

## THE RESOURCES OF SHARR MOUNTAIN AS A STABLE ECONOMIC BASE

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### Abstract

The purpose of this scientific work is to highlight the natural values that lie with a prosperous diversity, which contains a gallery of values that exist unrepeatable. The study aims to present the geomorphological, climatic, and hydrographic forms as well as the evidence of all diverse natural assets. As economic values, forests, pastures, mountain peaks, and the rich diversity of endemic plants and animals are presented, many that are encountered in the Sharr Mountain massif, as a stable economic base. The dimensions of the importance of this work are very huge. Firstly, this paper provides detailed data on Sharr Mountain.

*Keywords:* Resources; Water resources; Pastures; Mountains; Plants; Animals.

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### Introduction

The Sharr massif extends approximately over 1600 square kilometers, between Kosovo in the North valley (43% of its surface) and North Macedonia in the South (57%). Geographically, it is separated from the valley of Pollog in the North, from the plain of Prizren in the South, and the river Radika in the North-West. A large number of streams intersect the massif, the three most important of which are respectively the Shkumbin (Mk. Pena), Lesocka, and Mazdraça rivers. They are joined by the great river Vardar, which crosses the state to flow into the Aegean Sea near Thessaloniki.

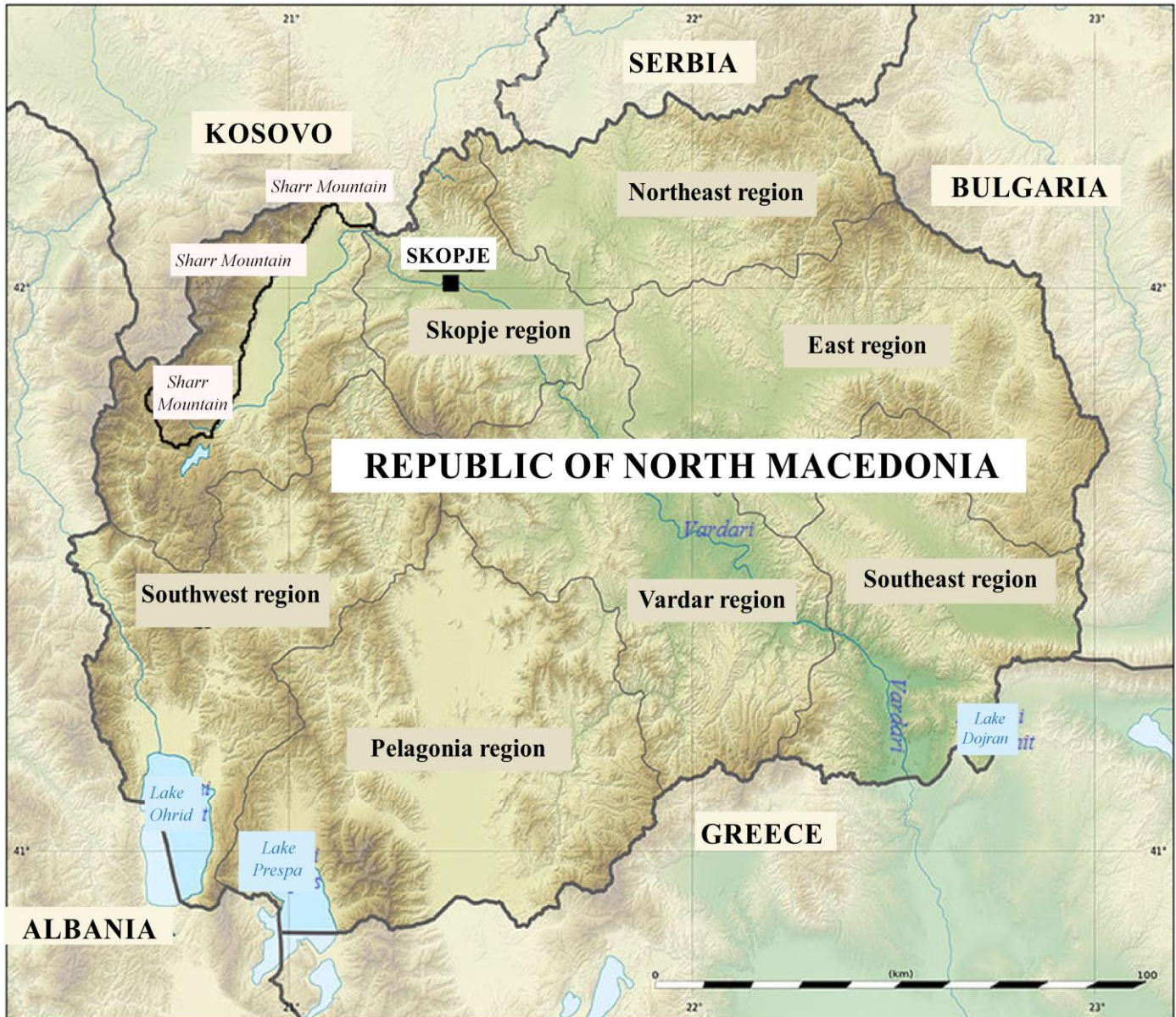
This massif is one of the highest in the Balkans with 15 peaks above 2500 m. It reaches the highest point Titov Vrv, 2747 m, and stretches 80 km in length for a width that varies from 10 to 30 km. For Tetovo, which is only 450 m high, the relief of the Sharr Mountain is particularly pronounced and has all the advantages of the average alpine mountain. Forests, mainly composed of beech and more or less pine and oak, cover a wide part of the massif between 600 and 1600 m. Above this limit, the trees are more scattered and give way to lawns. The favorable period in the growth of plants does not exceed three months and the flora reminds us of that of the Alps. Broad hills and high cliffs characterize this territory.

The flora is rich with approximately 2000 species of which 150 are permanent and the fauna is represented by a large number of mammals, birds, reptiles, amphibians, and an incredible number of insects that have not yet been identified. Most of the protected species, rare in other massifs in Europe, still live in the mountains of Sharr. The most emblematic are the brown bear, the lynx, and the wolf.

### General physical-geographic features

The Sharr massif is a high horst, located on the western side of the Pollog valley, with a great height above sea level of 2748m, it is one of the largest and highest mountain massifs in North Macedonia. The Sharr Masif belongs to 3 countries: Albania, Kosovo and North Macedonia. It has a length of 80 km, and a width of 10 to 20 km, covering an area of 840.2 km<sup>2</sup>, of which 693.9 km<sup>2</sup> are located above 1000 m altitude. Areas located above 2000 m above sea level are represented by 158.8 km<sup>2</sup> (18.9% of the total surface of the mountain).

**Map.1.** The geographical position of Sharr Mountain within the Republic of North Macedonia.



## Geomorphological features

As a whole, the Sharr Mountain represents the massif which has a great height compared to the valley of Pollog, according to this, this mountain in the geomorphological sense has a typical mountain division, which means that it was created as a result of tectonic processes first of all, as a result of radial movements, and later erosive factors also played an important role in its shaping.

At an altitude between 2000 and 2100 m above sea level, Mount Sharr appears as a wide erosive plateau, from which small mountain peaks rise to 2748 m, such as *Maja e Zeze* (2585 m), *Ezerska Čuka* (2603 m), *Luboten* (2499m), while in the southern part of Sharr, the most known highest mountain peaks are: *Babahasanica* (2533m), *Karanikola* (2408m), *Rudoka* (2662m), etc.



**Photo1.** Luboten peak (2499 m)

## Hydrographic resources

Sharr Mountain as a high and wide mountain range is characterized by various hydrographic phenomena such as a large number of streams, rivers, and glacial lakes that make Sharr Mountain one of the most water-rich mountains in the Balkan Peninsula. Some of the rivers flow from glacial lakes. They are always rich in water, with fast and clean water flows - rivers whose longitudinal profiles are characterized by large drops, which represent economic capacities for hydroelectric power plants.

Their waters often burst through the steep slopes, creating noisy rapids, and waterfalls that are of extraordinary beauty, which present a tourist attraction. The volcanic lakes, which the population calls "Eyes of Sharr" are a special asset, and this mountain region has a fascinating attraction and an irreplaceable tourist potential.

**Table 1.** Basic data of Sharr Mountain lakes

Lake name	Altitude	Area in m <sup>2</sup>	Length in meters	Width in meters	The length of the lake line in meters	Depth in meters
Lower Dobrosht Lake	2440	1200	32	50	125	1.5
Dedelbesh Lake	1980	3916	100	80	243	0.5
Black Lake	2122	33520	248	185	825	2.2
Bogovina Lake	1960	66880	452.5	255	1200	2.2
White Lake	2282	18000	185	120	540	1
Krivoshina Lake	2250	7400	115	87	325	0.5
Big Gjoli	2180	26240	290	115	675	5,6

Big Gjoli- this is what the population of Tetovo Highlands calls it - is in the area of the Karanikolla peak at an altitude of 2,180 m and is very close to the border with Kosovo. This lake has the shape of an ellipse and together with the surroundings creates a rare natural attraction. Its length is 290 m, width 115 m, depth 5.6 m, and an area of 26,240 m<sup>2</sup>.



**Photo 2.** Big Gjoli

The White Lake has continuous flow without an influence from atmospheric gatherings. Along the shores of this lake, there are several resources - permanent and temporary. The lake also has outlets that flow into the Bogovina River.



**Photo 3.** White Lake

Lake Bogovina is located between Borislavec and Small Dëllinja and is the largest lake of Sharr Mountain. The lake is 4-5 m deep. The Bogovina River flows into this lake and then through a stream, it comes out again. There are several waterfalls near the lake.



**Photo 4.** Bogovina Lake

The Black Lake is still deeper than the Bogovina Lake. It is one of the most beautiful lakes in the Sharr Mountain. As a result of the large presence of many dairy farms on the northern side, part of the northern shore is overgrown with marsh vegetation.



**Photo 4.** Black Lake

## **Resources**

In the massif of Sharr Mountain, the sources of the following rivers are the sources of large flow: Jellovcë River, Mzraçë River, Bogovina River, Kamjani River, Pallçisht River, Reçica River, Shkumbin River, Karanikolle, Leshnica, Cold River, Cepenovë, Poroj River, Slatina River, Lumbardh or Tearca River, Dobroshti River, Vratnica River, Bardhë River, etc. There are several hundreds of resources in the Sharr Mountain massif. At a higher altitude above sea level, it is considered that the source is found in the cirque of the Great Lake, which is more precisely located at an altitude of 2,460 m above sea level and has a water temperature of 5°C.

The source of the river Shkuma is located in the southern part of the Gjinibeg cirque, in a meadow plain at an altitude of 2,400 m. The most powerful source appears at the bottom of the rock (on its right side) consisting of crystalline melts, in which a layer of quartz with a thickness of 9 cm has been interspersed. Very close to it, two other resources emerge in the molten layers. Their water has a temperature of only 2°C.

The width of the resources' space in which 8 resources originate, reaches about 28 m. The most powerful of them is the fourth source. Apart from the eighth source that dries up during the hot period of the year, the other sources are permanent but with a changing flow. The total capacity of the springs reaches more than 100 l/s, from which a prosperous river begins.

In addition to the sources of ordinary water mentioned above, at the foot of the Sharr Mountain massif there are also mineral and thermal waters with mineral composition. There are more than 20 mineral springs on the dividing line that connects Pollog with Sharr Mountain. The most important of them are those found in the area of Tetovo. The best-known source of mineral water is the Mineral Water Spring of Tetovo, located in the valley of the river Shkumbin. The water of this source has an average temperature of 20°C and contains these minerals: hydro carbonates, calcium, magnesium and free carbon dioxide.

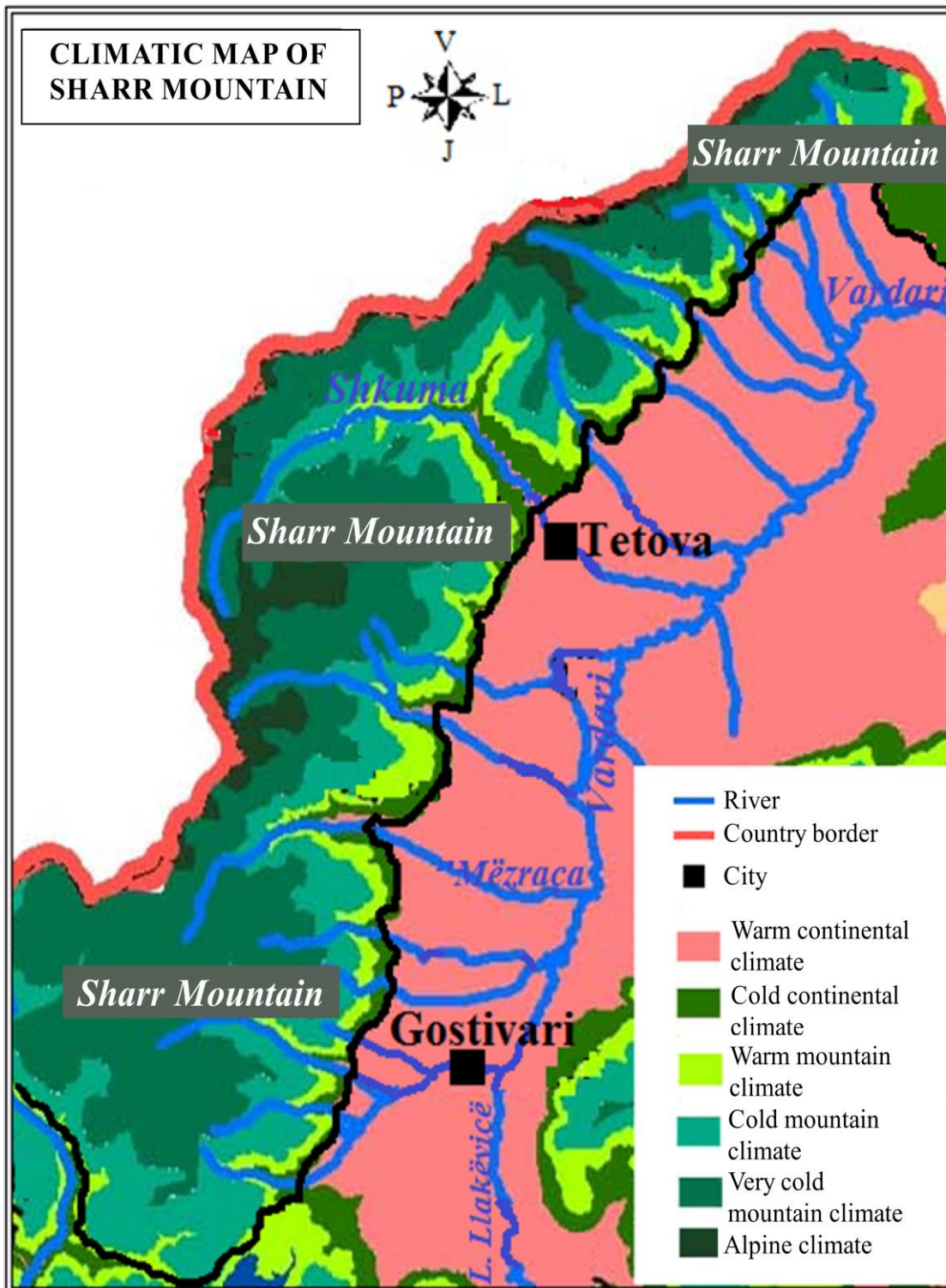
## **Climatic features**

The geographical position of the Sharr Mountain massif in the north-western part of North Macedonia, the dominance of the mountain relief, and the approximately meridional direction have determined two types of climate: medium continental climate and mountain climate. The proximity to the Adriatic Sea means that the

massif of Sharr Mountain is under the strong influence of the air masses coming from the said sea. The moist air masses coming from the Adriatic Sea in the direction of the Sharr Mountain massif, condition that there is a very large amount of precipitation in the high altitudes of this mountain massif within the year. During the warm period of the year, precipitation is in the form of rain, while during the cold period, it is mainly in the form of snow. The large amount of rainfall has influenced the development of a dense network of underground and surface water in the massif of Sharr Mountain, but also a sensational development of vegetation.

The medium cold continental climate reigns in the areas of the Sharr Mountain massif that are 550-1,000 m high, while in the areas with an altitude of more than 1,000 m a mountain climate reigns, respectively in the areas with an altitude of 1,000-1,700 m. moderately cold mountain climate and in areas with an altitude of more than 1,700 m, a very harsh mountain climate prevails. The climatic boundary in the Sharr Mountain massif also coincides with the extent of plant floors. In the countries where the medium continental cold climate reigns, the air temperature within the year ranges from 9.1-10.5°C, while the annual amount of precipitation ranges from 786.7 -1,000 mm of precipitation, that is, the amount of precipitation increases with the increase in altitude for an average of 56 mm of precipitation for every 100 m of altitude. While the opposite happens with the air temperature, i.e. with the increase in altitude, the air temperature decreases and for every 100 m of altitude, it decreases by an average of 0.39°C. The change in the amount of precipitation and air temperature with the increase in altitude has a significant impact on the spread of the plant and animal world, man and settlements, the way of life of man, as well as on the development of various economic activities. The moderately cold mountain climate is characterized by long, cold winters and heavy snowfalls, while summers are not very cool and rainy. The average annual air temperature is 5.2-9.0°C, while the annual amount of precipitation is from 1,000-1,200 mm of rain. The very harsh mountain climate reigns in the mountain areas that are above 1,700 m high, which is distinguished by an average annual temperature of 0.2-5.1°C, while the annual amount of precipitation is between 1,200-2,000 mm of precipitation.

The climatic characteristics are expressed quite well in the daily, monthly, seasonal and annual progress of its elements, related to the barrier that this mountain massif makes to the moist western air masses coming from the Adriatic Sea. The data on the climatic elements of this mountain massif were obtained from the Hill of Sun hydrometeorological station, for the observation period 1981-2020, and based on them, the characteristics of the mountain climate were determined.

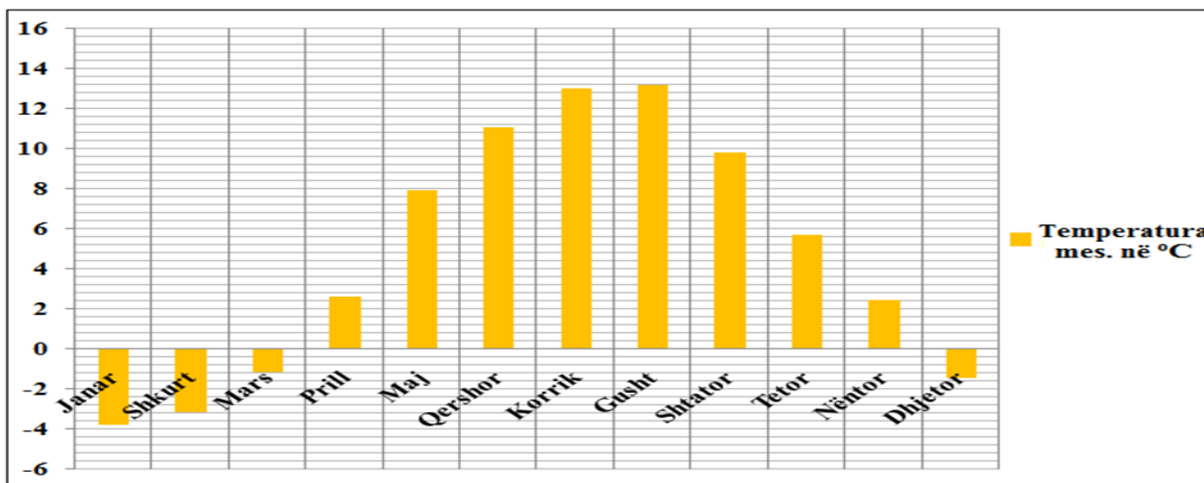


**Map2.** Climate map of the Sharr Mountain massif showing the climate types prevailing in the Sharr Mountain massif.



**Table 3.** Average monthly and annual air temperature in the Hill of the Sun in the 1981-2020 period.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Viti
Temp. °C	-3,8	-3,2	-1,2	2,6	7,9	11,1	13,0	13,2	9,8	5,7	2,4	-1,5	4,6



**Graph 1.** Average monthly air temperature in the Hill of the Sun in the 1981-2020 period

## Pastures

The slopes of the Sharr in the Macedonian area are more forested, however, a large part of the forests of the Sharr is generally degraded. Above the surface of the forests, the vast areas with pastures continue. Sharr's wealth is undoubtedly the broadest and best quality pastures in the entire Balkan region. These pastures are a good basis for the development of livestock, as evidenced by the numerous stables (dairies) where these pastures are located. Hundreds of medicinal and aromatic plants have also been identified in these pastures, a part of which is also used. Sharr's grasslands usually lie in shallow and gentle valleys where streams and rivers flow and where shepherds and caravans pass, while the lakes are at their edge, high-quality pastures that are a good basis for livestock development. In the pastures of Sharr, a large number of medicinal and aromatic plants grow, which are also the basis for the development of the pharmaceutical and aromatic industry.

## The tourist potential of Sharr

Wherever you go through the Sharr during the summer season, you will come across wonderful shapes where forests, pastures, sharp rock parts, gorges and meadows, colorful flowers, chirping birds, streams and waterfalls of rivers, rocks, and lakes, the glow of the rocks in the high pyramids of the mountain peaks, here and there patches of unmelted snow and during the winter the ski slopes. Sharr has great potential for all types of mountain tourism, whether in the summer or winter season. Each peak of Sharr, each lake, stone, and river are special attractions. Sharr has long and quality trails for skiing, always connecting these trails with the exposure of the terrain, with sufficient altitude above sea level, with good climatic conditions, with plenty of sunny days and few foggy days, etc.

## Flora and fauna

In the plant diversity of Sharr Mountain, the exposure and the climate of the Sharr Massif lies in the northwest of the Republic of North Macedonia. This mountain massif also carries many different plant communities, which are distributed in different habitats depending on the height above sea level, the type of soil, and the composition of the substrate. The flora of Sharr Mountain is characterized by the high diversity of its taxonomic and phytogeographical levels. Although the floristic wealth of Sharr Mountain is not fully studied, it is estimated with about 2000 taxa, which make up about 75% of the flora of the Republic of North Macedonia distributed according to the vertical extent, the lowlands are represented by about 300 taxa.

The largest number of taxa belong to seed plants, which represent over 90% of the floristic wealth of the country, while the number of ferns and especially gymnosperms is small. In this group, there are different types of plant life forms such as: therophytes, geophytes, hemicrypophytes, camephytes, phanerophytes, etc. In the plant diversity of Sharr Mountain, the exposure and climate of the Sharr Massif, which lies in the northwest of Rep. of North Macedonia, has an important contribution. This Massif also carries many different plant communities, which are found distributed in different habitats depending on the height above sea level, the type of soil, and the composition of the substrate.



**Photo 5.** Flora on Sharr Mountain

The great variety of different wild plants, fungi, and animals in Sharr Mountain is an important sign. However, this mountain is also known for the variety of domestic animals and plants, and the local breed of dogs - the Sharr dog and the Sharr sheep - give it a distinguishing mark.

In terms of fauna, Sharr Mountain stands out for its great diversity. Here we can list invertebrates, vertebrates, and agrobiodiversity. The fauna of diurnal butterflies is presented with 167 species, which represents 80% of the fauna of diurnal butterflies in North Macedonia. On Sharr Mountain, there are not yet to be found endemic diurnal butterflies. More rare butterfly species are important from the point of view of biodiversity conservation: *Pyrgus andromedae*, *Euphydryas maturna*, *Erebia gorge*, *Erebia alberganus*, *Erebia rhodopensis*, *Erebia pandrose*, *Plebeius (Vacciniina) optilete*, *Plebeius (Agriades) pyrenaica*, *Maculinea arion*, *Zerynthia polyxena*. The beetles (*Carabidae*) are representatives of the best group of organisms - strong-winged (*Coleoptera*). About 140 species of beetles are known on Sharr Mountain. From the number of species, Mali i Sharr is one of the richest mountains with racers in Macedonia, while from the number of endemics and relics, Sharr Mountain is included among the most important mountains in the Balkan peninsula together with Prokletije, Pirin, and Rila. The grasshoppers in Sharr Mountain are very poorly preserved. So far, 40 species are known, which is less than half of the real number. There are no local grasshoppers, but 7 sub-endemics are known (*Pholidoptera aptera gjorgjevici*, *Oropodisma macedonica*, *Psorodonotus fiberi macedonicus*,

Metrioptera oblongicollis, Platycleis ebneri, Anterastes serbicus и Chorthippus biguttulus euhedicki). The land snail fauna in Sharr Mountain is represented by 49 species. Five species (Balea nordsiecki, Carinigera pellucida, Helicigona haberhaueri ljubetenensis, Orculaägneri ljubetenensis and Triloba thaumasia talevi) are local endemics of Sharr Mountain, while 11 are Balkan endemics. The Sharr dog is a breed of cattle dog with an instinct formed for guarding flocks of sheep. For the first time this breed was mentioned in the 30s of the last centuries and in 1957 it was registered as the dog of Sharr in the international cynological federation (from 1939 to 1957 it was known as the Illyrian shepherd).



**Photo 6.** Fauna on Sharr Mountain

### **Opportunities for economic activities in Sharr Mountain**

- Although Sharr Mountain has great opportunities for economic activity, for now, these opportunities are very little used. At the moment, almost only Hill of the Sun uses economic activity. This recreation centre is among the most preferred resorts in North Macedonia by fans of winter sports. This well-known recreational centre is located at an altitude of 1780 meters above sea level and about 18 kilometres from Tetovo. The road Tetovë – Hill of the Sun is regularly maintained, but remains very busy during the winter season.
- In Hill of the Sun there are several luxury hotels and weekend lodges, which are holiday homes for visitors from different countries, mainly from Albania and Kosovo. Beautiful views and ski trails make it a very attractive and relaxing place for Albanian and foreign visitors.
- In this context, Leshnica is also worth mentioning as one of the most beautiful valleys of Sharr Mountain. Leshnica is characterized by a pronounced alpine landscape and character, with high cliffs, grassy areas and dense evergreen forest with abundant conifers and other mixed forests, as well as rich endemic flora and fauna that can only be found in this country. In the rocky area there is a large and occasional waterfall, which is especially strong in spring and summer. Leshnica Valley can be reached from Sunny Hill through two routes: through Jelak and Plat peak or Ceripashina, and it can also be reached by paths leading from the village of Bozovce.

### **Discussions and Conclusions**

The assets of Sharr Mountain are distinguished by a water potential, in particular by a large number of circus lakes, with springs, stones and rivers that possess hydropower potential, then with very high-quality pastures that are a good basis for the development of livestock. A large number of medicinal and aromatic plants

grow in the pastures of Sharr, which are also the basis for the development of the pharmaceutical and aromatic industry. Sharr also has great potential for mountain tourism.

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