

## THE HUMAN PRESSURE IN THE APUSENI NATURAL PARK

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**Abstract:** The present study captures the pressure exerted by the population on the Apuseni Natural Park (ANP), from the perspective of the significant role of the human component in the conservation and development of these fragile areas from a natural and human point of view. The proposed study is focused both on the quantitative characteristics (general density, physiological density, pasture load) and on the quantitative ones (naturalness index, human pressure through forestry), analyzed at the level of the ANP. The analysis of these indicators highlights the fact that, from the point of view of the human

pressures exerted at the level of the ANP, it is not a strong one, and moreover it can jeopardize the optimal use of the potential of the ANP.

**Key words:** human pressure, Apuseni Natural Park, population density, naturality index, pasture load, forestry pressure

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## INTRODUCTION

Until Romania's return to a democratic regime in 1989, there were occasional initiatives to create national parks, but none came to fruition. The most important of these initiatives occurred in the mid-1970s, when the state appointed the forest management specialist Zeno Oarcea to prepare the documentation for the declaration of the first national parks (Moş and Brînzan, 2024). Unfortunately, this further proposal for ANP again remained on paper, along with 12 other park proposals. In 1990, Order No. 7 was drawn up by the Ministry of Water, Forests and the Environment in an endeavour to create one or more national parks. This, however, failed to ensure all the legal conditions necessary to create the parks. Hence, the Apuseni park had to wait another ten years, until Law No. 5 of 2000, by which it was declared a protected area of national interest, but as a natural and not a national park, following the recommendations of the IUCN, notably because of the presence of human communities on its territory. This law established the surface area and the management category, but not the precise location and limits. For these to be agreed, there was a further wait, of three years, until Government Decision No. 230 of 2003, when the ANP finally came into existence, no less than 75 years after the first initiative. Also in 2003, Order No. 552 of the Ministry of Agriculture, Forests, Water and the Environment established the first (provisional) internal zoning of the ANP until the approval of the management plan by the Ministry of Agriculture, Forests, Water and the Environment in 2003 (Moş and Brînzan, 2024).

The ANP is a protected area of national interest, with a total area of 75,784 hectares, the third largest of Romania's 29 nature and national parks. It is categorized as a Nature Park to protect its landscape, which is the result of the long-term interaction between man and nature, equivalent to IUCN management category V. The ANP includes areas from 3 counties (Bihor, Cluj and Alba), and 17 territorial administrative units. One third of its territory belongs to the state. As the ownership of the remaining two thirds is in various other hands (including local communes, owners' associations and private individuals), biodiversity conservation is a great challenge for management (figure 1).

In 2004, the conditions were created for the establishment of the administrative structure and the operationalization of the ANP's management. The Ministry of the Environment decided that most parks would be administered and financed by the National Forests Administration – Romsilva, a structure within the same Ministry. The ANP Administration was created in 2004 as a unit within Romsilva; in addition, a Scientific Committee was established. This Scientific Committee has a guiding role in relation to the ANP Administration and supports management decisions. Alongside the ANP administration is the Advisory board, which is made up of key stakeholders. The Advisory board provides analysis, facilitates debate, and formulates proposals regarding the

management of the ANP. The ANP's ten-year management plans and the regulations are drawn up in collaboration with the Advisory Board, are then analysed and approved by the Scientific Committee, and subsequently given final approval by the relevant Minister.



**Figure 1.** Areal study

The protection, conservation, development of mountain areas, especially the disadvantaged ones, are a major coordinate of the European Union's development policy. The concerns in the field of protection of mountain areas are with old traditions within the European states, reference being the legislation regarding the mountains developed by France and Italy (Borsdorf and Braun, 2009). In 1994 in Chamonix, France, the first European Conference of Mountain Regions was organized, sponsored by the Council of Europe, on which occasion the "European Charta of Mountains" was promoted. Subsequently, in 2003, in Quito, Ecuador, the "World Charta of Mountain Populations" was launched and approved by 40 states. The objectives stipulated in the two documents are the research of all existing components and resources, the conservation of the mountain environment seen as a mandatory condition for the survival of the global ecosystem (Rey, 2007).

The ESPON 2004 report on the mountain regions of Europe provides a pertinent snapshot of mountain areas. Chapter 5, Demographic Trends in Mountainous Regions, is devoted to human resources and the pressures they exert (IPCC Sixth Assessment Report, 2024).

In the 17 territorial administrative units (TAU) related to the ANP, there is a total population of 32,448 inhabitants. The basic component of the mountain

system, the population in this area faces a series of problems such as impoverishment, demographic aging and finally the exodus, all with repercussions on the ANP as well.

The characteristics of the ANP, the fragility and vulnerability of the mountain areas, are dependent on the pressure that the population, through its presence, the activities carried out exert on the mountain space (Moş and Brânzan, 2024). At the same time, it should be noted that the population is also dependent on the goods and services offered by this ecosystem. In parallel, the ANP puts pressure on the population through the legislative framework that stipulates the accepted economic activities and the limits within which they must fall. From the point of view of economic activities, specific to the communities in the area and which put pressure are especially animal husbandry and forestry. The two activities are those, taking into account the specificity of the ecosystem, which constitute the main components of human pressures and which can lead to the degradation of the mountain space.

One can say that this demographic component, as land managers, plays an important role in optimally capitalizing on the natural potential held by the ANP, preserving and maintaining biodiversity.

The study of mountain areas has aroused and continues to arouse the interest of researchers in various fields and geographers, in particular. In this regard, in direct connection with the proposed area, we mention the studies aimed at demographic risks in the Apuseni Mountains (Filimon and Filimon, 2011; Mureşan, 2014; Surd et al., 2007), population, settlements, tourist activities (Axinte et al., 2020; Boc et al., 2022; Filimon et al., 2011; Herman and Benchis, 2017; Herman et al., 2019; Ilieş et al., 2014; Lung and Gligor, 2018; Lung, 2019; Moş and Brânzan, 2024; Staşac et al., 2016), disadvantaged mining areas, with a focus on tourism development (Morar, 2012),

The main objective is to highlight the pressures exerted by the population on the Apuseni Natural Park. To achieve this objective, a few indicators considered relevant and frequently used in the literature have been selected (Goudie, 2006; Ianăş and Germain, 2018; Ionuş et al., 2011; Maruszczak, 1988; Manea, 2003; Pecher et al., 2018).

## **MATERIALS AND METHODS**

To be able to capture the human pressure exerted, the indicators used are *population density* and *physiological density*, which highlight the pressure exerted on the entire area but also on the agricultural land. Another indicator is the pasture load with animals, an indicator that reflects the way in which the areas occupied by pasture are capitalized and if there is overgrazing. For this indicator we used the calculation formula established by the Ministry of Agriculture and Rural Development and which is based on the European regulations in this regard (Order 544, 2013). In order to highlight the current degree in which the ecological balance of the ANP is found, we used the *naturality index*, using the established calculation formula,  $I_{nat} = (S_{forest}/S_{total}) \times 100$ , where  $S_{forest}$  is forest area in hectares,  $S_{total}$  is total area in hectares, respectively the *human pressure (PUF)* exerted by the forest  $PUF = S_{forest}/\text{Number of inhabitants}$ , where  $S_{forest}$  is forest area in hectares.

Statistical information on population, total areas, forests, pastures, were obtained from the National Institute of Statistics, for the livestock, from the Veterinary Sanitary Directorates in Alba, Bihor and Cluj counties. Results

obtained (table 1) were correlated with the threshold values, to highlight the critical situations and cartographically represented using the ArcGis 10 software.

**Table 1.** Study indicators

	UAT	Inhabitans	Total Area (ha)	Forests (ha)	Density (inhabitants/km <sup>2</sup> )	Physiological density (inhabitants/ha)	HPF (ha/inhabitants)	N.I (%)	LSU (LSU/ha)
1	Arieșeni	1846	5389	3039	19.9	0.6	3.0	60.6	1.2
2	Albac	1464	7322	4442	34.2	0.9	1.6	56.3	1.2
3	Gârda de Sus	1415	8270	5958	17.1	0.6	4.2	72.0	1.1
4	Horea	1774	6041	4389	29.3	1.5	2.5	72.6	3.7
5	Scărișoara	1391	9441	6947	14.7	0.7	5.0	73.5	1.1
6	Budureasa	2553	34646	20424	7.3	0.2	8.0	59.0	0.2
7	Buntești	4090	7386	2081	55.3	0.8	0.5	28.2	0.3
8	Câmpani	2111	4449	1911	47.4	0.9	0.9	43.0	1.1
9	Nucet	1987	4111	2951	48.3	2.3	1.5	71.8	0.2
10	Pietroasa	3014	20535	14785	14.6	0.8	4.9	72.0	1.2
11	Beliș	1008	20649	20424	4.8	0.1	9.1	44.5	0.2
12	Călățele	2307	7472	2081	30.8	0.5	0.8	23.8	0.9
13	Mărgău	1363	21168	1911	6.4	0.1	6.3	40.8	0.3
14	Mărișel	1499	8594	2951	17.4	0.3	2.5	44.2	1.0
15	Măguri Răcătău	2077	26895	14785	7.7	0.2	7.7	59.7	0.3
16	Râșca	1180	6565	2275	17.9	0.3	1.9	34.6	0.4
17	Săcuieu	1369	12112	2596	11.3	0.2	1.9	21.5	0.3
18	ANP	<b>32448</b>	<b>211045</b>	<b>113950</b>	<b>17.1</b>	<b>0.4</b>	<b>3.4</b>	<b>49.9</b>	<b>0.4</b>

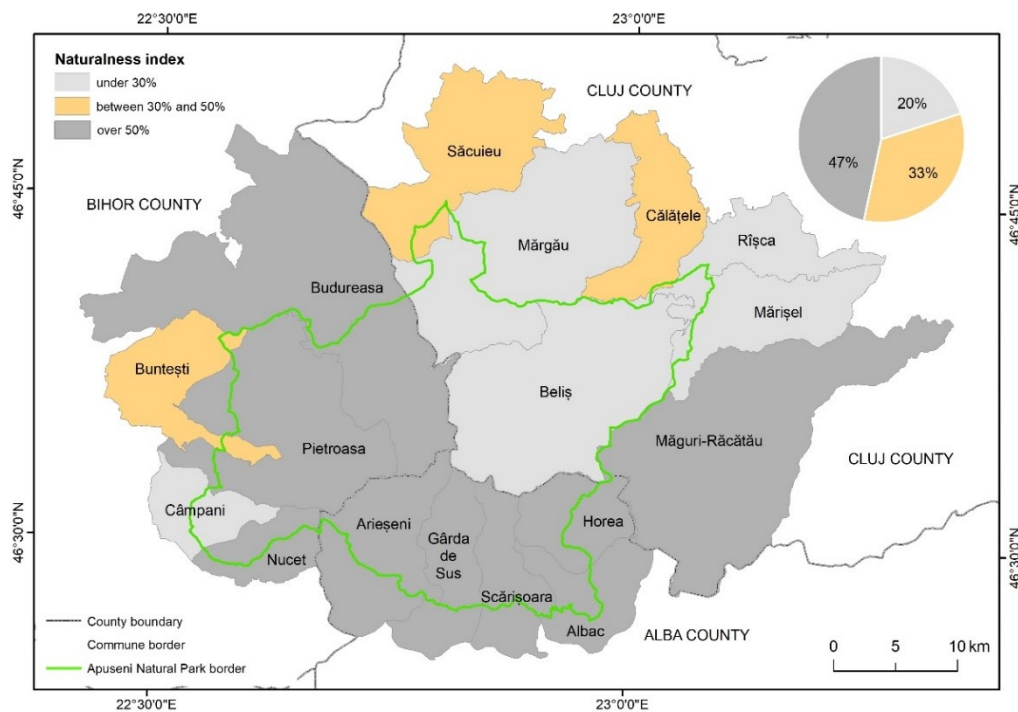
## RESULTS AND DISCUSSIONS

The naturality index is the one that highlights the degree of artificialization, the degree of affectation of the ecological balance in the Apuseni Natural Park. The values recorded by it differ from one administrative unit to another depending on the share that forests currently hold. The forest represents an essential component of the environment with profound implications for the protection and conservation of biodiversity (Andronache et al., 2019; Butchart et al., 2010; Edwards, 2017; Morales-Hidalgo et al., 2015; Schusser, 2013). Over time, the areas covered by forests have undergone profound changes, in the direction of their reduction and fragmentation, with profound implications for the reduction of biodiversity (Bakker et al., 2004; Diaconu et al., 2020; McAlpine et al., 2007; Niculae et al., 2016; Peptenatu et al., 2020, 2022, 2023). The factors that led to the reduction of forest areas were the need to identify new lands for agricultural activities (Fraser and Stringer, 2009) and human settlements (Dewan, 2009; Foley et al., 2005), the

demand for timber from the wood industry (Pintilii et al., 2017, 2015) the increase in population, etc. (van der Sluis et al., 2016).

Its average value is 49.9%, which means that overall, the analyzed area is in an ecological balance close to the initial one. Territorially, in relation to the recorded average, depending on the recorded values, there are three distinct categories, areas with strongly affected ecological balance, with values below 30%, areas with relative stable ecological balance, with values between 30%-50%, these two situations being present only in territorial units of Bihor and Cluj counties. The last category, those with an ecological balance close to the original one, defines all the communes in Alba County, three in Bihor and one in Cluj counties.

The first category, the areas where the ecological balance is strongly affected, the values of this index having values just over 20%. The three communes defined by this category are Buntești (Bihor) respectively Călățele and Săcuieu in Cluj County. Their presence in this category is generated by the fact that (figure 2) are located on the periphery of the ANP, and the forest area they own is relatively small in relation to the total area.



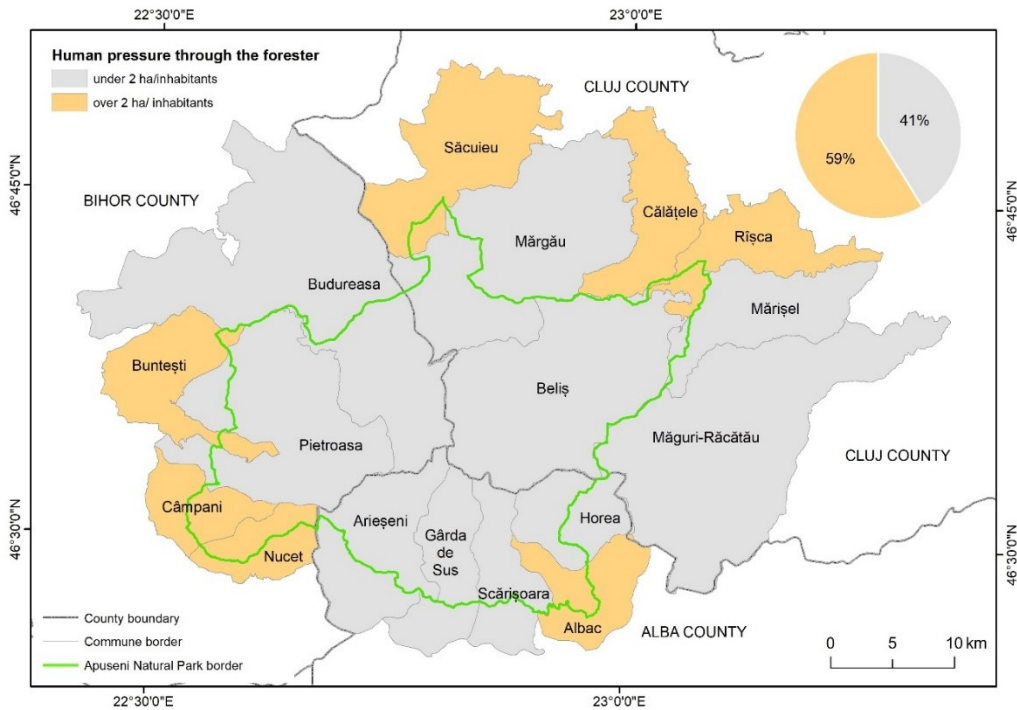
**Figure 2.** The naturality index within ANP

The second category, that of areas with relatively stable ecological balance, the values being close to 50%, includes a number of four territorial entities, three located in Cluj County, Beliș, Mărișel, Râșca and one belongs to Bihor County, Câmpani commune. Except for Beliș commune, which has an appreciable forest area (approximately 10 000 ha), the others do not have a significant forest area.

The third category, namely where the ecological balance considered close to the original one, corresponds to a number of nine communes, distributed in all three counties. As we previously mentioned, this situation is present in all the communes of Alba County (figure 3) to which are added three units from Bihor (Budureasa, Nucet, Pietroasa) and one commune which belongs to Cluj County, Măguri Răcătău commune.

A fact worth mentioning is the high values of this index, over 70%, in a number of five communes: Gârda de Sus, Horea, Scărișoara (Alba County), Nucet and Pietroasa (Bihor County).

The human pressure through forestry index completes the naturality index because it highlights the anthropogenic intervention on the forest. If in the case of the naturality index the values are influenced by the total area of the commune, in this case, the demographic dimension is the one that has an important role. When this indicator has values above 2 ha/inhabitants, the system is able to preserve the relative balance of natural components.



**Figure 3.** The human pressure through forestry index within ANP

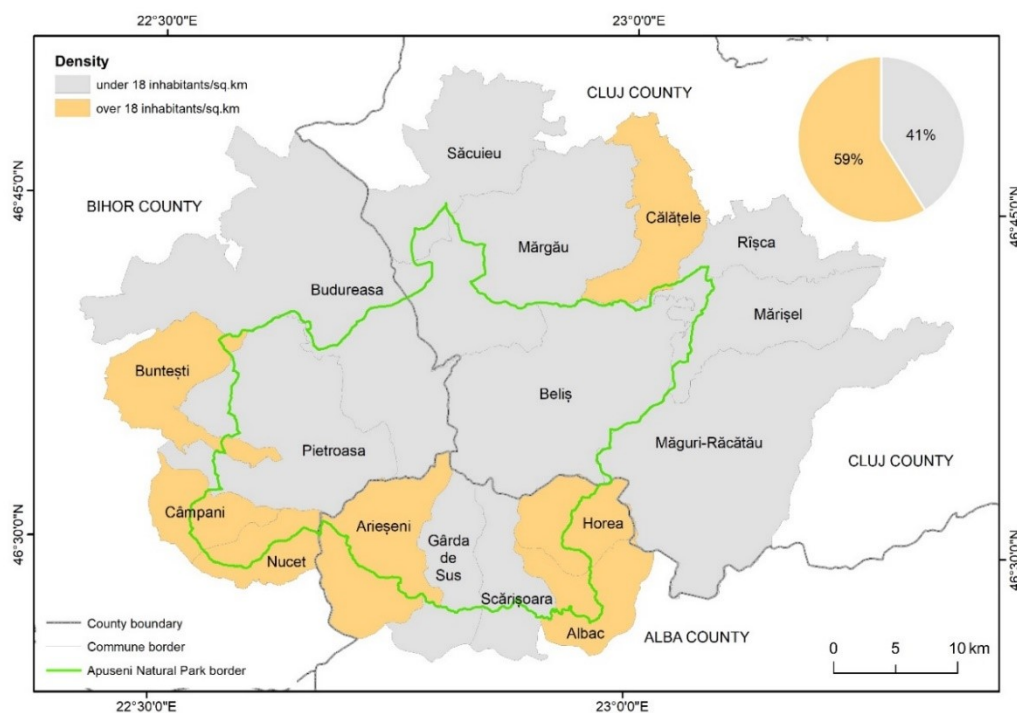
The average value of this index within ANP is 3.4 ha/inhabitants, and it is closely related to naturality index. Situations in which this index has values below 2 ha/inhabitants is specific to a number of seven communes (figure 3) representing 41% of the total communes. The lowest values characterise communes of Buntești, Câmpani (Bihor), Călățele (Cluj) values below 1ha/inhabitants, characterise communes Albac (Alba), Râșca, Săcuieu (Cluj).

In the communes with an index of over 2 ha/inhabitants, 59% of the total communes, the values vary greatly from 2.5 ha/inhabitants. in Horea commune,



to over 6 ha/inhabitants in communes such as Beliș, Mărgău, Măguri Răcătău (Cluj), Budureasa (Bihor), the maximum value recorded being 9.1 ha/inhabitants in Beliș commune.

Population density is an indicator that highlights the physical pressure exerted by the population on a territory. In the case of the present study, this indicator is in close correlation with the characteristics of the support component, namely mountain area with a higher livability potential, more attractive for the population, as well as areas with a modest capacity, and whose attractiveness is more limited or even becomes restrictive (Filimon, 2012; Ropa, 2020; Surd et al., 2007). The values of population density and physical pressure exerted by the population in the case of the studied area are directly influenced by the demographic size of the settlements located in the Apuseni Natural Park, the most numerous small settlements, and the area related to each TAU. If in the case of the demographic dimensions of the settlements the values are relatively approximate, the same cannot be said in terms of their area. The analysis of this indicator highlights the fact that the degree of anthropization is low, the average density value being 17.1 inhabitants/km<sup>2</sup>, but explainable given the fact that it is a mountainous area par excellence.



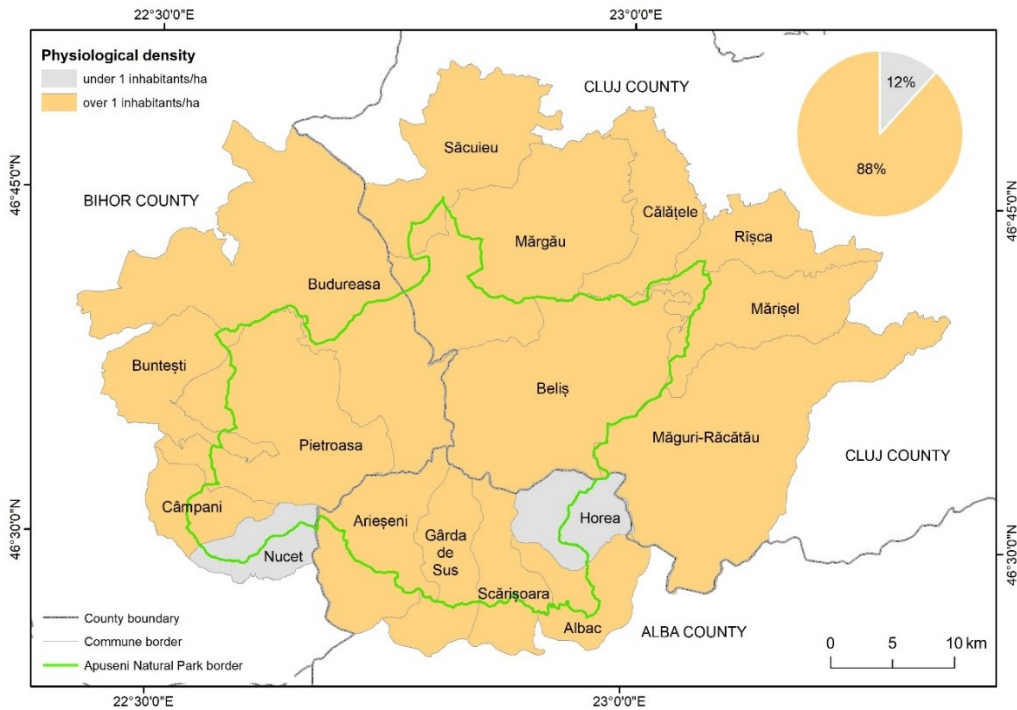
**Figure 4.** Population density within Apuseni Natural Park

At the territorial level, compared to the average value, there are particular situations, in the sense that 59% of the communes are characterised by values above the general average, within which stand out communes such as Buntești 55.3%, Câmpani and Nucet town 48%, located on the territory of Bihor County, Călățele 30% in Cluj County and Albac, with 34%, in Alba County (Figure 4). At



the opposite side, with low population densities, are the communes of Beliș 4.8%, Mărgău 6.4%, Măguri Racatau, 7.7% in Cluj County and Pietroasa 7.7% in Bihor County. The low population density values in these communes are the result of the large area they have. The other TAUs are defined by values close to or slightly above the general average.

The physiological density highlights the anthropogenic pressure exerted on the agricultural area, which represents the support of human activities, provides part of the living needs on the side, but also highlights the potential for maintenance and valorization of agricultural land. Similar to the general density, this is also influenced by the demographic size and the agricultural area of each community.



**Figure 5.** Physiological density within Apuseni Natural Park

As can be seen (figure 5), the values of physiological density are not high, the average value recorded being 0.4 inhabitants/ha. The values vary between a minimum of 0.1 inhabitants/ha in the communes of Beliș, Mărgău (Cluj), the maximum value being returned to the city of Nucet (Bihor) with 2.3 inhabitants/ha, as a result of the small agricultural area it has. Otherwise, the values broadly follow the values of the general density, the communes with higher density having also higher values of the physiological density.

Through its values, the physiological density highlights the fact that, even if it is a mountainous area, the potential for capitalization and maintenance of the agricultural area is reduced.

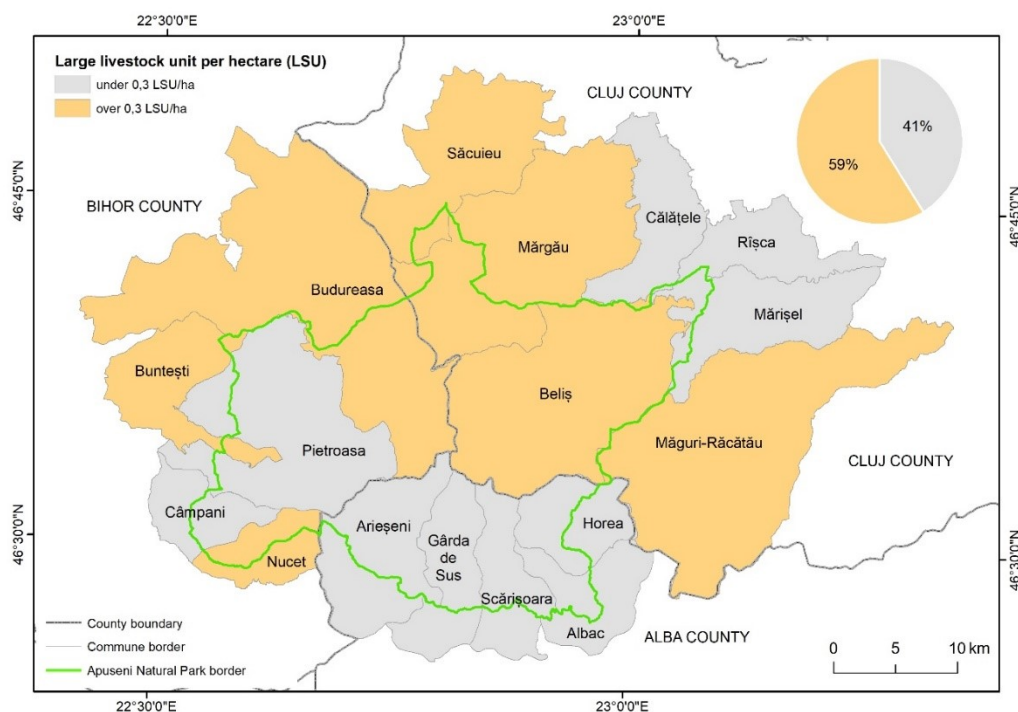
The human pressure exerted by animal husbandry (UMV pasture load/ha), represents, from the point of view of the population's activities, we believe, the

greatest pressure exerted on the Apuseni Natural Park. Even if, in the last period, this occupation has also suffered because of socio-economic, human, legislative changes, it remains the main occupation of the human communities in this area.

Animal husbandry, especially cattle and sheep, is a tradition within the communities related to the study area. The area occupied by pastures totals over 56,000 ha, naturally unevenly distributed within the TAUs. With large pasture areas, the communes of Beliș, Mărgău, Măguri Răcătău, Săcuieu (Cluj), Budureasa (Bihor) stand out, where they exceed 6,000 ha. With smaller pasture areas, under 1000 ha there are the communes of Câmpani, Nucet city (Bihor), Albac, Gârda de Sus, Horea (Alba).

In relation to the related pasture area, numerous herds of animals, cattle have the communes of Albac, Arieșeni, Gârda de Sus, Horea and Scărișoara (Alba), cattle and sheep Budureasa, Câmpani, Pietroasa (Bihor). The communes in Cluj County stand out especially for the larger herds of sheep to which are added cattle. The composition of the herd leaves its mark on pasture loads with UMV, given that the calculation methodology for sheep and cattle differs according to the legislation.

Following the calculation of pasture loads, according to the legislation in force for both sheep and cattle and the correlation with the minimum necessary (0.3UMV/ha) for the efficient use of pastures at the level of the ANP, the average UMV/ha load is 0.4UMV/ha. This value places the area close to the minimum mandatory value for adequate pasture maintenance and at the same time is in line with the desire and recommendation of the ANP Administration, through the management plan, not to exceed the value of 1 UMV/ha.



**Figure 6.** UMV pasture load/ha in the ANP

As can be seen from (figure 6), within the park there are communes where the average value, but also the one agreed by the park is exceeded. In this situation are all the communes in Alba County, the maximum value being in Horea commune where it is 3.7 UMV/ha. This value is generated by the relatively small area of pastures (315 ha) compared to the number of animals.

Values that exceed the minimum value and reach the target recommended by the ANP, are recorded in Câmpani and Pietroasa communes in Bihor County, while in Budureasa commune the value is below the minimum. Similar situations are also encountered within the communes of Cluj County where, except for Săcuieu commune, with a value below 0.3UMV/ha, the others are close to the value of 1UMV/ha.

### **CONCLUSIONS**

The analysis of human pressures within Apuseni Natural Park, through the indicators used, allows us to draw an overall picture and highlight some significant aspects regarding its degree of artificialization and anthropization.

Thus, the low values of the general density and the physiological ones highlight the fact that, from this point of view, there is no high physical pressure within the area. On the other hand, these values also reveal the fact that, in the long term and depending on the evolution of the population within the TAUs, problems may arise in terms of depopulation.

The phenomenon of depopulation entails the appearance of dysfunctions in the management and optimal capitalization of the natural and economic potential, with negative effects on future evolution.

In fact, the pressure exerted by the population on the park, highlighted by the basic economic activity, animal husbandry, also highlights a poor use of the land occupied by pastures, below their potential. The use of pastures below their potential has repercussions on their quality and even their abandonment. Exceptions are the communes in Alba County where the pressure on the pastures is slightly higher, exceeding the value agreed by the park administration, but not the potential to sustain the pastures.

The naturality index, the pressure through forestry highlights the fact that we can talk about a space where the ecological balance, for the moment, is little affected. At the same time, several territorial units the natural components are affected, the ecological balance being fragile or affected. In this situation there are several communes in Bihor County (Buntești, Câmpani) and Cluj (Călățele, Săcuieu).

Through the values of these indicators and their correlation with the threshold values, those that highlight the artificialization processes, we can appreciate that, at least for the moment, the human pressure exerted on this area is not a strong one, the degree of naturalness of the Apuseni Natural Park being still high.

The fact that the human pressure is not strong highlights a worrying aspect, namely the fact that from a human point of view, the demographic dimension of the communities, the agro-pastoral activities practiced, are below the support capacity of the Apuseni Natural Park and implicitly the inability to make optimal use of it.

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