based on geobotanical methods that give us the possibility to calculate important parameters for rational use of the pastures (pastoral value and grazing capacity).

Thus, there were established and crossed the following routes: Pietreni-Cacova Grassland, Cacova Grassland-Din Dos Sheepfold – Din Dos Grassland, Cheia Chalet-Curmătura Oale Grassland, Cheia Chalet-Arnota Grassland.

In this way, for each studied pasture there were achieved surveys, according to methodology of the Central-European Floristic School. Considering the phytocoenoses limits in accordance with ecological factors we chose samples of about 100 m^2 for each area. As part of the survey there were inventoried plant species, which were given grades of abundance-dominance, according to Braun-Blanquet scale.

The surveys were included in the synthetic phytocoenological tables, from which we determined the pastoral value for estimating the agricultural value of the grasslands (production and quality). Because we used the geobotanical method for to characterize grasslands vegetation, the pastoral value formula was:

$$Vp = \frac{\sum A \bullet Is}{100}$$, Vp=pastoral value; A= the coverage of the species (%);

Is=specific index of quality (index of fodder value).

We calculated the grazing capacity for each grassland on the basis of pastoral value index, in other terms the number of animals that can feed on one hectare of pasture during a grazing period. In this case, the formula for the grazing capacity was:

Cp=Vp x 0.4(0.6) (UVM/ha); Cp=grazing capacity; Vp=pastoral value.

The number of animals per species and category, corresponding to the grazing capacity expressed in UVM was established by transformation on the basis of coefficients MARUŞCA (2006) (Table 1). Livestock units (UVM) represent the load or number of animals per one hectare of pasture and are given by the production of green fodder per hectare and the green fodder needs of an animal, per day or a period.

The characterization of the grasslands vegetation from Buila-Vânturariţa Mountains was made up according to the information from the literature: BĂRBULESCU & MOTCĂ (1983), CIOCÂRLAN (2009), DONIŢĂ *et al*. (2005), GEAMĂNU (2000), KOVACS (1979), IONESCU (1997), MARUŞCA (2006), PUŞCARU *et al*. (1956).

Table 1. The transformation coefficient of the different species and animal categories in UVM.
Tabel 1. Coeficientul de transformare a diferitelor specii şi categorii de animale în UVM.

Animal category	Transformation coefficient in UVM	Number of animals for 1 UVM
Bulls	1.0-1.2	0.8-1.0
Dairy cows	1.0	1.0
Cattles (different ages)	0.7-0.8	1.3-1.4
Young bovines > 1 year	0.5-0.7	1.4-2.0
Young bovines < 1 year	0.2-0.3	3.3-5.0
Sheep and goats (different ages)	0.14	7.1
Sheep and goats (adult)	0.15-0.16	6.3-6.7
Horses (different ages)	0.8	1.3
Traction horses	1.0-1.1	0.9-1.0
Youth equine > 1 an	0.5-0.7	1.4-2.0
Youth equine < 1 an	0.2-0.3	3.3-5.0

Table 2. Assessment of pasture productivity and quality in accordance with pastoral value (Vp) GEAMĂNU (2000).
Tabel 2. Aprecierea producţiei şi calităţii pajiştilor pe baza indicelui de valoare pastorală (Vp) GEAMĂNU (2000).

Pastoral value (Vp) evaluated through the specific coverage	Grazing capacity (Cp) – UVM/ha	Pasture classifying
3.75-5.00	>2-3	Very good
2.50-3.75	1-2	Good
1.25-2.50	0.5-1	Average
0.25-1.25	0.2-0.5	Poor
<0.25	<0.2	Degraded

RESULTS AND DISCUSSIONS

The phytocoenological investigation of the grasslands from Buila-Vânturariţa Mountains has been made in August 2011. Preliminary research in grasslands from Buila-Vânturariţa Mountains revealed that the phytocoenoses from subalpine and alpine level are integrated in the *Festuco rubrae-Agrostietum capillaris* HORVAT 1951 subas. *nardetosum strictae* POP 1976. The coenoses from upper mountainous level belong to the *Festuco rubrae-Agrostietum capillaris* HORVAT 1951.

Cacova Grassland

The effected surveys in this grassland have emphasized a high floristic diversity (species with different coenotic characteristics), because of an irrational grazing. The edifying species is *Festuca rubra* which realizes a coverage of 40% (Table 3). In this area there have been identified two sheepfolds of cattle, with about 70 dairy cows.

The overgrazing has led to weeding, in some areas, with *Veratrum album, Urtica dioica, Rumex alpinus*. These species reduce high production. On other surfaces, due to uncontrolled grazing, it was edified, in time, *Trifolium repens* facies.

Overgrazing is the initial process leading to land degradation; besides the modification of layer composition, we found an increased erosion of the slopes (Fig. 2). Large areas from Cacova grassland are covered with mounds, on which unworthy vegetation develops, uneaten by animals (Fig. 3). These are both of vegetal origin (due to accumulation of uneaten and undecomposed organic matter) and animal origin (formed by ants or moles). Their formation was favoured by movements of the animals on certain routes, during wet weather. We recommend the destruction of mounds, in summer or autumn, where there is no precipitation, for improving the fodder quality. The resulted material will be spread on grassland, and free spaces will be sown with *Festuca rubra*. It is necessary to apply chemical fertilizers with phosphorus and nitrogen.

The pastoral value is medium with an index of 2.2. The vegetation coverage is about 70%. The grazing capacity in Cacova grassland is between 0.88 and 1.32 UVM/ha, which means that grazing capacity is 160-240 UVM/182 ha. Thus, on the entire surface of Cacova grassland there can fed 160-240 dairy cows, 1136-1704 sheep and goats of different ages, respectively 208-312 horses of all ages.

Din Dos Grassland

The phytocoenoses with *Festuca rubra* from Din Dos grassland vegetate at 1590 m altitude, on slopes with inclination degree of $30\text{-}50^0$ (Fig. 4). The vegetal layer is dominated by *Festuca rubra*; there are also other species with good and very good fodder value, such us: *Festuca pratensis, Agrostis capillaris, Trifolium repens, Lotus corniculatus, Trifolium pratense* (Table 3). In this area *Campanula serrata* vegetates, an important species mentioned both in Annex IIb of the Habitats Directive 92/43/EEC and in Annex 3b of the OUG nr. 57/2007.

On area of about 1 ha from Din Dos grassland, it functioned, in previous years, a sheepfold, currently represented by two abandoned buildings (Fig. 5). The initial phytocoenoses with *Festuca rubra* and *Agrostis capillaris* were maintained on a small surface, of about 200 m^2, in the westernmost, at 1445 m altitude, on slopes of 10^0 (Table 3).

Figure 2. Erosion Cacova grassland.
Figura 2. Eroziune în păşunea Cacova (original).

Figure 3. Mounds in Cacova grassland.
Figura 3. Muşuroaie în păşunea Cacova (original).

Figure 4. Din Dos grassland.
Figura 4. Pajiştea Din Dos (original).

Figure 5. Degraded grassland (Din Dos sheepfold.
Figura 5. Pajişte degradată (Stâna Din Dos) (original).

The animals stationing for a long time caused the degradation of the grassland habitat by increasing organic matter loading. Now, most of the grassland (0.5 ha) is covered with nitrophilous weeds: *Urtica dioica, Veratrum album, Rumex alpinum*. We recommend weeding, cutting and repeated mowing of the weed, before seeds formation for

improving the fodder quality of this surface. It is also necessary grubbing and establishment of temporary meadows. The quality improvement requires fertilization, amendment and overseeding works. If not taken appropriate measures to restore this grassland, due to small surfaces, in time, it is possible to be assimilated by nearby forestry ecosystem. In this area we remarked vigorous individuals of *Picea abies* and *Fagus sylvatica*.

The pastoral value of Din Dos grassland is 2.68 on an area of 9 ha, and grazing capacity is 1.072-1.608 UVM/ha. The lowest pastoral value, due to an advanced stage of degradation favoured by the extension of the nitrophilous weeds, is 1.07 on a surface about 1 ha. In this case, the grazing capacity is 0.428-0.642 UVM/ha.

Thus, on the entire surface of Din Dos grassland (about 10 ha), the pastoral value is 2.51, and grazing capacity is 10-15 UVM/10 ha. We considered that this grassland can support about 71-107 sheep, respectively 13-20 cows of different ages.

Curmătura Oale Grassland

The vegetal groupings with *Festuca rubra* and *Agrostis capillaris* from Curmătura Oale grassland are installed at 1594-1621 m altitude, on slopes with north-eastern exposure and inclination degree of $30\text{-}60^0$. In the present, these phytocoenoses from boreal level function as wooded grasslands (Fig. 6). Approximately 20% of their surface is covered with *Picea abies* and *Juniperus communis* (Table 3). Obviously, these grasslands will develop to spruce forests, either directly, or through *Juniperus* communities. The conservative importance of this habitat is shown by the presence of the *Gentiana lutea*, species of community interest, mentioned in Annex Vb of the Habitats Directive 92/43/EEC.

The pastoral value of this grassland is 1.26 and grazing capacity of about 0.504-0.756 UVM/ha. This means that 3 ha of wooded grassland can support 2 UVM, respectively 14 sheep and 3 cows of different ages.

Arnota Grassland

The mesophilous grasslands have been identified near the monastery Arnota, which are installed on slopes with different degrees of inclination, northern or eastern exposure, at 950 m altitude. These vegetate on brown forest or brown podzolic soils, rich in humus and nitrogen, with acid reaction.

The *Agrostis capillaris* is a dominant species in the coenoses from Arnota, unlike of these in the subalpine and alpine level (Cacova, Din Dos, Curmătura Oale grasslands), the greatest abundance-dominance is realized by *Festuca rubra* (Table 3). Characteristic for these groupings are the cormophytes from *Artemisietea* class, which are arranged in groups (*Carduus acanthoides*), which emphasize a significant anthropozoogenic influence. The overgrazing from this lawn, led, in time, both to soil denudation in certain areas and the appearance of erosion along the slopes (Fig. 7).

Currently, the Arnota grassland functions as a grassland invaded by shrubs. The main species of trees and shrubs are: *Rosa canina, Crataegus monogyna, Acer pseudoplatanus, Fagus sylvatica, Carpinus betulus*. Ideally, this habitat may evolve to a forest, either hornbeam-beech forest or pure beech forest. In this moment, in Arnota grassland there are two seasonal buildings of animal careers. The animals are represented by two flocks of sheep (about 250 individuals), one of goats (approximately 30 individuals) and one of cows (30 individuals).

The pastoral value is 1.25, that indicates a grassland with medium fodder value, which evolves to mediocre. The vegetation coverage is 90%, the rest being represented by rocks or denuded land due to overgrazing.

The grazing capacity is 0.5-0.75 UVM/ha. Thus, it is possible a full load of 22–32 UVM/43 ha, about 156-227 sheep and goats of all ages, respectively 29-42 cows. Given the animal load observed in the fields, currently it is exceeded the carrying capacity of the Arnota grassland.

Figure 6. Curmătura Oale grassland.
Figura 6. Pajiştea Curmătura Oale (original).

Figure 7. Arnota grassland.
Figura 7. Pajiştea Arnota (original).

CONCLUSIONS

The studied grasslands occupy 238 ha in the area of Buila-Vânturariţa Mountains, that are able to maintain of 194-289 UVM, which corresponds to the grazing capacity of 0.815-1.214 UVM/ha. The adequate measures to improve the quality of grasslands take into account the ecological peculiarities of each station, floristic composition and soil characteristics. It is also necessary to observe the grazing period, which according to literature recommendations will be triggered when plants have 15-20 cm high, like in natural grasslands MARUŞCA (2006). The end of the grazing period coincides with the second decade of October; in winter (until March) the grasslands come to rest for recovery of vegetal layer.

ACKNOLEDGEMENTS

The research reported in this paper was financed by the project SOP-Environment **Studies concerning the grazing impact on grasslands biodiversity.**

REFERENCES

BĂRBULESCU C. & MOTCĂ GH. 1983. *Păşunile munţilor înalţi*. Edit. Ceres. Bucureşti. 245 pp.

BUIA AL. & PĂUN M. 1956. *Materiale pentru flora Muntelui Buila, raionul Vâlcea, regiunea Piteşti*. Studii şi Cercetări de Biologie. Edit. Academiei R.P.R. filiala Cluj. **7**(1-4): 85-105.

CIOCÂRLAN V. 2009. *Flora ilustrată a României, Pteridophyta et Spermatophyta*. Edit. Ceres. Bucureşti. 1141 pp.

DONIŢĂ N., POPESCU A., COMĂNESCU PAUCĂ MIHAELA, MIHĂILESCU SIMONA, BIRIŞ I. A. 2005. *Habitatele din România*. Edit. Tehnică Silvică. Bucureşti. 496 pp.

GAFTA D. & MOUNTFORD O. (coord.). 2008. *Manual de interpretare a habitatelor Natura 2000 din România*. Edit. „Risoprint". Cluj-Napoca. 101 pp.

GEAMĂNU LIDIA. 2000. *Cultura pajiştilor şi a plantelor furajere. Lucrări practice*. Atelierul de multiplicat cursuri. USAMV Bucureşti. 229 pp.

KOVACS A. 1979. *Indici biologici, ecologici şi economici ai florei pajiştilor*. Centrul de material didactic şi propagandă agricolă. Bucureşti. 51 pp.

IONESCU I. 1997. *Cultura pajiştilor şi a plantelor furajere*. Reprografia Universităţii din Craiova. 344 pp.

MARUŞCA T. 2006. *Îndrumar metodologic de gospodărire ecologică a pajiştilor în ariile protejate*. ASAS Gheorghe Ionescu Siseşti-ICDP. Braşov. 150 pp.

PUŞCARU D., PUŞCARU EVDOCHIA, PAUCĂ ANA, ŞERBĂNESCU I., BELDIE AL., ŞTEFUREAC TR., CERNESCU N., SAGHIN F., CREŢU V., LUPAN L., TASCENCO V. 1956. *Păşunile alpine din Munţii Bucegi*. Edit. Academiei R.P.R. Bucureşti. 512 pp.

*** *Ordonanţa de Urgenţă nr. 57 din 20 iunie 2007 privind regimul ariilor naturale protejate, conservarea habitatelor naturale, a florei şi a faunei sălbatice*. Anexa 3b. Monitorul Oficial al României, nr. 442/29 iunie 2007. Bucureşti.

*** http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm (accessed: February 29, 2012).

*** http://www.buila.ro/index.pl/harta_turistica_ro (accessed: February 29, 2012).

Neblea Monica
University of Piteşti
Tg. Vale Str., No. 110040, Piteşti, Romania
E-mail: monica_neb@yahoo.com

Received: March 23, 2012
Accepted: June 22, 2012

Table 3. Pastoral value of the grasslands from Buila-Vânturariţa Mountains.
Tabel 3.Valoarea pastorală a pajiştilor din Munţii Buila-Vânturariţa.

Cacova Grassland		**Din Dos Grassland**				**Curmătura Oale Grassland**		**Arnota Grassland**	
Festuco rubrae-Agrostietum capillaris HORVAT 1951 subas. *nardetosum strictae* POP 1976 (surface 182 ha)		*Festuco rubrae-Agrostietum capillaris* HORVAT 1951 subas. *nardetosum strictae* POP 1976 (surface 9 ha)		*Festuco rubrae-Agrostietum capillaris* HORVAT 1951 subas. *nardetosum strictae* POP 1976 (surface 1 ha)		*Festuco rubrae-Agrostietum capillaris* HORVAT 1951 subas. *nardetosum strictae* POP 1976 (surface 3 ha)		*Festuco rubrae-Agrostietum capillaris* HORVAT 1951 (surface 43 ha)	
Dominant species	**Specific coverage (%)**	**Dominant species**	**Specific coverage (%)**	**Dominant species**	**Specific coverage (%)**	**Dominant species**	**Specific coverage (%)**	**Dominant species**	**Specific coverage (%)**
Festuca rubra	40	*Festuca rubra*	55	*Festuca rubra*	15	*Festuca rubra*	30	*Festuca rubra*	10
Agrostis capillaris	10	*Agrostis capillaris*	10	*Agrostis capillaris*	10	*Agrostis capillaris*	5	*Agrostis capillaris*	20
Abundant species		*Festuca pratensis*	10	*Urtica dioica*	40	**Abundant species**		*Crataegus monogyna* juv.	15
Trifolium repens	8	**Abundant species**		**Abundant species**		*Leontodon hispidus*	10	*Rosa canina* juv.	15
Hieracium pilosella	5	*Festuca ovina*	5	*Rumex alpinus*	7	*Juniperus communis*	10	**Abundant species**	
Trifolium pratense	4	*Phleum alpinum*	4	*Alchemilla xanthochlora*	5	*Picea abies* juv.	10	*Carduus acanthoides*	6
Thymus pulegioides	3	*Luzula sudetica*	3	*Picea abies* juv.	5	*Luzula luzuloides*	5	*Trifolium repens*	3
Lotus corniculatus	3	*Anthoxanthum odoratum*	2	*Veratrum album*	2	*Scabiosa lucida*	5	*Bellis perennis*	3
Primula elatior	3	*Carlina acaulis*	2	*Achillea millefolium*	2	*Primula elatior*	5	*Leontodon autumnalis*	3
Antennaria dioica	3	*Alchemilla xanthochlora*	2	*Leucanthemum vulgare*	2	*Hypericum maculatum*	2	*Medicago minima*	2
Nardus stricta	3	*Festuca picta*	2	*Trifolium pratense*	2	*Achillea millefolium*	2	*Plantago lanceolata*	2
Ranunculus nemorosus	3	*Hieracium pilosella*	1	*Leontodon hispidus*	2	*Carlina acaulis*	2	*Potentilla argentea*	2
Verbascum lychnitis	3	*Antennaria dioica*	1	*Primula elatior*	2	*Silene nutans* ssp. *dubia*	2	*Thymus pannonicus*	2
Carlina acaulis	2	*Veratrum album*	1	*Antennaria dioica*	2	*Nardus stricta*	2	*Origanum vulgare*	2
Medicago minima	2	*Nardus stricta*	1	*Ranunculus nemorosus*	1	*Origanum vulgare*	2	*Prunella vulgaris*	2
Cerastium arvense	2	*Carum carvi*	1	*Trifolium repens*	1	*Aconitum tauricum*	2	*Helleborus purpurascens*	2
Achillea millefolium	1	**Pastoral value: 2.68**	**Good**	*Bellis perennis*	1	*Achillea distans*	2	*Mentha longifolia*	2
Alchemilla xanthochlora	1	**Coenotic integration**	***Cynosurion***	*Veronica chamaedrys*	1	*Festuca pratensis*	1	*Taraxacum officinale*	1
Bromus barcensis	1			**Pastoral value: 1.07**	**Poor**	*Alchemilla xanthochlora*	1	*Achillea millefolium*	1
Alyssum repens	1			**Coenotic integration**	***Cynosurion***	*Carex vulpina*	1	*Trifolium pratense*	1
Myosotis micrantha	1					*Delphinium elatum*	1	*Verbascum phlomoides*	1
Minuartia verna	1					**Pastoral value: 1.26**	**Average**	*Artemisia absinthium*	1
Pastoral value: 2.2	**Average**					**Coenotic integration**	***Cynosurion***	*Geranium sanguineum*	1
Coenotic integration	***Cynosurion***							*Rumex acetosella*	1
								Cruciata laevipes	1
								Anthoxanthum odoratum	1
								Pastoral value: 1.25	**Average-Poor**
								Coenotic integration	***Cynosurion***