QUANTIFICATION OF HIGH NATURAL VALUE GRASSLANDS IN THE ROMANIAN BANAT, A NORMATIVE AND PRACTICAL TOOL FOR BIODIVERSITY PROTECTION

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Abstract. *The importance of biodiversity conservation, and also the underlining of the support mechanisms in the sustainable development of the Romanian rural area were the two premises in the elaboration of the present study. Consequently, its purpose was, in the first stage, the identification and quantification of High Natural Value grasslands and in the second stage, their multicriteria analysis, in accordance with other environmental factors. The area analyzed in the present paper is superimposed on the Romanian Banat, consisting of 199 administrative - territorial units, from five counties, totally or partially included (Timiş, Caraş-Severin, Arad, Mehedinţi and Hunedoara); historical-geographical and administrative criterion were considered for the delimitation of the study area. The working methodology comprises five stages: delimiting the area of interest, identifying the grassland surfaces, identifying the administrative-territorial units with High Natural Value lands, identifying the High Natural Value grasslands and finally, the regional, multicriteria analysis of the High Natural Value grasslands. Statistical analysis, interpretation of results and generation of cartographic materials was done by techniques and methods specific to Geographic Information Systems. The researches have shown that: in the territory of 46.23% of the ATUs from Banat we may find HNV lands, areas characterized by a high degree of biodiversity; from the total area of the Banat grasslands, 61% are HNV grasslands; the HNV grasslands represent 53.23% of the mountain area, although in their case the degree of biodiversity is very high, a series of physical-geographical factors (relief, climate) act upon them and become economic and organizational restrictions. Out of the total area of HNV grasslands, 40.98% are "unrestricted", located in areas with favorable physical-geographical conditions, in hilly or high plains and can be considered "balanced" with both high biodiversity and optimal conditions of exploitation and recovery. The largest areas are located in the administrative territories Fârliug, Oraviţa, Bogda, Secaş etc.*

Keywords: *grasslands, High Natural Value, biodiversity, funding, Banat*

INTRODUCTION

Climate change, change of river streams and hydrological regime, intensification of agriculture and change of land use constitute as stress factors on the capacity of ecosystems to provide essential services to society (MOONEY, H , 2019). These changes are also felt at the level of biodiversity, with profound consequences on the services that people obtain from ecosystems (CHAPIN, F.S, 2000)

In order to estimate the senses in which the biodiversity changes occur, the affected components and the effects produced in time and space, assessments and scenarios that take into account different parameters such as carbon dioxide, climate indicators, vegetation and land use, but also the known sensitivity of biodiversity to the variation of these parameters are considered. One of the "calculated" scenarios up to 2100 shows that for terrestrial ecosystems, the change in land use will have the greatest effect, followed by climate change, nitrogen deposition, biotic exchange and increased carbon dioxide concentration (SALA, O.E, 2000).

Scientific research in the field of biodiversity has shown that the multifunctionality of the ecosystem requires a greater number of species. Thus, with the increase of the number of ecosystem processes, a greater number of species affects the general functioning (HECTOR, A., 2007). In general, communities with a greater diversity of species and functional groups are more productive and effectively utilize resources such as light, nitrogen, but also space, respectively, presenting a higher degree of vegetation cover (SPEHN, E., 2005).

In another context, the hypothesis that biodiversity improves predictability and productivity in terrestrial ecosystems is scientifically supported (MCGRADY-STEED, JILL,1997) .

Given the importance of biodiversity conservation, at all hierarchical levels, strategies, political instruments, norms and agreements have been developed, implemented both as general standards and as targeted, depending on the regional needs.

In the European Union (EU), the Common Agricultural Policy (CAP), through different instruments, supports and stimulates the actions of biodiversity conservation, and in Romania, the National Rural Development Program (PNDR) 2014-2020, follows both the protection of biodiversity and implicitly the evolution towards a sustainable agriculture, the increase of life quality and overall a sustainable development of the rural area (BURJA, CAMELIA, 2014).

The Measure 10 Agro-environment and climate from PNDR (2014 - 2020) describes and establishes the High Natural Value (HNV) lands at the level of Romania, by administrative-territorial units (ATU).

According to the European Environment Agency, the concept of agricultural land with High Natural Value links the biodiversity and to the continuation of agriculture on certain types of land, but also to the maintenance of specific agricultural systems, lands on which an extensive agricultural system is practiced (ÖLLERER, K. 2014)

The HNV land category includes also grasslands, if their biodiversity level is extremely high, if they are grafted on "healthy" soils, have a large number of wild species and an extensive agriculture is practiced of them (Life Viva Grass, 2019).

The importance of biodiversity conservation, and also the underlining of the support mechanisms in the sustainable development of the Romanian rural area were the two premises in the elaboration of the present study. Consequently, its purpose was, in the first stage, the identification and quantification of HNV, and in the second stage, their multicriteria analysis, in accordance with other environmental factors.

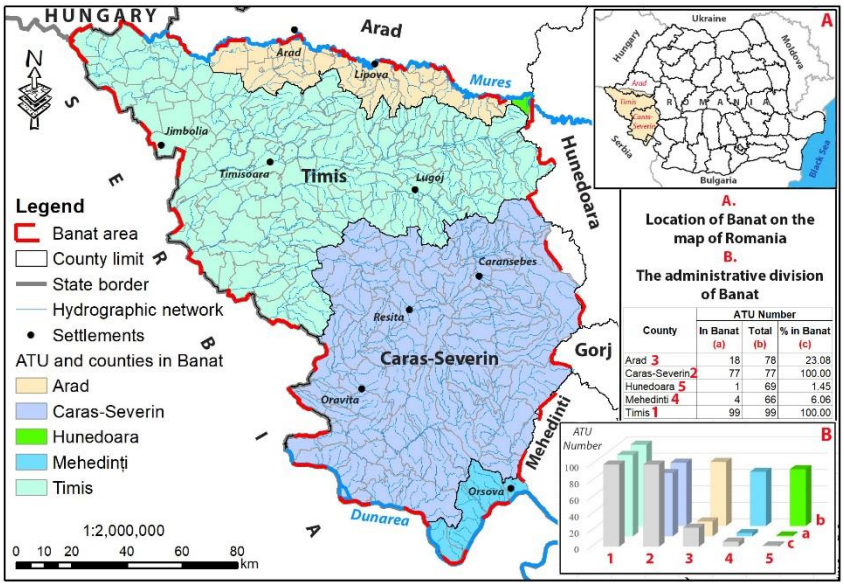
The present study can be considered a methodological "pattern" considering that the final result was the localization of the HNV grasslands, not only the representation of the ATUs where they are, according to the PNDR (2014 – 2020).

MATERIALS AND METHODS

1. Study area

Historical-geographical and administrative criterion were considered for the delimitation of the study area. Thus, the Romanian Banat includes 199 ATUs and as it is printed in the popular conceptions, it is identified, for the most part, with the counties of Timiş (in full) and Caraş-Severin (except the Băuţar commune, partially included). Although Arad County is part of Crisana, the communes South of Mures are considered part of Banat (Figure 1).

Banat also includes, partially, ATU Zam from Hunedoara County and the administrative territories of Orşova, Dubova, Eşelniţa and Sviniţa from Western Mehedinţi County (Figure 1).



County	ATU Number In Banat (a)	Total (b)	% in Banat (c)
Arad 3	18	78	23.08
Caras-Severin 2	77	77	100.00
Hunedoara 5	1	69	1.45
Mehedinti 4	4	66	6.06
Timis 1	99	99	100.00

Figure 1 Delimitation of the study area
(processing after [11, 1, 8, 6])

Considering that in the present study, besides the physical-geographical criterion the administrative criterion was applied, the total area of the Banat (calculated by summing the surfaces of the component ATUs) is 1900862.36 ha (19008.62 km^2).

2. Work methodology

The research methods and materials used are schematically shown in Figure 2.

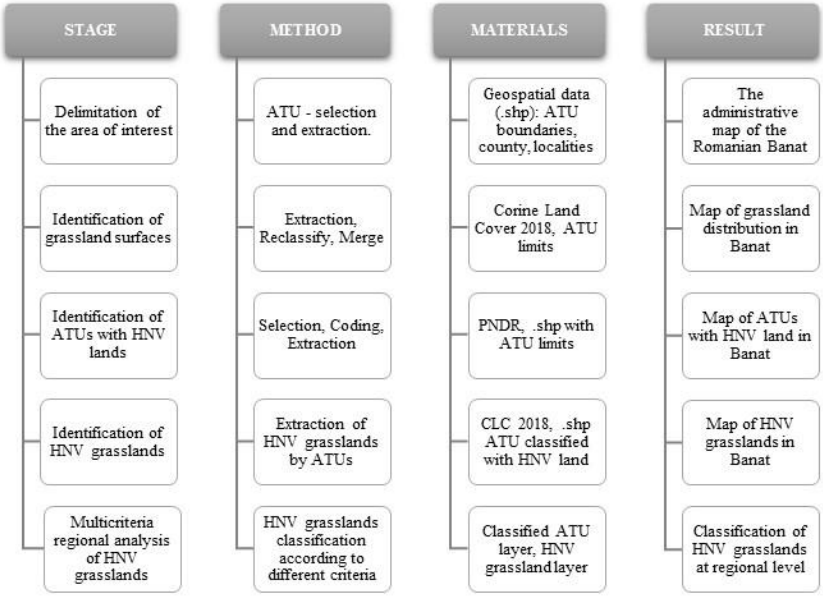


Figure 2 Work methodology

As each stage of work is constituted as a result of the researches, the detailed description will be made in the section "Results and Discussions".

The processing of geospatial data and information, as well as the generation of cartographic materials was done with ArcGIS 10.6.1 software.

RESULTS AND DISCUSSIONS

1. Identification of grassland surfaces

Spatial representation of grasslands in the study area (Figure 3) started with the Corine Land Cover database, 2018 edition. We extracted the areas classified as: secondary grasslands (code CLC 231), natural grasslands (code CLC 321), partially mainly agricultural land with significant areas of natural vegetation (code CLC 243), land covered with shrub vegetation (code CLC 322, 324) and areas with reduced vegetation, specific to mountain gaps (code CLC 333). The geometry of the plots was verified and validated with orthophotoplanes and cadastral maps, and where required, spatial "adjustments" were made.

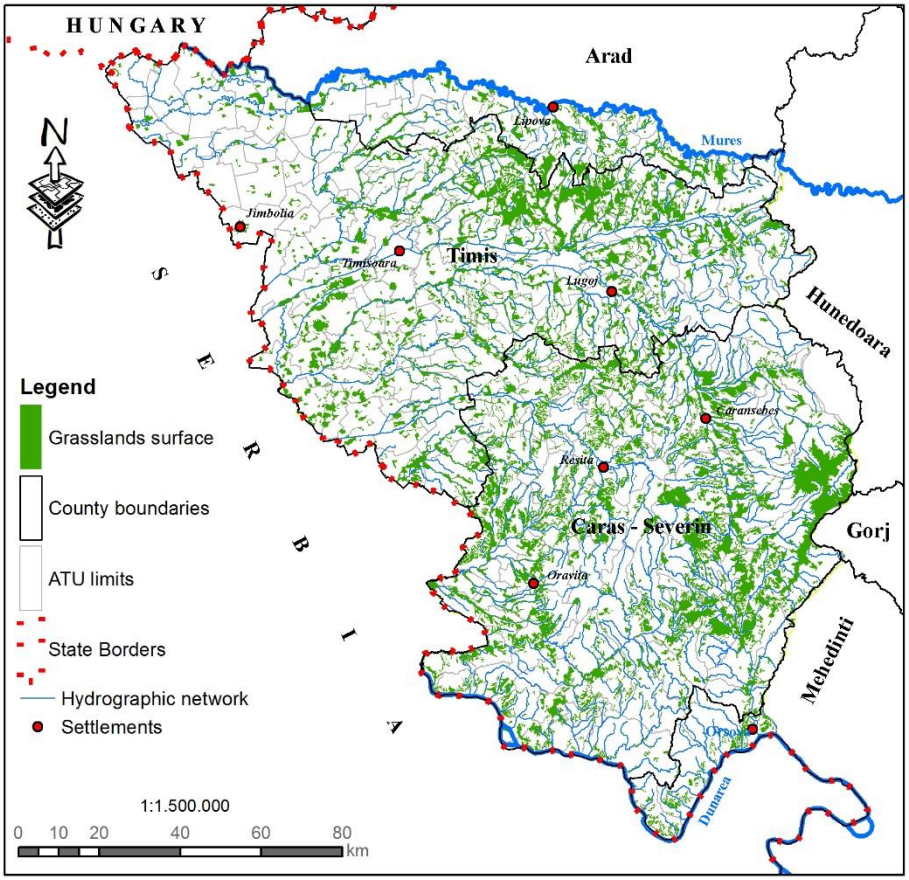


Figure 3 Grassland surfaces in Banat territory
(processing after [1, 8, 5])

After the selection, we obtained 2502 grassland units (grasslands, hayfields, woodland pastures) with an area of between 0.04 - 6983.29 ha and the total area of 339,900.24 ha (Figure

3), representing 17.88% of the entire Banat. The figures obtained in this study may show slight differences from previous research [10], on the one hand, due to the delimitation of the Banat territory, and on the other, due to the use of the Corine Land Cover database in another edition.

According to Figure 3, the grasslands are present in all units and relief forms, with a higher concentration in the Northeast and East of Banat, in the hill and mountain areas.

2. Lands with High Natural Value in Banat

For the identification of the lands with High Natural Value, the PNDR 2014 - 2020 was taken into consideration, and establishes the ATUs where these lands are located (Figure 4): of the 199 communes, 92 ATUs (46.23%) falls into this category.

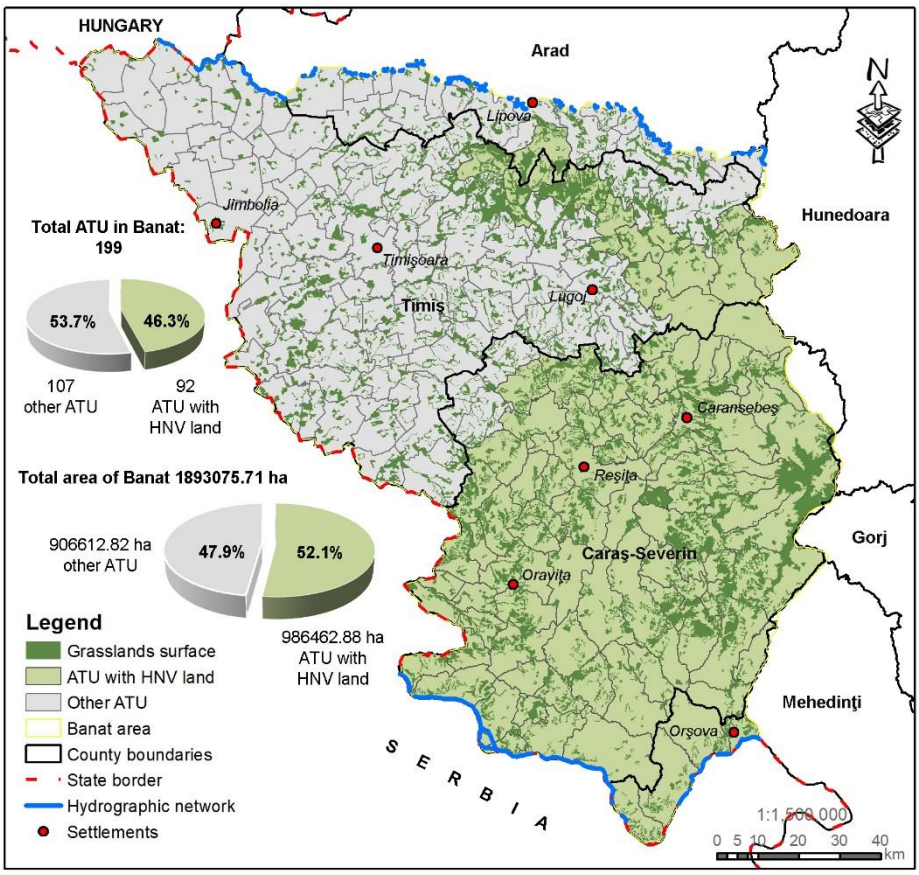


Figure 4 Lands with High Natural Value in Banat
(processing after [1, 8, 17, 5])

According to PNDR (2014-2020), in all ATUs in the South and Northeast of Banat, agricultural lands are considered HNV (Figure 4).

3. Identification of High Natural Value grasslands

In order to identify the HNV grasslands, the following algorithm was applied: in the first stage, all the ATUs were selected on the radius of which the HNV lands are located; in the

next stage, we determined the overlap with the grassland surfaces of Banat, and in the final stage, their extraction according to the ATU limits. In this way, we obtained the "HNV" cataloged grasslands, distributed according to Figure 5.

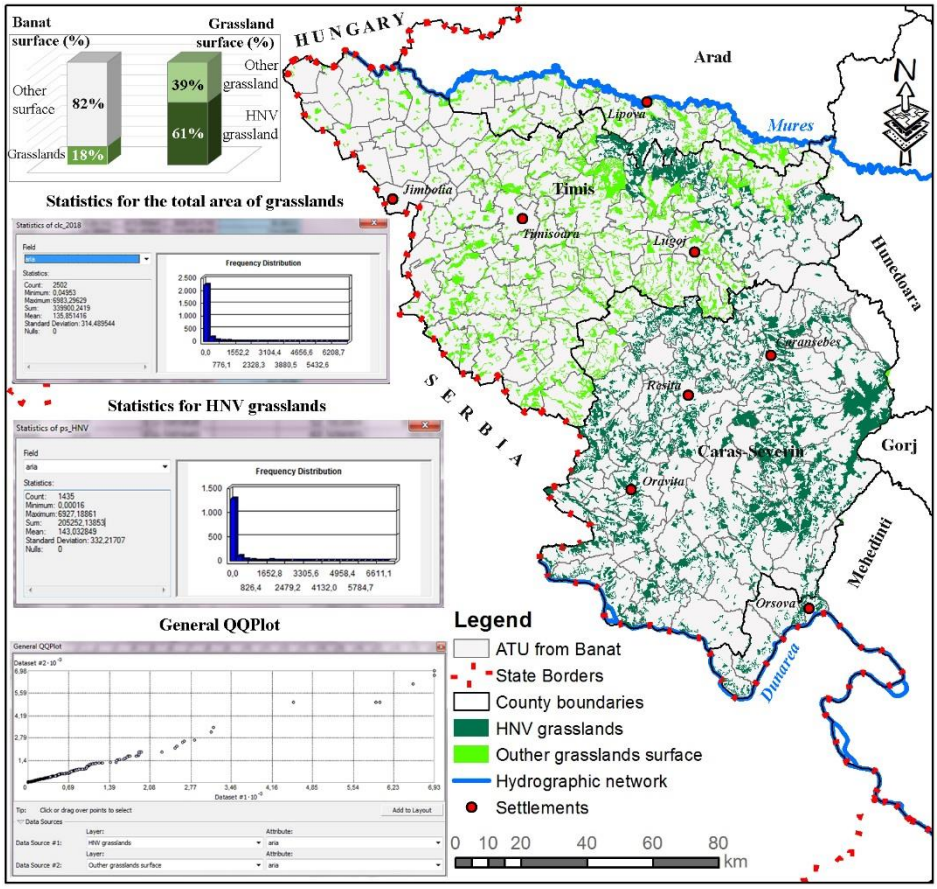


Figure 5 Distribution of HNV grasslands at Banat level
((processing after [1, 8, 5, 17])

As we have mentioned before, out of the total area of the Banat, the grasslands occupy approx. 18%, and out of the total grassland surfaces, 61% are HNV grasslands (Figure 5), distributed mainly in the Eastern half of Banat, in the mountain area defined by complex environmental conditions and thus a high degree of biodiversity.

The HNV grasslands are widespread throughout the mountain area, the funding programs being allocated for traditional agricultural practices as a compensatory measure to limit the effects given by the pedo-climatic conditions of the area [4].

From a quantitative aspect, out of the 2502 grassland units analyzed, 1435 units are HNV lands; the dimensions of the grassland units are between 0.001 - 6927 ha (Figure 5).

4. Analysis of HNV grasslands in correlation with other environmental factors

Because the study area is characterized by different environmental conditions, the HNV grasslands have, in addition to biological attributes, characteristics given by the

environment in which they are located: HNV grasslands located in areas with significant constraints (in 10 ATUs), linked mainly to the excess of humidity and HNV grasslands located in the mountain area (43 ATUs) (Figure 6, Table 1).

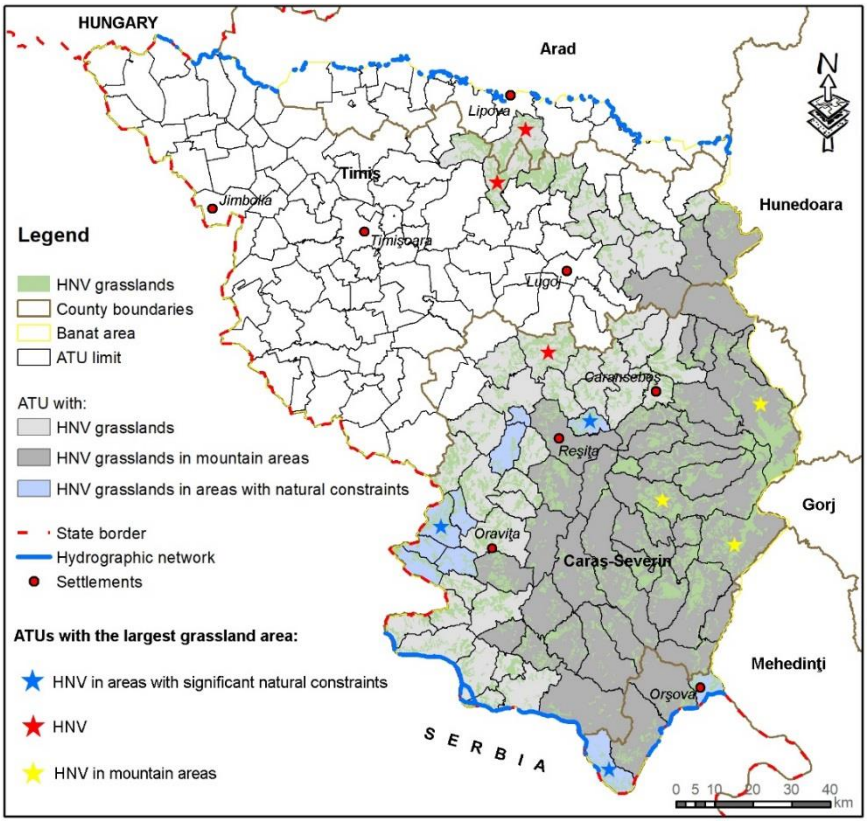


Figure 6 Categories of HNV grasslands in Banat
(processing after [1, 8, 5, 17])

Based on the data presented in Figure 6 and Table 1, the following statements can be formulated:

- all agricultural lands in the mountain area of Banat, due to the high degree of biodiversity, are considered HNV lands
- out of the 92 ATUs with HNV land, 43 ATUs (46.73%) are in the mountain area, 39 ATUs (42.39%) have HNV lands without other "restrictions" and in 10 ATUs (9.78%) HNV lands are under the influence of limiting processes or natural phenomena, especially due to the excess of humidity
- the HNV grasslands from the mountain areas hold the highest share of HNV grasslands (53,23%); in their case, although they have the highest degree of biodiversity, due to the restrictive physico-geographical conditions, operating difficulties related to accessibility or infrastructure may be reported; restrictions on exploitation or productivity can also be noticed in the case of HNV grasslands located in areas with significant natural constraints

Table 1

Classification of HNV grasslands in relation to the physical-geographic environment and the ATUs where they are located

HNV grassland category / features	HNV grasslands	HNV grasslands in mountain area	HNV grasslands in areas with significant natural constraints
No. ATU	39	43	10
Total surface of HNVgrasslands (ha)	83844.02	108898.33	11812.89
Area of grasslands (ha) within the commune surface:			
Interval (ha):			
Below 1000	Bocşa, Coronini	Văliug, Anina, Glimboca Băile Herculane, Cărbunari, Nădrag, Rusca Montană, Băuţar	Grădinari, Dognecea, Vrani, Ocna de Fier
1001 - 3000	Obreja, Sasca Montană, Caransebeş, Ramna, Pojejena, Bethausen, Păltiniş, Goruia, Doclin, Lupac, Naidăş, Moldova Nouă, Ciuchici, Constantin Daicoviciu, Ezeriş, Fârdea, Zorlenţu Mare, Brebu, Sicheviţa, Gîrnic, Dumbrava, Traian Vuia, Sacu, Bîrna, Copacele, Curtea, Ciudanoviţa, Socol	Reşiţa, Ciclova Română, Buchin, Brebu Nou, Bolvaşniţa, Dalboşeţ, Bucoşniţa, Şopotu Nou, Pietroasa, Luncaviţa, Domaşnea, Cornea, Turnu Ruieni, Bozovici, Mehadica, Lapuşnicu Mare, Tomeşti, Dubova, Eşelniţa, Eftimie Murgu, Berzasca, Topleţ, Bănia, Oţelu Roşu, Marga	Vărădia, Tîrnova, Sviniţa, Berlişte, Orşova, Răcăşdia
3001 - 5000	Ştiştarovăţ, Brestovăţ, Secaş, Ticvaniu Mare, Bara, Forotic, Bogda, Oraviţa	Mehadia, Prigor, Caraşova, Armeniş, Iablaniţa, Slatina-Timiş, Lăpuşnicel	-
5001 - 7000	Fârliug	-	-
7001 - 9000	-	Cornereva	-
Above 9001	-	Teregova, Zăvoi	-

- of the total HNV grasslands, 40.98% are "unrestricted" HNV grasslands, located in the highland or highland areas, where the soils are of good natural fertility, the climatic conditions do not impose restrictions, accessible and with "agricultural" infrastructure and appropriate transport.

CONCLUSIONS

According to the spatial analyzes, in the territory of 46.23% of the ATUs from Banat we may find HNV lands, these being superposed to the mountain area, hill and high plains, areas characterized by a high degree of biodiversity.

Among the grasslands of Banat covering approx. 18% of the total area, 61% are HNV grasslands, the largest areas being identified on the territory of Zăvoi, Teregova and Cornereva communes, from Caraş-Severin County.

The HNV grasslands represent 53.23% of the mountain area. Although in their case the degree of biodiversity is very high, a series of physical-geographical factors (relief, climate) act upon them, and become economic and organizational restrictions: lack of road infrastructure, restrictions related to accessibility and capitalization of products, impediments in the improvement.

Out of the total area of HNV grasslands, 40.98% are "unrestricted", located in areas with favorable physical-geographical conditions, in hilly or high plains and can be considered "balanced" with both high biodiversity and optimal conditions of exploitation and recovery. The largest areas are located in the administrative territories Fârliug, Oraviţa, Bogda, Secaş etc.

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