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Field work report

Comprehensive territorial approach and environmental stakes in two municipalities of Bosnia and Herzegovina: Mrkonjić Grad and Sanski Most

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GLOSSARY

Balkan peninsula: this is a geographical area in southeastern Europe which takes its name from the Balkan Mountains which cross the whole of Bulgaria. The region is surrounded by the Adriatic Sea in the in the northwest, the Ionian Sea in the southwest, the Aegean Sea in the south, the Turkish Straits in the east, and the Black Sea in the north.

Entity: the Dayton Agreement (signed in 1995) divides Bosnia and Herzegovina into two federal entities (the Federation of Bosnia and Herzegovina (FB&H) and the Republika Srpska (RS)) and one condominium named the Brčko District. In Bosnia and Herzegovina, entities are the first administrative division at the national level.

Ha-diesel fuel: subsidies that are given according to the surface of your field.

Heifer: a young cow that has not had a calf (Merriam-Webster, 2022)

Karstic area: terrain usually characterized by barren, rocky ground, caves, sinkholes, underground rivers, and the absence of surface streams and lakes. It results from the excavating effects of underground water on massive soluble limestone (Britannica, 2022)

Magistral road: a public road that is connected to European roads.

Natural Monument: 'protected areas set aside to protect a specific land feature, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value' (IUCN, 2022)

Polje: an extensive depression having a flat floor and steep walls but no outflowing surface stream and found in a region having karst topography (Merriam-Webster, 2022)

Ponor: a steep-sided sinkhole (Merriam-Webster, 2022)

Sink holes: a hollow place or depression in which drainage collects (Merriam-Webster, 2022)

ABSTRACT

Bosnia and Herzegovina (hereinafter B&H) is a country, rich in natural resources: diverse forests, clean water, and biodiversity. In the current context of climate change and overexploitation of natural resources, it represents a territory with environmental challenges. Studies on these issues have already been carried out at the country scale or across sectors, but few focus on territories. In this study, we assume that the territorial approach would be the best way to understand the socio-economic and cultural dynamics that lead to environmental issues. This would also allow us to make connections between scales. For this, territorial diagnostics were made in two municipalities: Mrkonjić Grad and Sanski Most, belonging to two separate entities of B&H. Landscape studies were carried out and 5 themes were studied specifically: demography, agriculture, forests, water, and industry. Management systems and governance for the main sectors were described. Several environmental threats were also identified. In both municipalities, some open spaces have disappeared due to the abandonment of certain lands during the war, as well as the constant depopulation of the country. The villages are gradually emptying, especially since agricultural activities are no longer profitable. Rivers are also subject to many pressures such as the installation of hydroelectric power stations and work to denaturalize the environment (the concrete construction of river banks, the destruction of ecosystems). They also face pollution from coal mines, present in the two territories. These mines, as well as factories present in the municipalities, are a source of pollution that directly affects the surrounding population and environment. The in-depth understanding of these different issues will aim to establish a document proposing action strategies at the territorial level and to improve advocacy at the national level.

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INTRODUCTION

This document was produced as part of an international collaborative project between two French (AIDA) and Bosnian (CZZS) environmental associations, funded by the European Climate Foundation (ECF). The International Association for the Development of Agroenvironment (AIDA) is based in Combaillaux and offers technical expertise for environmental purposes and promoting agroecology. AIDA has already participated in numerous studies in the Balkans, particularly in Albania and Kosovo. It is also working on global issues at the European level. It is the driving force behind the project. The Bosnian environmental organization *Centar za životnu sredinu* (CZZS or Centre for the Environment) is based in Banja Luka. It leads multiple campaigns in both entities: the Republika Srpska (RS) and in the Federation of Bosnia and Herzegovina (FB&H), particularly on energy transition, transport and biodiversity protection in Bosnia and Herzegovina. Advocacy and public awareness activities are also carried out.

General objectives of the project

The objective of this project is to start from territories in Bosnia and Herzegovina that make sense from the point of view of the Climate Change / Biodiversity / Agro-environment nexus, and to identify their dynamics. This is based on the assumption that the territorial scale would make it easier to link these three environmental issues. It is thus a question of apprehending which economic, sociological and cultural factors induce them and how these latter are interrelated (Figure 1).

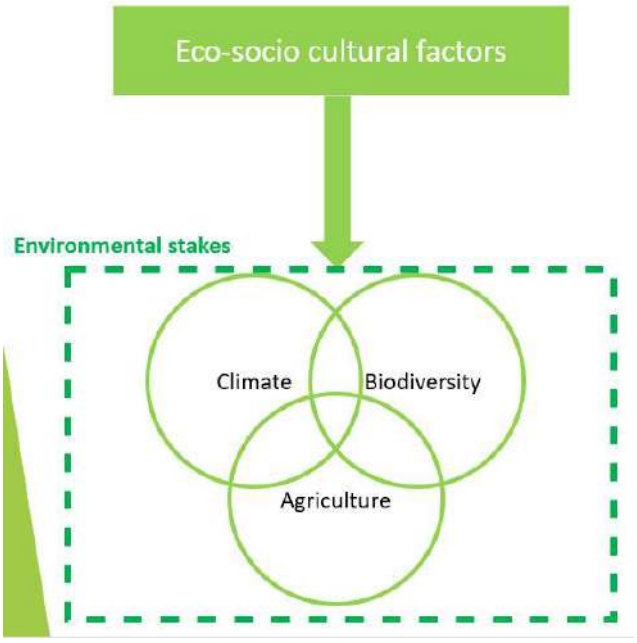


Figure 1: the objective of analyzing the Climate/Biodiversity/Agro-environment nexus in the territories.
Source: Zoé Siegel, 2023

This is in order to develop a global territorial strategy that will allow the CZZS to have an integrative vision of the issues and to put in place concrete actions of awareness, mobilization, and improvement of advocacy.

3 stages of the project have thus been planned*:*

1. Carry out a territorial diagnosis on two study areas and compare them (June to December): A French/Bosnian pair.
2. Produce a strategic document based on the diagnosis (January to March): AIDA and the CZZS.
3. Provide presentations and discussions to the actors (March/April).

This report constitutes the point 1 of the project.

The main focus of the report

What eco-socio-cultural factors induce the environmental issues of Climate Change/Biodiversity/Agro-environment in the territories and how are these interconnected?

I. METHODOLOGY

The work carried out throughout this internship is an inductive, comparative and iterative work. Preliminary hypotheses using information collected upstream were constructed and compared with observations in the field. This makes it possible to readjust/question the issues according to the discrepancies found.

I.1. STUDY AREAS

The territorial diagnosis was carried out on two study areas, each belonging to a different Entity. This was done in order to allow a comparison of governance and management methods between the two political systems, and to question a possible common management at the country level. These are the municipalities of Sanski Most in the Federation of Bosnia and Herzegovina and Mrkonjić Grad in the Republic of Serbia (Figure 2). These territories were chosen because they are subject to development pressures from harmful energy projects that threaten to paralyze the pursuit of sustainable development of areas enriched with natural and rural spaces with high potential. On the territories of Sanski Most and Mrkonjić Grad, many concessions for small hydroelectric dams have been ceded and coal mines are also present. In addition to being faced with environmental issues, these two municipalities also have specific social and administrative characteristics. They are territories located on the border with the other Entity. They are generally those which have undergone the most administrative changes after the war. Moreover, their resources (rivers, forests) straddle two political structures and therefore two different managers. This raises the question of a possible future common management of these spaces.

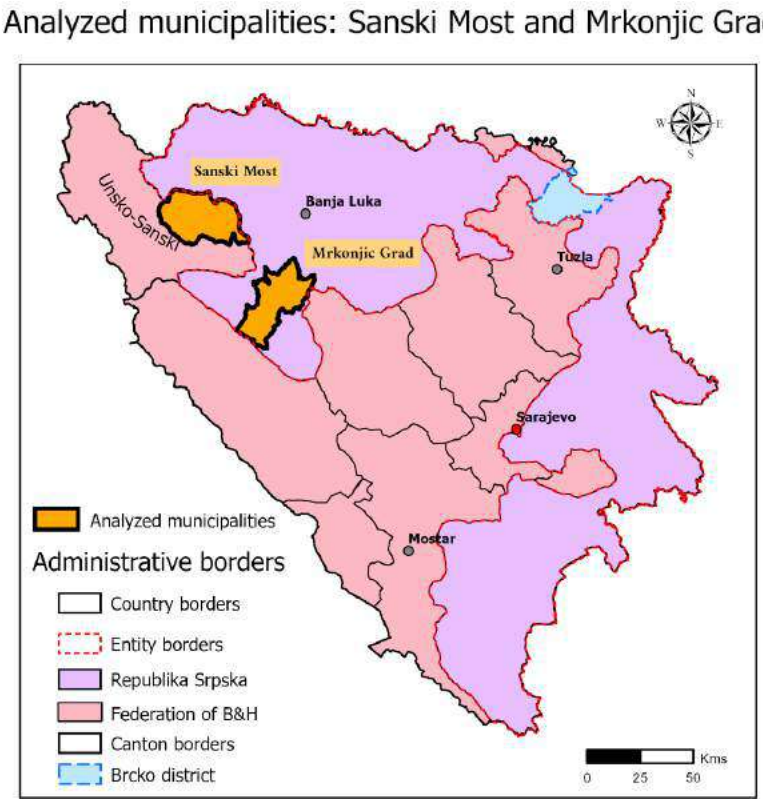


Figure 2: Analyzed municipality locations.
Source: Zoé Siegel, 2023

I.2. THEORETICAL FRAMEWORKS

The methods used to carry out the territorial diagnosis mobilized two theoretical frameworks. However, their use was not systematic.

The first framework used is the Strategic Analysis for Environmental Management (SAEM) which stems from management sciences. The SAEM is based on an objective of environmental performance and thus expects an ecological result. It puts at the centre an environmental reference to be preserved (an ecological entity such as an ecosystem, a species, etc.) which becomes the objective of its application. This environmental objective is supposed to coexist with other economic, social, logistical projects, etc. Various actors thus revolve around it with various practices and relationships (between them and in relation to the frame of reference), which should be explained and prioritized. This is called effective management. This makes it possible to follow the state of the repository and to understand the organization of which it is part. All this in order to be able to act on it by formulating a theory of action to achieve the environmental objective. This part is called intentional management. It analyzes the effective management and takes into account the balance of power between individuals and the available resources in order to establish a strategy. It relies on environmental actors, generally few in number, to implement it. This, assuming that the changes generally come from small groups of individuals (Mermet *et al.*, 2005).

In this project, however, there is no precise environmental reference defined. It is rather an exploration of the elements that could constitute it.
Effective management was used to understand the organization around the issues of the Climate Change/Biodiversity/Agro-Environment nexus.
Intentional management will be addressed in the discussion and when designing the strategy document.

The second theoretical framework stems from socio-anthropology and is based on two approaches:
- the interactionist approach which encourages the study of local dynamics through the interactions between individuals. It is thus a question of understanding the relationships and the balance of power between the different people.
- the comprehensive approach which pushes the analysis of the meaning that individuals give themselves to a situation. It is thus a question of influencing their remarks as little as possible (Olivier de Sardan, 1995).

I.3. THE PROCESS OF THE MISSION AND THE METHODS USED

This work was carried out by a French student and a Bosnian student over a period of 6 months, from June to December 2022: 1.5 months of preparation and bibliographic reading, 4 months in the field and 1.5 months of analyses and writing.
The final document was written in English, the language in which we communicated.
The field phases were carried out in the two municipalities of Sanski Most and Mrkonjić Grad, while the bibliographic and analytical work was carried out in Banja Luka, which was the place where the two students lived.

In order to carry out the territorial diagnosis and to address the issues we have identified, a landscape analysis was carried out and 5 themes were particularly analysed.

I.4. LANDSCAPE ANALYSIS

In this study we consider the landscape as the first key to observing and understanding the dynamics of the territories. It is a question of integrating initial information concerning the development of natural spaces in order to understand the existing connections between Man and Nature. The state of natural areas and the apparent pollution of the territories are also direct indicators of Climate Change / Biodiversity / Agro-environment.

The analysis of the landscape of the two territories was carried out by crossing different sources of information, at different scales:

- Bibliographic information
- Satellite and cartographic data
- Our observations: constant observation took place in the field, coupled with taking photos.
- Informal discussions with the population

Different tools were used to assemble and synthesize this information: maps, diagrams, images, associated with descriptions. A general presentation of the landscape starting from the scale of the country to the scale of the municipality was carried out initially. Then a detailed landscape analysis guide for the territories was created as an additional source of information.

I.4.A. FIVE IN-DEPTH THEMES

The 5 themes on which we have focused are: demography, agriculture, forests, rivers and industries. To do this, we cross-referenced information from the bibliography with that taken from interviews in the field.

I.4.A.a. A preliminary bibliographic work

A preliminary bibliographic work was carried out in order to create thematic sheets on each of the 5 sectors analysed. This achievement made it possible to develop initial hypotheses and to establish interview records.
The questions that led us to establish them are the following:

What are the natural resources present in the territories? What threats are they subject to? What are the dynamics of management and use of these resources and how are they interconnected? Who are the actors? What are the sources of pollution?

During this work, the Bosnian student had the role of translating and highlighting important information (concerning the different themes) from the documents in Bosnian.

I.4.A.b. Semi-structured interviews

Our study was conducted on the basis of semi-structured interviews (guided by general open and non-specific questions). In the majority of cases, the language used was Serbian. The questions were asked/written in English and then translated by the Bosnian student. The caller's response was translated into English.
Some interviews, considered as being more important than others, were recorded, allowing the full transcription of the conversation. In the majority of cases, only notes were taken. Informal discussions with the inhabitants also made it possible to gather information.

The interviews took place in the form of field surveys. Only 3 contacts had been identified before the mission, given by the CZZS.

This method allowed us to meet many different profiles (Figure 3 and Figure 4). A total of 90 interviews were carried out: 52 for Mrkonjić Grad (including 3 in Banja Luka), as well as 38 in Sanski Most.

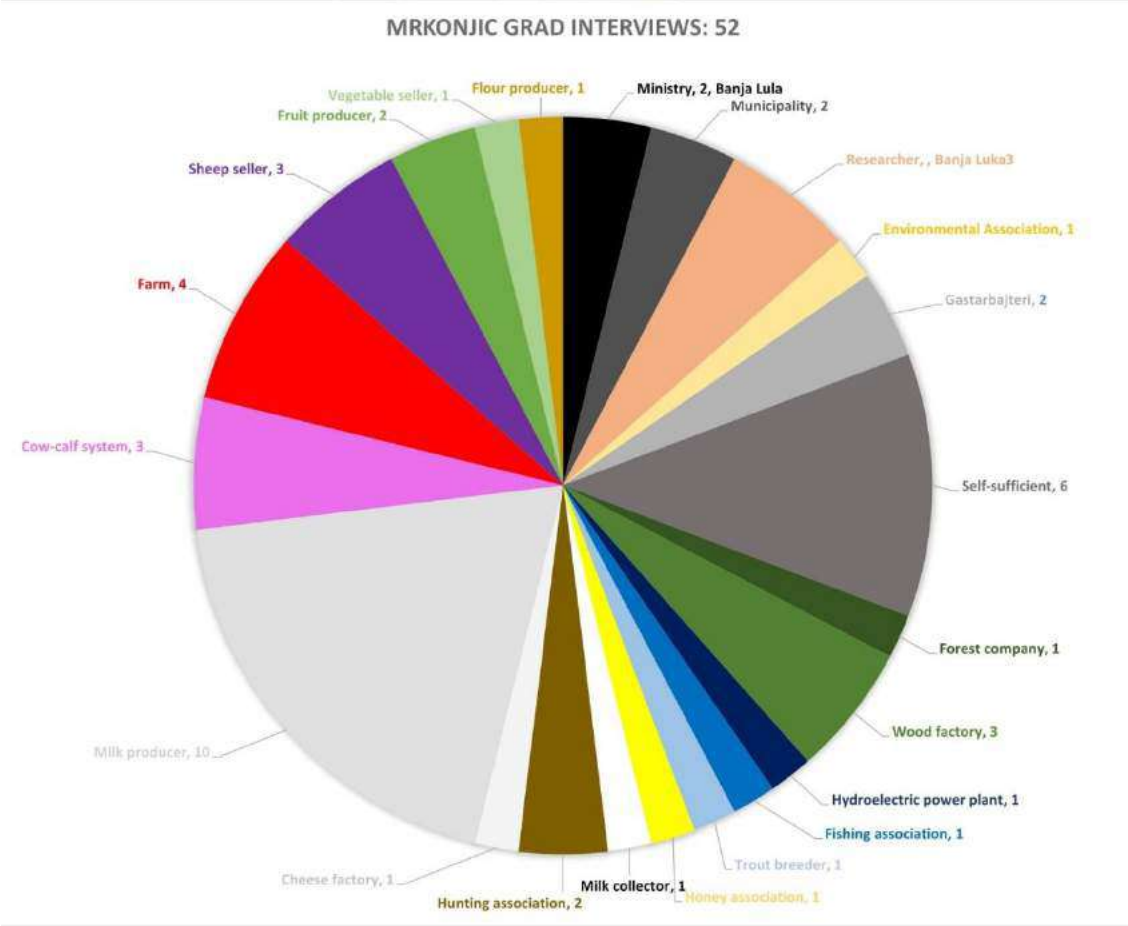


Figure 3: Interviews in Mrkonjić Grad per type of actor.[1]
Source: Zoé Siegel, 2023

[1] *Gastarbajteri*: Serbian word for Bosnian people who no longer live in the country but usually return there for holidays.

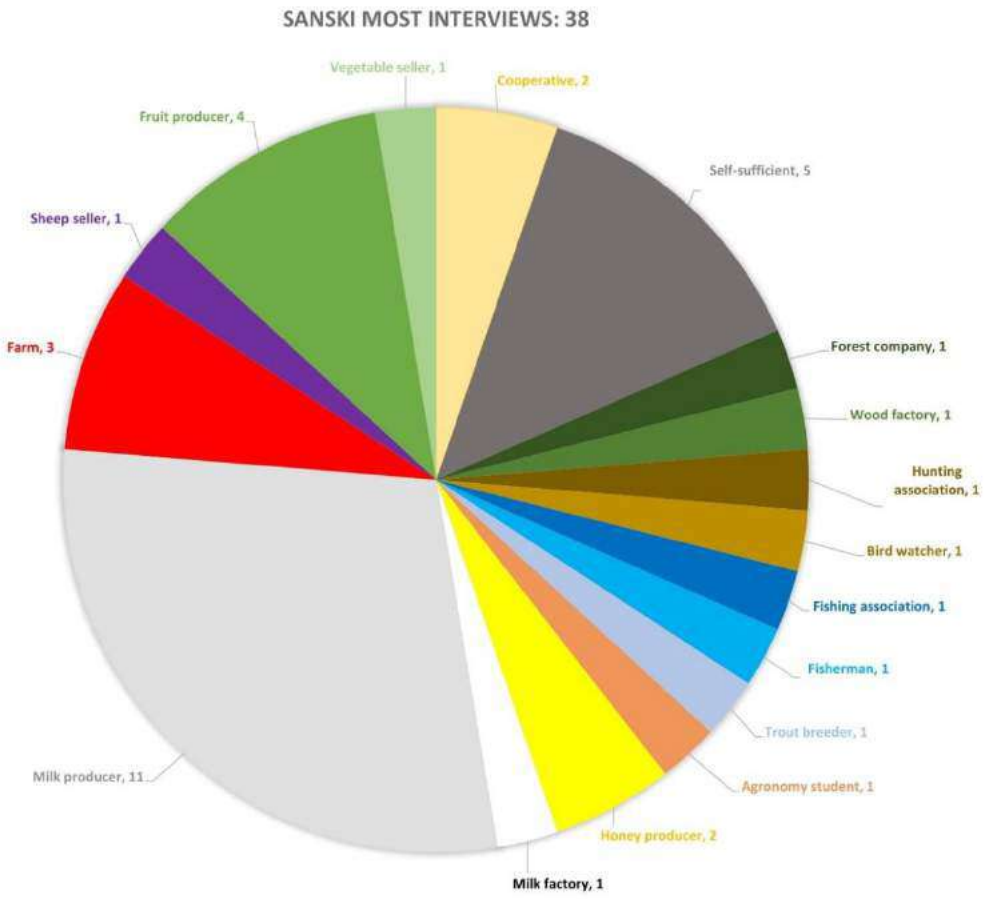


Figure 4: Interviews in Sanski Most per type of actor.
Source: Zoé Siegel, 2023

After each territorial exploration session (4-5 days), we returned to Banja Luka to transcribe the interviews and put our information in order. A break of about 5-6 days was thus made, also allowing the preparation of the second phase of exploration.

The division of labour

The transcripts were distributed according to the quality of the translation of the interviews. Those that had not been translated well went to the Bosnian student.

While the French student took care of gathering the important information from the exploration phase and making the presentation, the Bosnian student organized the contact with the actors to be interviewed and reserved accommodation.

The following questions, concerning the next phase of exploration, were discussed together: which area to explore, which actors to interview, how many days would be needed, which maps, documents to make or print?

I.4.B. THE ANALYSIS PHASE

Important information from the transcripts was listed in an Excel table and classified according to each sector studied. For agriculture, these data were georeferenced and statistics were calculated. Synthetic schemes were also developed from the data collected.

I.4.B.a. The cartographic tool

Many maps were produced using the Geographic Information System (GIS) processing software ArcGIS Pro 2.8.0. They were carried out mainly for landscape analysis, allowing multi-scalar topographical representations, as well as for administrative representations.
Google Earth was also used as an instrument in the creation of maps with a background of satellite images.
Most of the map data was provided by Marko Ivanisevic in Banja Luka. The other maps were created from our observations, or pre-existing data retrieved from open source (Copernicus, FGU, IPP FB&H, European Environment Agency, GADM, Protected Planet, MapCruzin, GeoData).

The analysis phase was carried out in parallel with the writing phase.

I.4.B.b. A not entirely accessible territory

In Bosnia and Herzegovina, land mines are still present, dating from the civil war. Some areas are therefore inaccessible because they are dangerous. In both municipalities, it was impossible to go to such areas, located mainly in the forests adjacent to the borders of the Entity.
In addition, most of the roads indicated on Google Maps dating from before the war no longer existed or are no longer in a good condition, which also limited our exploration.

The fieldwork was carried out by a pair of students from France and Bosnia and Herzegovina (Banja Luka).
Certain subjects were complicated to broach, in particular in relation to the war, personal trajectories and decisions about places
of residence. This is why these questions will not be discussed in detail in this document based on the interviews.
Contacts were sometimes more delicate in the Federation and therefore there were more interviews carried out in the municipality of Mrkonjić Grad
which has probably been studied in more detail.

II. A MULTI-SCALAR LANDSCAPE ANALYSIS

II.1. BOSNIA AND HERZEGOVINA -A MULTI-FACETED COUNTRY RICH IN WATER.

Bosnia and Herzegovina (B&H) is a relatively small country with a total area of 51 209 km^2, including 12.2 km^2 of continental coast (Ahmetbegović, 2014). The only access to the Adriatic Sea is by Nemuski bay, which is 7.8 km long and cuts the Croatian lands into two.

B&H is characterized by a complex relief. The territory is constituted of 5 % of lowlands, 24% of hills, 29% of **karst**ic areas and 42% of mountains (UN, 2013). The country is predominantly mountainous with an average altitude of 625 meters, and the highest point is at 2 368 m above sea level (the Maglić mountains) (Annexes 1.8). In the morph tectonic sense, the area of Bosnia and Herzegovina belongs to the geomorphic structure of the Dinarides, a mountain range that stretches in a northwest-southeast direction, from Slovenia to Albania (Figure 5).

Based on geological, geomorphological, pedological, hydrological, and climatic characteristics, the territory of Bosnia and Herzegovina is generally divided into three morphological units: the Pannonian region in the north, the mountain-basin in the central part of the country, and the Adriatic part in the south (Annexe 1.1) (University of Banja Luka, n. d).

- The Pannonian region encompasses the northern plains of Bosnia and Herzegovina, as well as the southern rim of the Pannonian basin (Annexe 1.2). It rises 200 to 800 m above sea level, and in some places up to 1000 m. The Pannonian region has favorable conditions for agriculture. The most valuable arable areas of the country are located there: Posavina, Lijevče **polje** and Semberija (Annexe 1.3). From this northern part, a moderate continental climate penetrates the river valleys deeper into the Mountain-basin unit.

- The Mountain-basin unit is very diverse in relief forms and structure. Mountains belong to the Dinaric system and smaller parts to ore and flysch mountains. In relation to the natural-geographic characteristics, several zones are conditionally distinguished (Annexe 1.4). In addition to the continental climate, a mountain climate is also felt in this unit, in the foothill and mountain areas (over 1000 meters above sea level).

- The Adriatic unit includes the territory of Lower Herzegovina (region Humina, Popovo polje, Hutovo Blato and Mostar basin), Bilećke Rudine, and the coast. The relief of Lower Herzegovina is diverse and characterized by flat **karst** fields (**polj**a), low plains and the Neretva river with mountains on the outskirts of the region. A Mediterranean climate appears in the southern part of the country: the area of Herzegovina, due to the presence of the Adriatic Sea.

The two studied municipalities are located in the northwest part of the country (Figure 11). Mrkonjić Grad and the southern part of Sanski Most belong to the mountain basin unit, in

karst regions where mountains are mostly composed of limestone folds with **polje** in between (Annexe 1.5). The northern part of Sanski Most belongs to the Pannonian unit. A plain marks the separation between the two morphological units.
One important difference between the two municipalities is the elevation. Sanski Most varies between 160 and 1100 m with a mean altitude of 500m, whereas Mrkonjić Grad rises from 300 m to 1400 m, with a mean of 591m (Annexe 2.2).
Both municipalities are under the influence of a moderate-continental climate but their geomorphological structures also drive differences. Sanski Most is characterized by a moderately warm and humid climate while Mrkonjić Grad is characterized by the microclimatic characteristics of the mountain climate (University of Banja Luka, n.d.).

In these municipalities as for the whole country this geomorphological complexity allowed the development of various ecosystems and a rich biodiversity with a high rate of **endemism** (World Bank, 2021; Lerin & Bernard-Mongin, 2021). Bosnia and Herzegovina is rich in natural resources: 63% of its territory is covered by forests and forest lands (3 231 500 ha) (Annexe 1.3). It includes 51.13% of high forests and 38.7% of coppice forests. The rest is composed of other forest lands such as thickets, glades etc. (Second state inventory of forests in B&H, 2005-2009) (FAO, 2015).
Mrkonjić Grad and Sanski Most are two heavily forested municipalities, with several types of forests. Forests and forest lands cover 76.55 % of Mrkonjić Grad municipality and 62.20% of Sanski Most territory (Institute of Civil Engineering "IG",2017; 2022).

B&H is also rich in water with significant numbers of natural springs with potable water and thermal groundwater (USAID, 2020). In the hydrological sense, the water of Bosnia and Herzegovina belongs to two watersheds: the Danube and Adriatic basins, the dividing line being in the central Dinaric mountain (Annexe 1.6).
In total 75.7% of the territory gravitates to the Sava river at the northern border of the country. This flows into the Danube and by repercussion into the Black Sea. The other 24.3% flows to the Adriatic Sea basin (Federal Hydrometeorological Institute, 2022). B&H possesses 8 main rivers. The Sava, Vrbas, Bosna, Drina, Una and Sana are surface rivers with springs in mountainous areas and belong to the Danube basin. The **karst**ic rivers Trebišnjica and Neretva belong to the Adriatic basin. The Trebišnjica is the longest sinkhole river in Europe with a total length of 187 km of which 96.5 km is underground. At the country scale, B&H is divided into 10 watersheds (Annexe 1.7).
Two main rivers cross the studied municipalities (Figure 5). The Vrbas river goes through the north of Mrkonjić Gras flowing through a canyon. Its source is in the municipality of Gornji Vakuf-Uskoplje in the Vranica mountains. After Mrkonjić Grad, it crosses the city of Banja Luka to finally flow into the Sava river in the north. The other river is the Sana. It starts in the south-west part of Mrkonjić Grad, where it flows through a canyon. The river keeps flowing through different geomorphological landscapes and arrives in Sanski Most, through a canyon. The landscape finally opens out to form a large plain in the municipality where the Sana continues to flow until it reaches the Una river. Both municipalities are part of the Una watershed but Mrkonjić also straddles another one: the Vrbas watershed (Annexe 1.7).

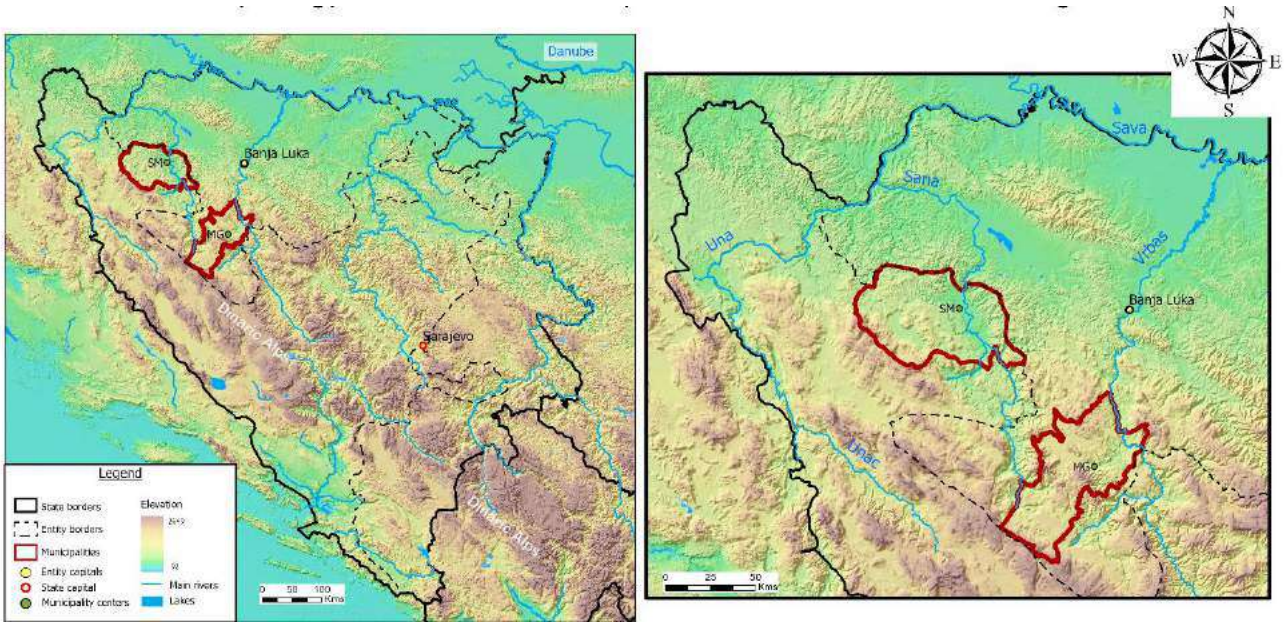


Figure 5: Geomorphology and main water components of Bosnia and Herzegovina.
Source: Zoé Siegel, 2023

Looking at the geomorphology of the country we can distinguish the three units of B&H; The flat part in green mixed with some hilly patches in the north corresponds to the Pannonian unit. The Mountainous basin crosses the country diagonally. The Adriatic unit corresponds to the southern part, also a mix of both flat and hilly mountainous areas. Sanski Most is divided between the flat green part which belongs to the Pannonian unit and the hilly, mountainous part from the Mountainous basin. Mrkonjić Grad is completely hilly and mountainous and belongs to the Mountainous basin. The main rivers are also represented with a close up of the water network linked to the two municipalities.

II.2. TWO NATURALLY CONNECTED MUNICIPALITIES...

Sanski Most and Mrkonjić Grad are two municipalities of respectively 781 and 685 km^2, separated by 35 km of valley (Municipality of Sanski Most; Municipality of Mrkonjić Grad, 2022).

They are connected by the river Sana, which is an important water component for both territories (Figure 6). It is considered one of the most beautiful and cleanest (latin adjective sano or sanare meaning cure, heal or healthy) rivers in the country. It starts from three strong **karst**ic springs near the Donja Pecka village in the municipality of Mrkonjić Grad. The natural importance of this place led to the creation of a protected area also overlapping a part of the adjacent municipality Ribnik (Annexe 6.1). It is classified as a **Natural Monument.** The three springs collide after 1.5 km into the Korana river to form the Sana. The total length of the river is 146 km. In its upper course, it is a fast-mountainous river (very cold and clean) which could be characterized as a transitional **karst**ic river until it reaches the municipality of Sanski Most when it becomes a real lowland river to its confluence.

The other connection between the two study areas is the Dinaric formation. These mountain ranges which cover both municipalities are mostly composed of dolomite and limestone rocks, characteristic of **karst**ic areas (Annexe 2.1). They are present in the south of Sanski Most and cover the whole municipality of Mrkonjić Grad with its five mountainous units (Figure 6).

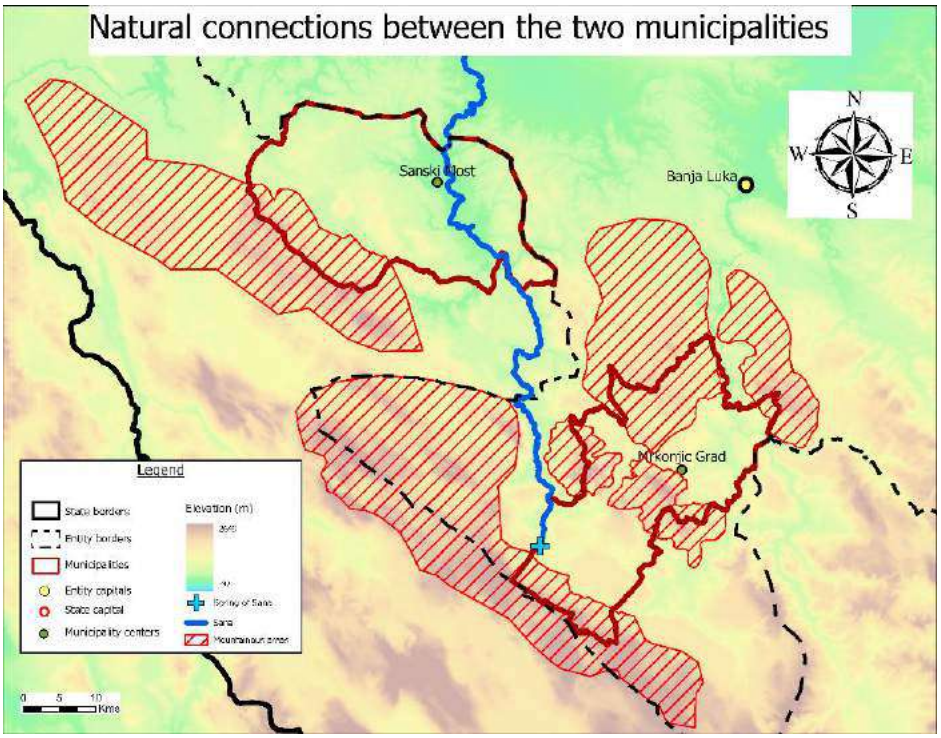


Figure 6: Mountain range units and common water courses of the two municipalities.
Source: Zoé Siegel, 2023

II.3. …WITH UNIQUE LANDSCAPES

Despite these connections, differences can be observed between the two municipalities. To characterize and describe the two territories, we divided them into units (Figure 7) that were identified based on several factors: geomorphology, geology, satellite images, bibliography, field observation and inhabitants' testimony (Annexe 2). As natural elements are not stopped by administrative borders, we represented the whole landscape formations even if they exceeded the municipality. Building our map mainly on topographic structures was a choice. It was a good way to distinguish the main components of the territories and compare them. Other parameters such as the vegetation, land use, and soil were too diverse inside each municipality at a more precise scale. However, we tried to describe them as well as possible inside the different units (*cf* Landscape guide: Malešević and Siegel, 2022: Annexe 8).

As the majority of people left during the war and depopulation currently continues, we observed different stages of natural regeneration in different environments. We chose to represent the main changes engendered by this phenomenon.

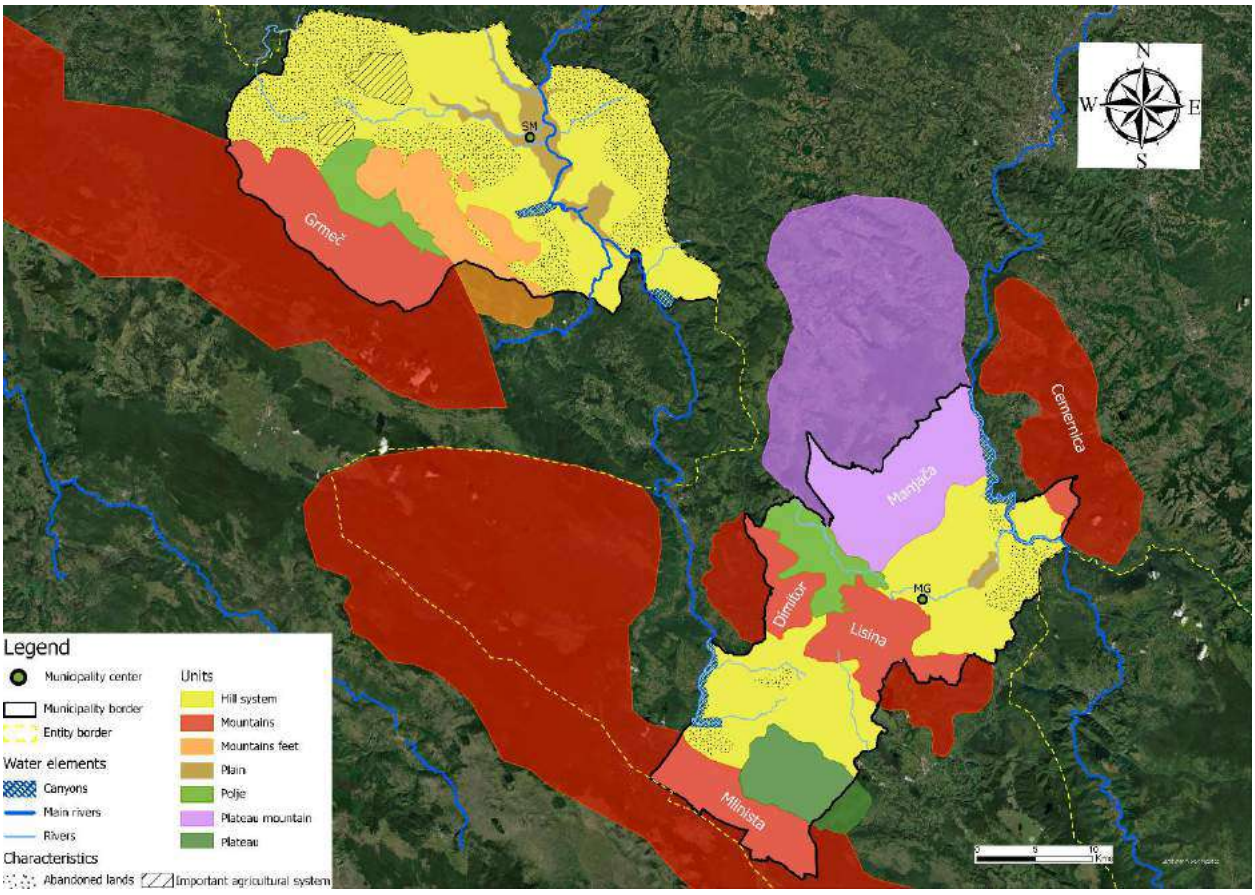


Figure 7: Landscape units of both municipalities and their main rivers.
Source: Zoé Siegel & Borka Malešević, 2022

There is only one mountainous area in Sanski Most (Grmeč) and five in Mrkonjić Grad (Mlinista, Dimitor, Lisina, Cemernica and also Manjaca, which is called a "plateau-mountain system"). In between the mountain units, a **polje** is present in both municipalities: Lušci polje in Sanski Most (380 m high) which is surrounded by Grmeč and its foothills; Podraško polje in Mrkonjić Grad (730 m high) between Manjača, Lisina and Dimitor. Both areas accumulate a lot of water from the mountain runoff. A karstic plateau is also located at the feet of Mlinista in Mrkonjić Grad: Podovi plateau which is 800 m high.

The biggest units of both municipalities are the hill systems. However, they are not homogeneous. The five mountains of Mrkonjić Grad fragment the landscape and lead to a complex and heterogeneous hill system. The landscape changes frequently when crossing the municipality, which makes it hard to describe. There is only one small plain area: Bjelajce. Sanski Most is easier to fragment. The plain of the Sana constitutes a natural barrier that divides the hill system into more differentiated parts. On the west side of the plain the whole area is karstic with an underground water network, whereas the eastern parts are rich in surface streams.

Land characteristics generally influence the demography. Activities are concentrated in plains, near rivers, and agriculture depends on where the fertile lands are located. However, this influence is not unilateral and humans also drive the landscape. In Europe, people are used to living in managed areas: everything is controlled, even the "wild" areas are delimited and monitored. These are anthropic landscapes.

In Bosnia and Herzegovina, it is the people's absence that fragments the formerly managed landscape. A lot of lands have been abandoned. They evolved in intermediate states of regeneration. This phenomenon is more or less observable everywhere. Sometimes, it has led to the formation of huge areas of pioneer vegetation.

The vegetation will depend on the initial abandoned habitat and also on other environmental conditions (climate, proximity to a forest, nature of the soil). We generally observed shrubs or trees in former calcareous pastures. In lands with more soil and fewer apparent rocks there would also be additional brambles and ferns. Wet areas turned into rich meadows or developed the monospecific vegetation characteristic of wetlands (

Figure 8). Forests in mining areas have grown denser. In rural areas, we observed that at least $\frac{1}{3}$ of land is subject to the spontaneous growth of the vegetation. This increases the farther you go from the main roads and developed areas. Many agrarian systems are closing, invaded by vegetation. Their typical open landscapes are disappearing.

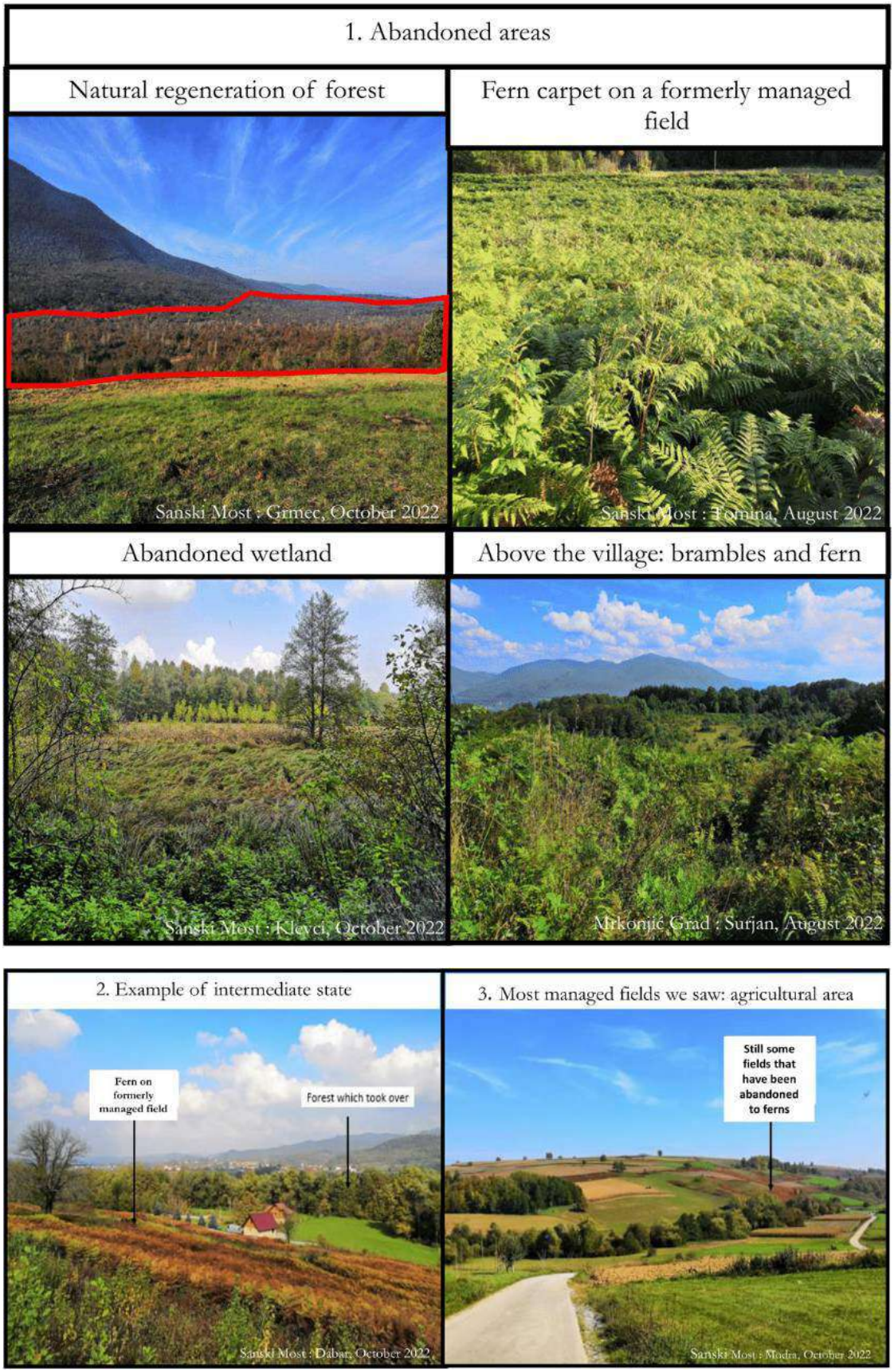


Figure 8: Pictures of different degrees of land abandonment.

Source: Zoé Siegel, 2023

1) Pictures of different abandoned areas in various environments. 2) Picture of mixed managed and unmanaged lands. 3) A used agrarian system.

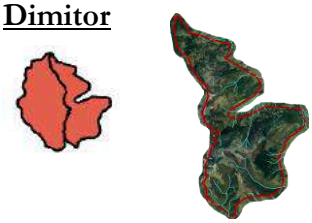
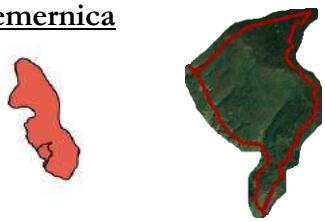
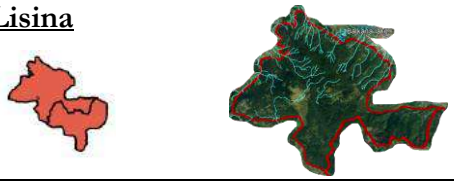
This phenomenon is particularly visible and important in Sanski Most where huge areas have been invaded by vegetation and become inaccessible. Traces of ancient exploited lands can be detected, especially on the plateaus of the hill system. Some parts are uninhabited. Mrkonjić Grad has smaller parts of abandoned lands, where a small number of people usually still live. Abandoned areas can still belong to some people who never returned to rebuild and manage their fields. Abandoned houses are present in the middle of the spontaneous vegetation. Some people use those lands for beekeeping or livestock, but no one really manages them.

Find the description in detail of each municipality and their landscape units in the following pages.

II.3.A. MOUNTAINS

Mrkonjić Grad

Some people still live in the mountainous villages but they are among the least accessible and most abandoned ones.

Dimitor 	**Čemernica** 
Description: Dimitor is a limestone mountain range, located southwest of Podračko polje and eastward from the upper stream of the Sana river. It straddles the municipalities of Mrkonjic Grad and Ribnik. Its streams flow into the Sana river. In those mountains, we find its source in the Štrbina pass (935 m) which separates the Dimitor and Lisina mountains. Despite this water presence, Dimitor is generally scarce in water springs.	**Description:** Čemernica mountain overlaps the municipalities of Mrkonjić Grad, Kneževo, and Banja Luka, and is surrounded by the Vrbas and Ugar rivers. It is characterized by karst terrain with limestone and dolomite rocks. The southern part is mostly dry, while the rest includes several springs. Čemernica is characterized by a significant presence of coniferous forests.
Ovčara-Mliništa 	**Lisina** 
Description: Ovčara is a mountain chain that stretches between areas of Mrkonjić Grad and Glamoč municipalities. Mlinište is a settlement in the mountain. Previously, there was a railway station on the Srnetica-Jajce narrow-gauge railway. Now it is a road that connects northern and central Bosnia.  Kurozeb is the highest point of Ovčara and the summit of the whole municipality with an altitude of 1,604 m.	**Description:** Lisina is located in the municipalities of Mrkonjić Grad, Šipovo, and Jezero. It is a mountain of volcanic origin with a complex geological structure made of different formations. From a pedogenetic point of view, all rocks present in the massif can be classified into two groups: carbonate and silicate rocks (Eremija, 2015). The area is characterized by a broken relief with steep slopes cut by numerous watercourses. It is one of the richest sources of potable water in the Republic of Srpska with more than 360 springs of clean water.

A close up on Lisina

Lisina mountain behind the city of Mrkonjic Grad

View from Oćune village

Thanks to its composition, Lisina is characterized by exceptional biological diversity: -1 000 plant species -About 1 500 species of fungi -5 types of fish -About 10 species of amphibians and reptiles -29 species of mammals -107 species of birds

Picture taken in Balkana lake surroundings

It is covered with mixed forest communities of beech, fir and spruce (Eremija, 2015).

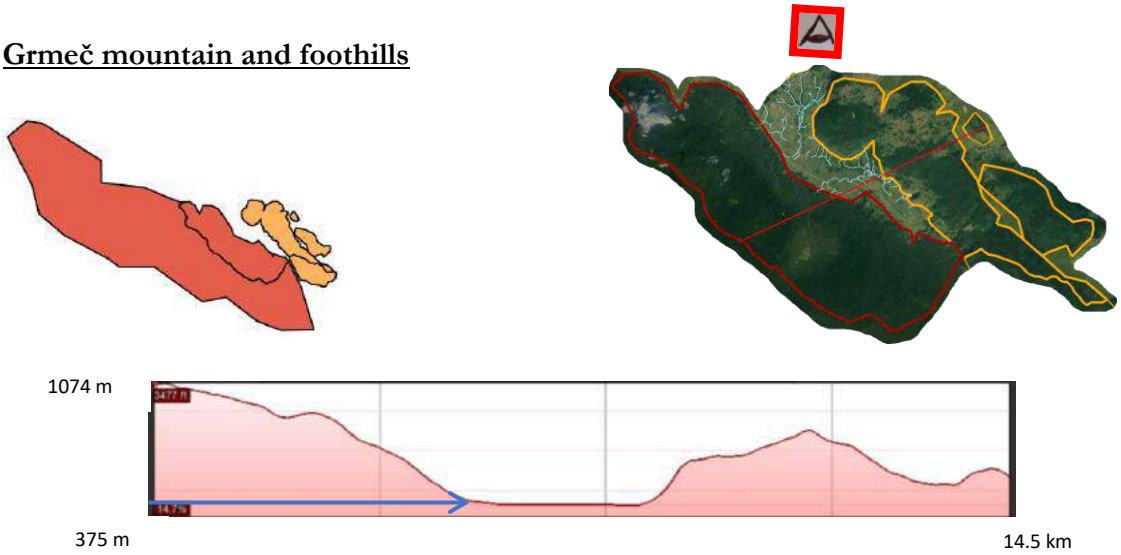
Mushrooms gathered by people from the Zelenkovac ecozone

Zelenkovac is an ecozone at the feet of the Lisina mountains: it is presented as a small village with typical old houses.

Lisina was proposed as a protected area but the idea was abandoned after multiple disagreements between the different actors.

Sanski Most

Grmeč mountain and foothills



Description:

Grmeč is a mountain that stretches in the northwest direction with a total length of about 70 km, between the valleys of the Sana and Una rivers. It is located on the territory of several municipalities: Sanski Most, Bihać, Bosanski Petrovac, Ključ, and Bosanska Krupa. It belongs to the medium-high mountains in B&H: with gentle slopes and hills. The highest peak in the Sanski Most is Koračnica (1480 m above sea level).

Grmeč and its foothills are karst relief dominant. The mountainous system envelops the Lušci karstic polje (375 m) (cf elevation profile). The mountain is characterized by an abundance of water under the limestone surface. Those waters reappear in the polje and sink on its edges.

The river Sanica, one of the nine rivers of Sanski Most, takes its source at the foot of Grmeč in the municipality of Klujc.

II.3.B. MANJAČA – KARSTIC PLATEAU

Mrkonjić Grad

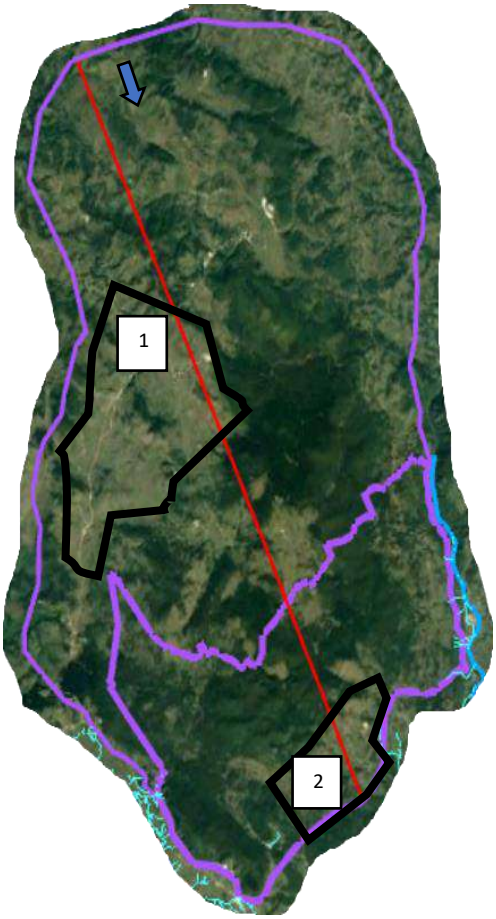
1. Huge karstic *plateaus* used as pastures, characterized by the presence of sinkholes. (Banja Luka municipality, October 2022)

2. Succession of small *plateaus* used as pastures. The soil is made of dystric kambisol (dystric brown soil) favourable for growing potatoes, wheat, oats, and barley. (September 2022)

Description:

Manjača stretches between the city of Banjaluka, Mrkonjić Grad and Ribnik municipality. It is surrounded by the Vrbas river in the east and the Sana river in the west.

It is a mountainous area characterized by patches of karstic *plateaux*, made of dolomite and limestone rocks. This karstic landscape is characterized by a large number of developed underground and surface karstic forms: sinkholes, coves, pits, caves. There is little fertile land, except at the bottom of a sinkhole, where water accumulates. A lot of shepherds use these vast areas as pasture for their sheep (2) and other farmers let their cows graze in the smaller ones (1). The white rocks are apparent at the surface and can be mistaken for sheep from afar.



Manjaca is a good place to observe the successional stages of vegetation. It alternates between pastures, shrub vegetation and forest. The shrub vegetation is a Natura 2000 habitat: a sclerophyllous scrubs habitat (or Matorral) characterized by *Juniperus communis* formation on heath and calcarous grasslands. (n° 5130; Milanovic *and al.*, 2015). It is actually a temporary habitat ("of natural limited duration") because it appears on abandoned pastures and moves "in the direction of climatogenic beech and fir forests in the hills, and beech, fir and spruce forests in the mountainous areas". It is the natural evolution of the pastures without cattle intervention.

Calcareous grasslands

Beech, fir forest

Bunarevi, Manjača (J. Brujić)

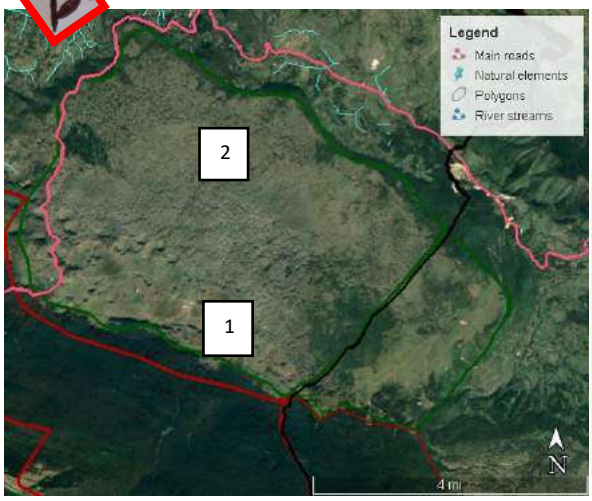
Matorral 5130

Successional stages of the habitat 5130

II.3.C. PLATEAU

Mrkonjić Grad

Podovi plateau



Description:

The Podovi plateau is located in the foothills of the Ovčara-Mliništa mountainous range and other mountains (Vitorog). It stretches between the area of two municipalities: Mrkonjić Grad and Šipovo. It rises above the surrounding terrain with an altitude from 800 to 1000 m above sea level.

The area is karstic and characterized by a succession of sinkholes that cover the entire surface: seen from the sky the plateau seems to be covered by dots. Caves are also present. These are unexplored and present in the areas of Jazimovača, Kosara, Korana, and Tursinovača for example. All water is underground and the terrain is represented by poorly developed stony soil (calcomelanosol). The entire plateau is built from a mosaic of calcocambisol, calcomelanosol, luvisol and rendzina. Luvisol (brown soil) appears in sinkholes, suitable for cultivation with necessary agrotechnical measures (poor in phosphorus). Cultivable surfaces (1) are bound to luvisol and calcocambisol. The rest of the terrain has the following characteristics: great rockiness, shallowness, drainage, and aridity (2) (Annexe 2.3).

The cultivable surfaces are populated. They are present at the edge of the plateau (the foothills of Mlinista). The dominant activity is cattle breeding. The area is managed into pastures: we observe grasslands as in Manjaca (1). Rocks are also used to build walls and sinkholes are exploited for agriculture.

The inner part of the plateau towards the Lisina mountain is uninhabited with no human activities present and is covered by scrub and some trees (2). The vegetation looks similar to the 5130 Natura 2000 habitat of Manjaca (*cf.* below), with a strong presence of *Juniperus*

communis. However it seems more advanced in the progression of afforestation, in between scrub and forest habitats.

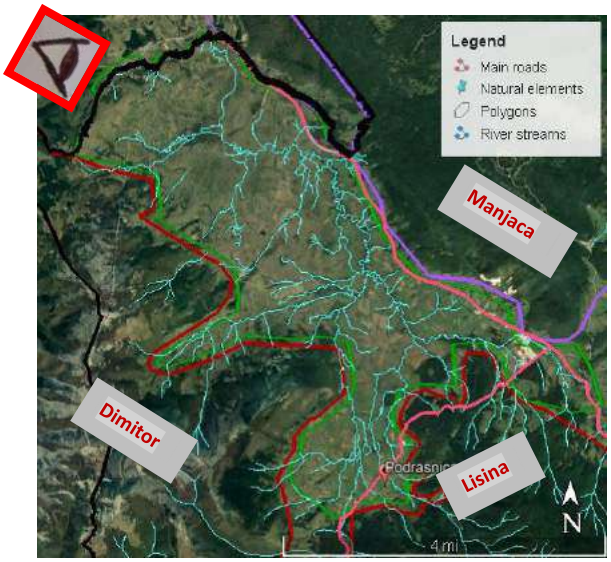
The difference between the 2 areas is clear.

Here we can observe the difference between the two habitats, with even a patch of forest.

II.3.D. POLJE

Mrkonjić Grad

Podracko polje



Description:

Podračko polje is located in the western part of the municipality. It is a karstic field surrounded by the Lisina Manjača, and Dimitor mountains in the southeast, the north and the west respectively.

The area is characterized by an alluvial terrain. An underground water network is developed with a unique river that flows into a ponor in the southern edge of the field. This river collects the waters of the smaller streams and sinks in the foothills of the Manjača mountain, crosses the whole unit, and reappears in Krupa na Vrbasu, a river in the city of Banjaluka. Krupa river then flows into Vrbas as a left tributary.

Podrašinačko polje represents the largest area of fertile lands in the municipality. It is managed and used for agriculture and animal grazing. Around the streams, wet areas appear with characteristic vegetation. We then observe a landscape fragmented between agricultural areas, pastures, abandoned land with ferns, and wetlands, with villages located at the foot of the mountains. The main village is Podrasnica which gives its name to the polje or vis versa.

Villages at the feet of the mountains - Podrasnica, September 2022

Pictures taken in Orahovljani

Wet areas

The water streams can be followed by patches of reeds and *Juncaceae,* or lines of riparian trees.

Grasslands

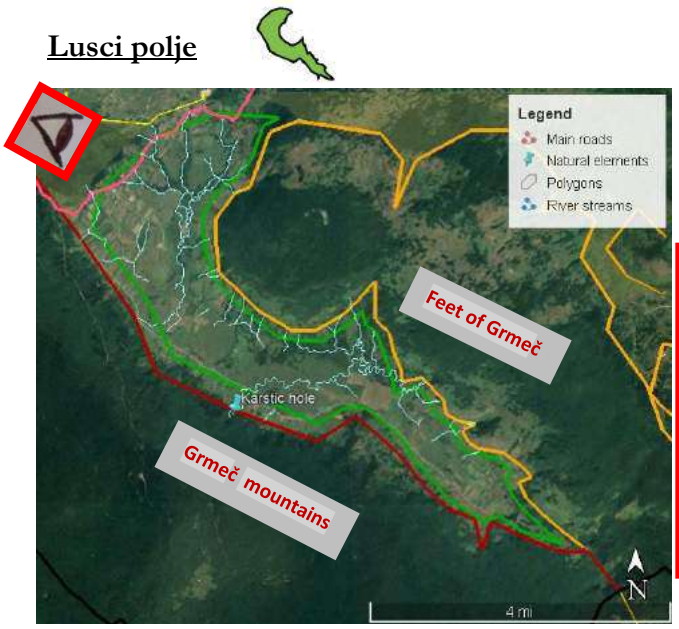
One shepherd with his sheep coming from Manjaca. (October, 2022)

Cultivated lands

The lower part of Orahovljani, at the feet of the Dimitor mountains. People cultivate vegetables in their small gardens, especially cabbages. There are also crop fields around that had already been harvested.

Sanski Most

Lusci polje



Description:

Lušci polje is located between Grmeč mountain and its foothills. It stretches in a northwest-southeast direction with a total area of 24.23 km^2 (Davidović & Miljković, 2001). The altitude of the field is 377-389 m above sea level (Davidović & Miljković, 2001). The field is characterized by a developed underground hydrological network, which sinks in the field and comes out of the springs of the Zdena and Dabar rivers. The longest surface river in the polje is the Jezernica, with a total length of 10. 5 km. Around 7 km2 of the area is periodically flooded and forms a small lake. The water also fills the estavel (hole) present at the border of the area. This hole is known as the Bobijaško oko (Bobijaško eye), a karst structure that, during high water levels and heavy rainfall, becomes a spring that overflows and floods the field.

Bobijaško oko

Grmeč mountain and its surrounding area are under the influence of two climates:

- A mountainous climate which belongs to the southern ranches of the northern temperate zone

- A moderate continental climate which belongs to the northern temperate zone and northern branches of the subtropical belt in the pre-Atlantic sector (Behram, 2018). That is why through Grmeč there is an intensive exchange of air masses, resulting in significant amounts of rain. Because of the karstic terrain, waters from Grmeč sink and reappear in the field by resurgence. Even though the Polje is karstic, it is covered by green vegetation such as meadows and arable lands, because of the constant presence of water. It is a karstic area rich in water even during the summer, which makes it different from the Herzegovina polje on the east. “Agriculturists in this area don't have problems with droughts at all”! (Professor Zoran Stanivuković).

Flodded Lušci polje, February 2019 (Source:Youtube-Svjetlopis)

The field is not uniform. The extremities are managed for agriculture whereas the centre of the polje is covered by wetlands. However, the eastern extremity, further from the main road is more abandoned and characterized by the presence of diverse meadows.

Agricultural lands

Meadows

Wetlands

Observed vegetation: birch, *Epilobium angustifolium*. And diverse vegetation

II.3.E. PLAIN

Mrkonjić Grad

Description:

The Crna is one of the important rivers in the municipality of Mrkonjić Grad. It starts at the artificial lake Balkana and flows into the Vrbas. This connection has formed the small plain of Bjelajce, surrounded by a hilly system. The area of Bjelajce has the soil characteristic of a valley in that it is more fertile and deeper, unlike the hilly areas. A road was built along the course of the river.

Sanski Most

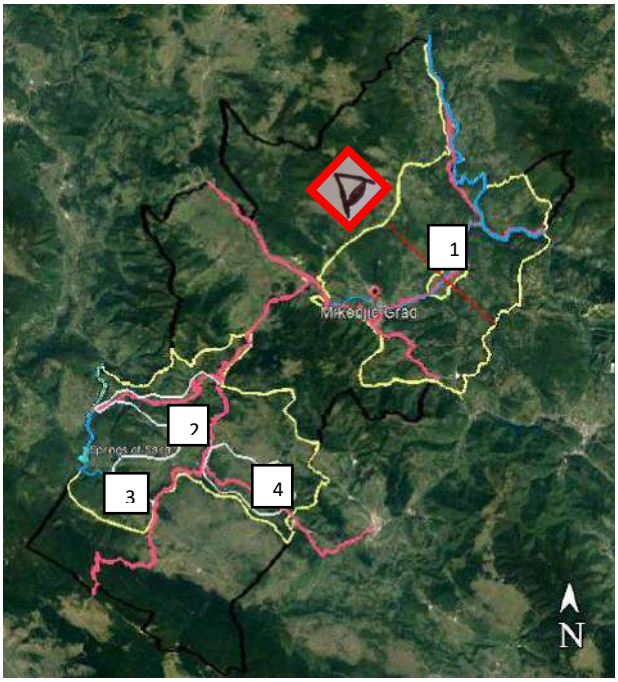
The village of Donja Trnova in the northern part of the plain (Source: Image from a shop un Trnova)

Description:

The Sana river has the characteristics of a transitional karstic river. It arrives in Sanski Most flowing through a canyon and opens up to a valley at Vrhpolje village. It then keeps that shape until it reaches its confluence in Una. One of the main forms of relief in Sanski Most is the valley of the Sana that creates an open alluvium plain terrain with an altitude of 158 m above sea level. The centre of the municipality is located in the north part of the valley. A road follows the river.

II.3.F. HILL SYSTEM

Mrkonjić Grad



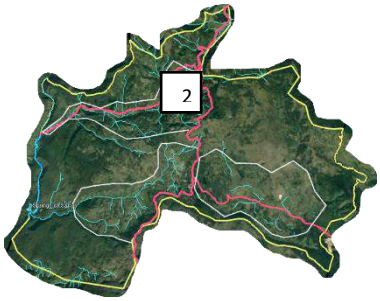
1

789 m

9.7 km

The northern part of the municipality has hilly terrain that is shaped and divided by the rivers: Vrbas and Crna Rijeka. We found different ecosystems present such as rocky grasslands, fertile lands with some exploitable soil, forest and the different stages of afforestation according to the degree of abandon of the lands. It is a huge heterogeneous area which, at a small scale, is driven by anthropogenic use.

Different pictures of the landscape

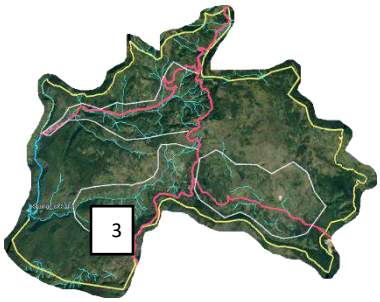


The southern part is also heterogeneous but perhaps easier to divide in some parts. We chose 3 examples of areas to present. They are situated near river courses and roads.

2 Medna area

The Medna area is characterized by a valley overlooked by a fragmented plateau. These breaks are easily observable from above (cf the picture below). Again, the habitat is fragmented between houses and gardens, pastures, orchards, fern fields, shrubs, forest … The pioneer vegetation is also easily visible in the former pastures.

The valley follows the Medljanska river. A road was built along it as well as houses and a watermill. In the pedological sense, in the Medljanska Rijeka valley, brown valley soils are present, which are more fertile than the surrounding hill soils (calcocambisol, calcomelanosol). This area also represents the most fertile land in Medna.



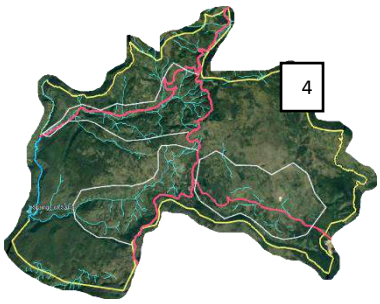
3 Pecka area

Pecka is a basin surrounded by different structures (Podovi plateau, the foothills of the Lisina mountains, the Medna and Sana canyons). It features several streams such as the Korana river which flows through a canyon on its way to the sources of the Sana. There are not a lot of villagers but the area attracts some tourists with the presence of the Pecka visiter centre managed by the Greenway association and particularly Boro Maric. The presence of the sources of the Sana and the beautiful surrounding landscape, motivated him to start a project in the region. Now the sources are part of a protected area and the surroundings are managed for tourists (indication signs and managed roads). We mostly observe patches of pastures, orchards and forest.


Pecka, September 2022


Ubavica Brdo, October 2022

This picture was taken from Ubavica Brdo, above Pecka. We can clearly observe the differences in the landscape. Here, the area is covered by shrubs and again, *Juniperus communis* is present.



4 Gerzovo area

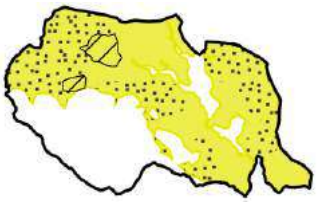
Gerzovo is situated in between the Lisina mountains and the Podovi plateau. Contrary to Medna and Pecka that are part of the Sana watershed, Gerzovo is located on the other side of the hill that leads into Vrbas. The main road goes down to Šipovo, the city centre of the adjacent municipality. Along this road small villages are present. The part near the road is accessible, with managed fields for agriculture and pastures. The upper part is harder to access and more afforested.

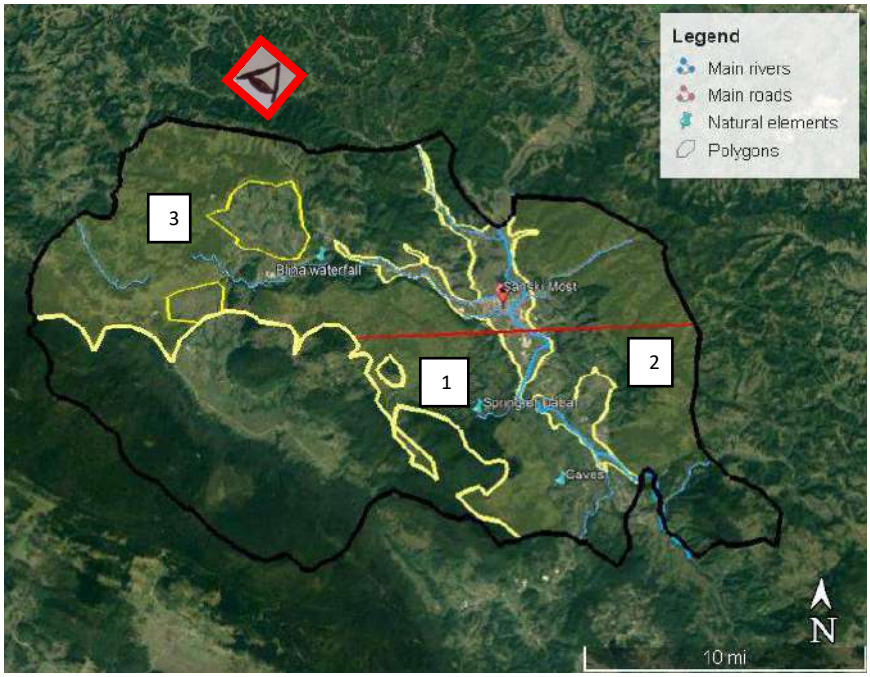

Gerzovo, October 2022

In the upper parts (on the left side); in the lower parts (on the right side) (Gerzovo, October 2022)


Gerzovo, October 2022

Sanski Most





1

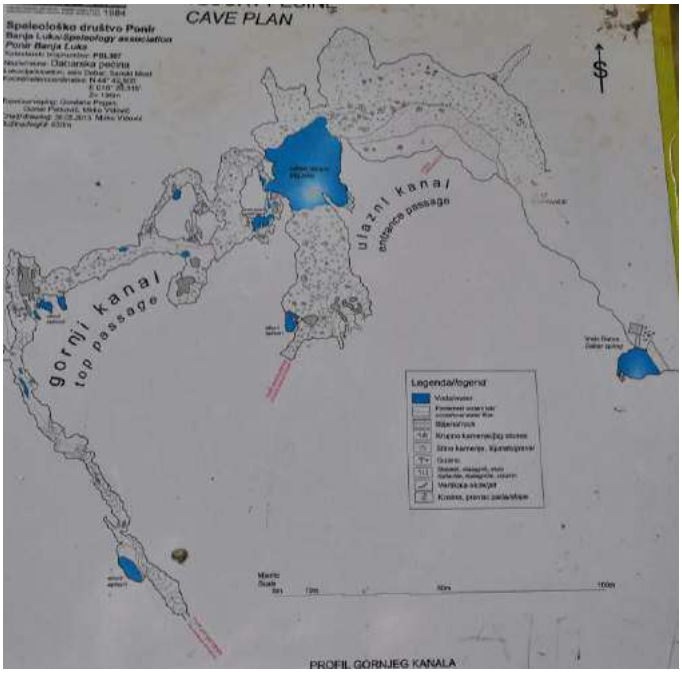
Karstic area with developed underground water network, caves and sinkholes

2

Area rich in rivers which form small valleys and flow into the Sana

1 Karstic elements of the area

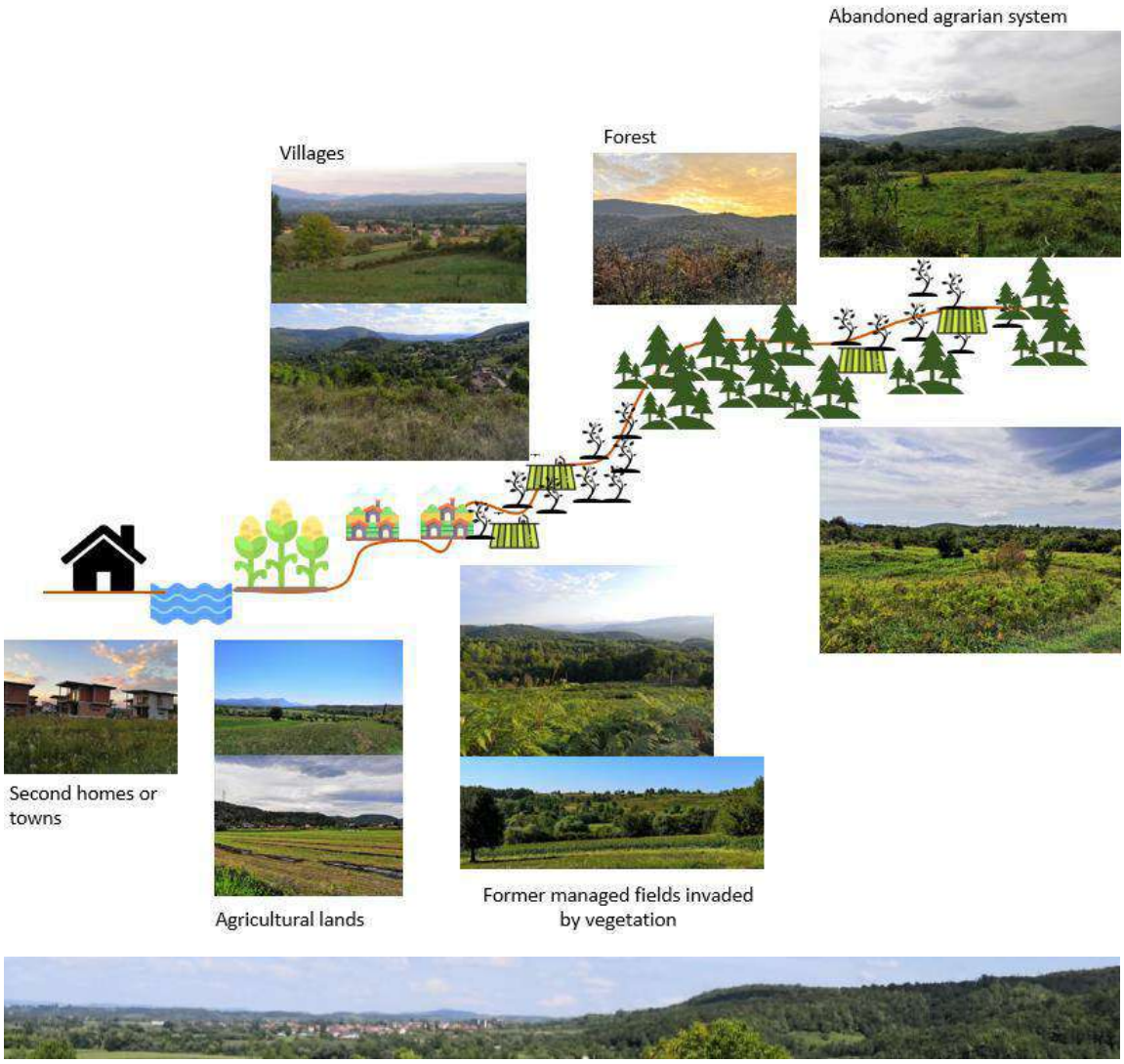
Underground system with caves:



Researchers have explored the network from Dabar cave which is an intermittent spring near the original spring of the Dabar river. The underground water shaped the gallery. One permanent lake and some lakelets. 6 species of bat and the olm -*Protheus anguinus*-, a cave-dwelling salamander, which is characteristic.

Sinkholes: with agriculture (on the left); in afforested plateau (on the right)

From the river it is possible to divide the landscape as follows, in both directions toward 1) and 2). Toward 2) the slope is less progressive between the villages and the forest



3 In this part of the municipality the biggest abandoned area was observed.: shrubs, fern and forest as far as the eye can see. Roads are unmanaged and the people have left. Closest to the road, another area stands in contrast. Near the lowest managed area, we find the most managed agricultural land. Here people harvest hay and plant crops for their animals.

Well managed agrarian system (on the left); Completely abandoned lands (on the right)

II.3.G. CANYON

Mrkonjić Grad

Vrbas canyon separates the Manjača and Čemernica mountains. Its geological base consists mainly of limestone with alluvium in the river valleys on which the flysch terraces continue (Brujić,Milanović, Travar&Stupar, 2011). The flora and fauna of the canyon is very rich with numerous endangered species, but still insufficiently explored.

The river Vrbas occupies an important place in the analyzed area of the municipality of Mrkonjić Grad as a significant natural resource that is managed and used for several needs (the hydroelectric power plant, fishing, the **magistral** road through the canyon). The Vrbas river is a right tributary of the Sava river with a total length of 235 km.

II.4. A CLOSE UP OF EACH MUNICIPALITY

II.4.A. SANSKI MOST: THE NINE RIVERS MUNICIPALITY

Sanski Most is known to be well irrigated with nine main rivers. The Sana crosses the municipality and is joined by seven tributary streams: the Kozica, Sanica, Dabar, Zdena, Sasina, Bliha and Majdanusa (in order). The Japra river is the ninth one which takes its source in the western part of the municipality and flows in the direction of Bosanska Krupa (Figure 9) (Annexe 2.4).

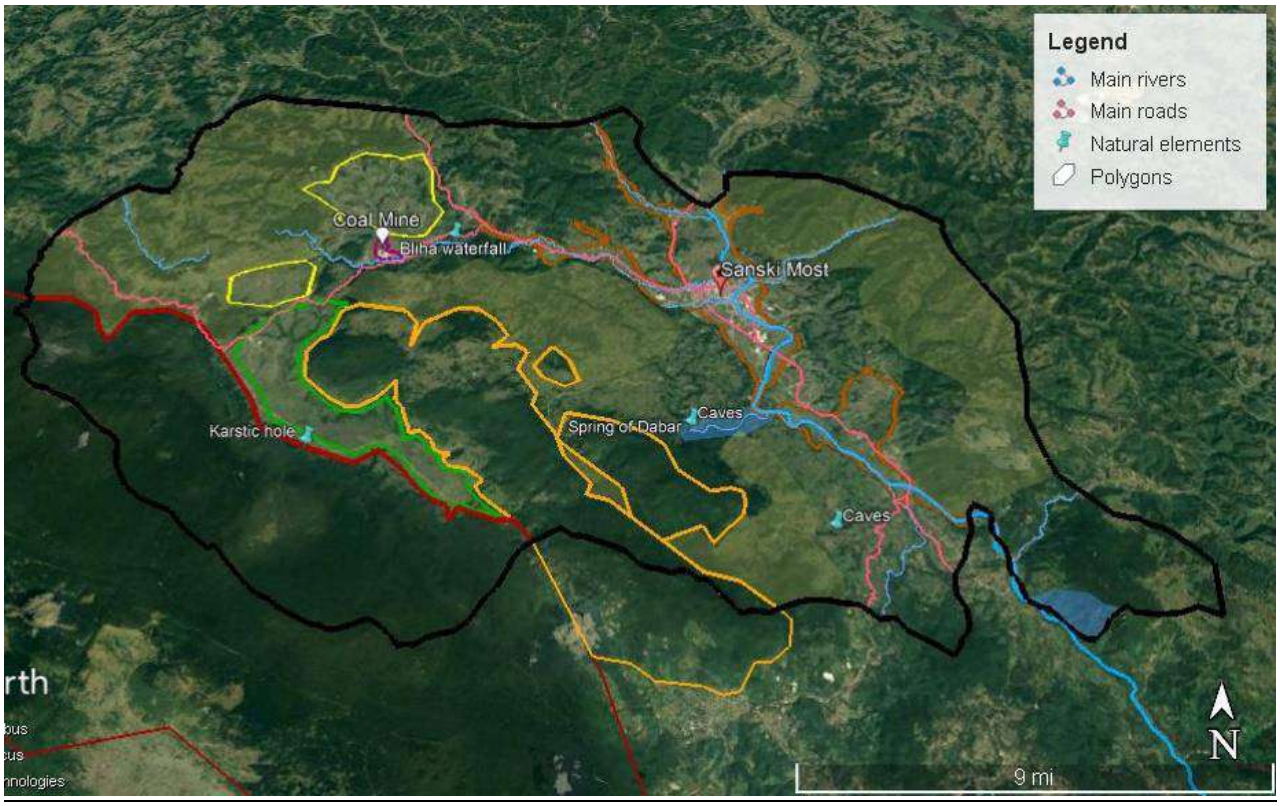


Figure 9: a satellite view of the municipality of Sanski Most with the landscape units (polygons) and the main human components that affect the landscape.
Source: Zoé Siegel, 2023

In the municipality of Sanski Most, the Kamengrad coal mine measures 1067.27 ha. It is situated in front of Gorice village and next to the most important agricultural area of the municipality. Its contrast with the surroundings is significant and impacts the landscape (Figure 10).

Figure 10: View from the heights of Gorice village.
Source: Zoé Siegel, 2023
The mine is just in front of it.

II.4.B. MRKONJIĆ GRAD AS A HETEROGENEOUS TERRITORY

The geomorphology and hydrology of Mrkonjić Grad are more complex than in Sanski Most. The municipality possesses a small artificial lake: Balkana lake where the Crna river starts before flowing into the Vrbas. This connection formed the small plain of Bjelajce. Korana which flows through a canyon and Madljanska which forms the valley of Medna, are two tributary rivers of the Sana. Two other distinguished rivers flow in Mrkonjić Grad: the Sokocnica which flows in the direction of Sipovi municipality and the Cadjavica in Podraško polje. In total, there are seven main rivers in Mrkonjić Grad (Figure 11).

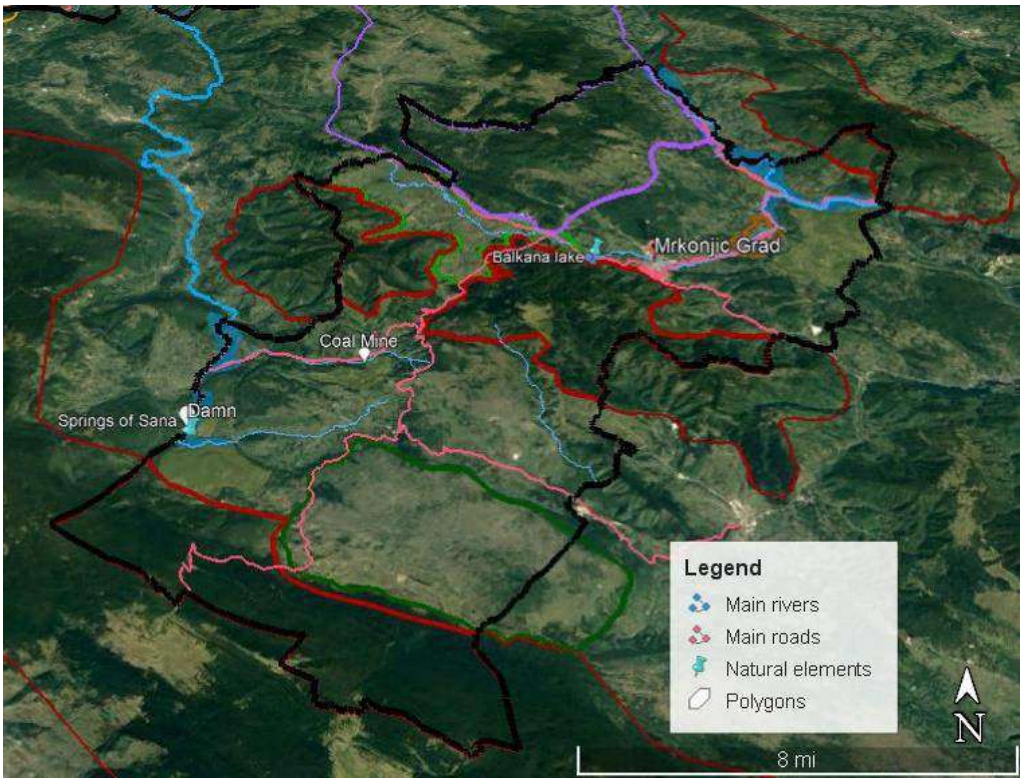


Figure 11: Satellite view of the municipality of Mrkonjić Grad with the landscape units (polygons) and the main human components that affect the landscape.
Source: Zoé Siegel, 2023

In this municipality, the Vrbas river occupies an important place as a significant natural resource that is managed and used for several needs (hydroelectric power plant, fishing, **magistral road** through the canyon). These constructions completely changed the shape of the river in 1981, forming two lakes. A damn was also built 600m away from the Sana springs. It has a smaller influence on the landscape but its presence prevented the establishment of a larger protected area.

One coal mine is also present in Mrkonjić Grad. It is located in Medna in the middle of the forest. As it is small (5 ha) and hidden, it does not have a huge impact on the landscape.

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Gravel quarries are present in both municipalities. Depending on their location, they also break up the landscape. In Mrkonjić Grad, concessions have been allocated for the exploitation of several minerals: bauxite, dolomite, and limestone. In Sanski Most, bauxite, limestone, and clay are exploited.

In conclusion, both municipalities are represented mostly by typical karstic structures: underground networks, polje, and arid areas with sinkholes. They are also rich in water, especially Sanski Most where the Sana river constitutes the main plain. Mountains in Mrkonjić Grad make its landscape highly heterogeneous. Abandoned lands in both territories engendered areas where the vegetation has taken over and several successional steps are observable in different environments. This actually constitutes the main threat to the agrarian landscape as it tends to close it up. Coal mines and gravel quarries also disrupt the landscape depending on their location.

III. INVESTIGING 5 SECTORS

III.1. GOVERNANCE AND DEMOGRAPHY

III.1.A. ORGANIZATION OF A MUNICIPALITY

In the municipalities, the territory is managed by a Mayor and an administrative team composed of different working departments (Annexe 3.2). Some sectors such as forestry and water management are also managed by public enterprises. These structures are generally located in the municipality centre (the city which gives name to the municipality): in the case of this study, Sanski Most and Mrkonjić Grad cities. Sanski Most, which is in the Federation of Bosnia and Herzegovina is under the direct supervision of the cantonal authorities, located in the Bihac municipality. Whereas Mrkonjić Grad, which is in the other entity, the Republic of Srpska, is governed at the entity level, by the municipality administration located in Banja Luka.
The municipality is divided into settlements: 67 in Sanski Most and 38 in Mrkonjić Grad (Annexe 3.3). In each settlement, one representative is named by the inhabitants of the area. This person, who belongs to a political party, is responsible for liaising with the municipality. The cadastral plan which records land use, lists several settlements.

In each settlement, villages are present. They are generally associated with the majority community (Serb, Bosniak, or Croat). They can be distinguished by their religious monuments (orthodox churches, mosques, or catholic churches).

Each community has also its own way of dividing villages and grouping houses. Serb villages are divided into *zaseok* which is a small group of houses where people from the same family live (Figure 12). In Bosniak villages, people dwell in *sosak* which is the street where the family live. These *zaseok* and *sokak* are used as addresses as follows: name of the settlement, *zaseok* or *sokak*, last name of the family.

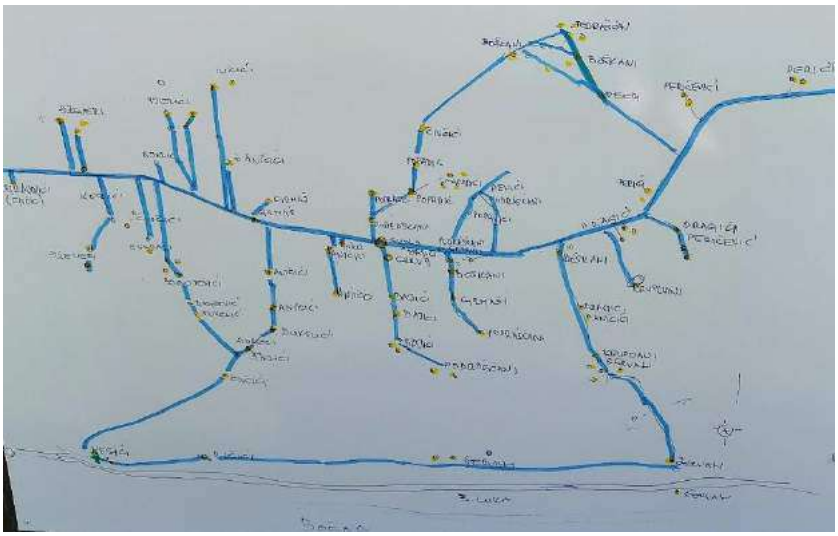

Figure 12: Structure of the village of Surjan in Mrkonjic Grad.
Source of the picture: Zoé Siegel, 2023
This image shows the plan for water routes that have to be installed.
Parts of the villages are divided into family names: *zaseoks*.

III.1.B. AN UNEQUAL DISTRIBUTION OF THE POPULATION

III.1.B.a. Sanski Most, a municipality twice as populated as Mrkonjić Grad

Only one census has been carried out since the war: in 2013. Since then, only estimates have been calculated. In Sanski Most, 41 475 inhabitants shared the municipality in 2013. The municipality of Mrkonjić Grad was less populated with a total number of 15 926 inhabitants (Table 1). The average population density was then: 54 inhabitants/km^2 in Sanski Most vs 24 inhabitants/km^2 in Mrkonjić Grad, that is about half less. Estimates for the year 2020 and 2021 did not change much but reflect a decrease in population.

Table 1 : The population of Mrkonjić Grad and Sanski Most from 1971 to 2020/2021.

	Population (census)				Total estimated population				
Sanski Most	**1971**	**1981**	**1991**	**2013**	**2017**	**2018**	**2019**	**2020**	**2021**
781 km2	62 102	62 487	60 307	41 475	40 402	40 166	39 852	39 651	39 324

Source: STATISTICAL BULLETIN 2021, Federal Institute of Statistics

	Population (census)				Total estimated population				
Mrkonjic Grad	**1971**	**1981**	**1991**	**2013**	**2016**	**2017**	**2018**	**2019**	**2020**
685 km2	30 159	29 604	27 379	15 926	15 460	15 278	15 073	14 853	14 622

Source :Cities and municipalities of Republika Srpska 2021, Republika Srpska Institute of Statistics

Numbers come from official census until 2013. After that, only estimates were made.

In these tables, we observe an important decrease in population during the war. Since 2013 evolution is slow compared to the national trend (Figure 19). One hypothesis would be that statistics include the non-permanent population[2]. An official census has not been carried out since 2013 and people tend to say that the current statistics are under estimated because of the complexity of migrations. People sometimes have 3 houses: one in Banja Luka, one in Mrkonjic Grad city and one in a village of the municipality for example. Others live abroad and have also several properties in B&H.

III.1.B.b. Different types of housing areas

In Sanski Most, most of the population is concentrated in the plain. The rest of the municipality is heterogeneous and covered by different types of villages: urban developed villages, large/small villages, hamlets, but also completely abandoned areas.

Conversely, Mrkonjić Grad is more homogeneous. Small villages are spread everywhere with numerous hamlets. Some activities are also concentrated in the small plain area of

[2] Cf the part 4.1.5

Bjelajce, but most people live and work in the centre: the Mrkonjić Grad settlement which is the only urban area.

Both municipality centres concentrate the main socio-economic and industrial functions in the territory. Sanski Most is located on the plain banks of the Sana River in the northern part of the plain whereas Mrkonjić Grad is located in the foothills of the Lisina mountains, in hilly terrain at 500-700 m in altitude. (Figure 13: Municipality centres and an example of a village in each municipality.).

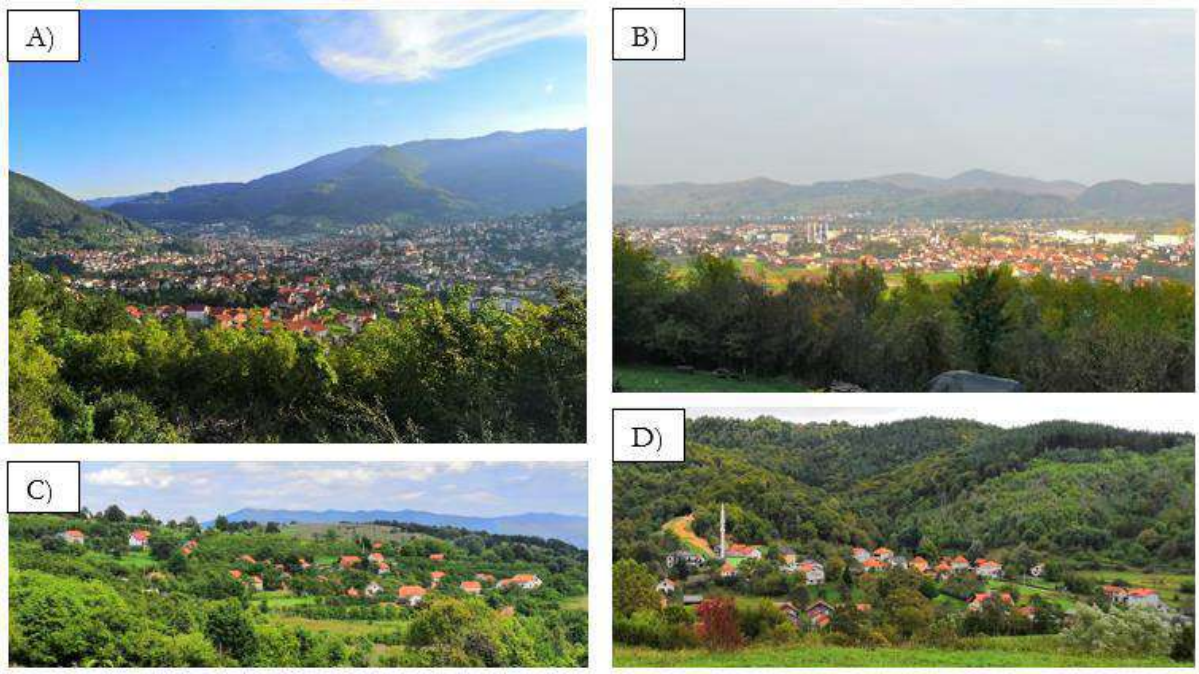

Figure 13: Municipality centres and an example of a village in each municipality.
Source: Zoé Siegel, 2023
Mrkonjić Grad city B) Sanski Most city C) Trijebovo in MG D) Vrše. In SM. Photos were taken in September and October 2022

Natural-geographic characteristics also influence the distribution of settlements and inhabitants. Therefore, Mrkonjić Grad, as a hilly-mountainous area, is characterized by a scattered type of village – with a lot of hamlets. In Sanski Most, the relief is less mountainous with the valley of Sana river and other rivers which meant larger settlements were possible in the plain areas around the rivers. Houses in the villages are more grouped.

III.1.B.c. Roads as a factor influencing population distribution

Roads are mostly near rivers or following streams. In Sanski Most, the most significant road is the **magistral road** (M15) Prijedor-Sanski Most-Ključ, which follows the course of the Sana river, passing through the centre of Sanski Most. Other important roads are the regional roads: R-405; R-407; R407a, R-404, R-406, R410, and R410a (Institute of Civil Engineering, 2022). Most of them are located in the valleys of the Sanica and Bliha rivers (Annexe 3.1).
The most important roads on the Mrkonjić Grad territory are the **magistral road**s M5 (Jajce-Mrkonjić Grad-Bihać), M15 (Mrkonjić Grad- Glamoč- Split), and M16 (Banja Luka-

Crna river-Jajce-Sarajevo) (Institute of Civil Engineering, 2022). Other significant roads are regional roads R412 (Mrkonjić Grad-Crna river) and R415a (Donji Braći-Šipovo). These regional roads via **magistral road**s connect Mrkonjić Grad with Banja Luka and neighboring municipalities (Annexe 3.1).
The main road infrastructures have an impact on the distribution of the population and activities. In Sanski Most, areas around highway M15 and the regional road are the most densely populated with economic and industrial activities nearby. The same process can be found in Mrkonjić Grad, more precisely in Bjelajce, Podrašnica, and Baraći. Houses are built along the road.

III.1.B.d. Loss of traditional architecture in villages

During the war, most of the houses were destroyed and people had to rebuild them. This wave of new construction led people to build new houses in a Balkan pavilion style. However, in smaller villages, some traditional houses, which survived the war can still be found, as well as other old wooden infrastructures (Figure 14). This traditional architecture is more present in Mrkonjić Grad.

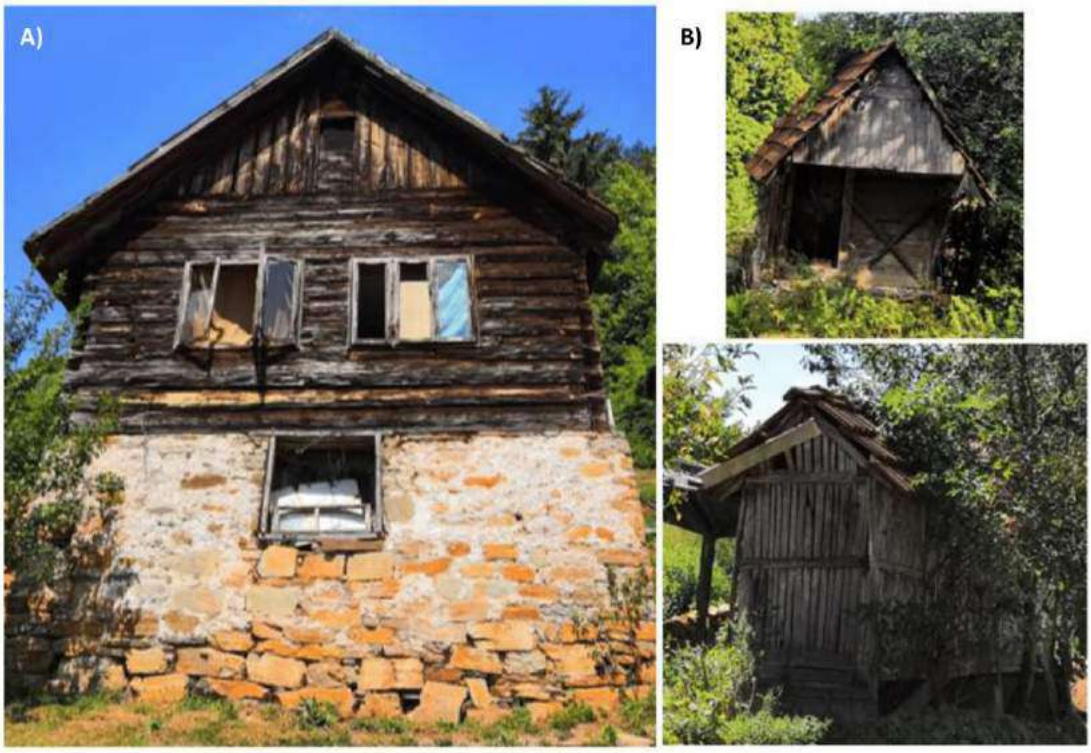

Figure 14: Traditional housing and outbuildings in Mrkonjić Grad
Source: Zoé Siegel, 2023
.A) Traditional house from 1936 in the settlement of Ocune (August 2022). B) *Kosana* or *Kuruznik* which are used to stock and thresh corn (Surjan settlement, September 2022).

Today the houses belong to the cultural and historical heritage of the country. They were built from materials available in the area: wood and stone, by the skill of local builders. To use the wood more economically, it was cut into planks that are then fitted vertically.

Wooden pegs were used for construction. The small wood infrastructure in figure 14.B, is an auxiliary village facility that was used for corn threshing, the so-called *Košana* or *Kuruznik*. It is built using long planks with a narrow rectangular shape. It can often be seen in village gardens (Mandić, 2019). Wooden tiles are also widespread.

III.1.C. INFRASTRUCTURES AND SERVICES

The main poles of development of both municipalities are the cities of Sanski Most and Mrkonjić Grad which regroup the main cultural, administrative, and financial activities. In Mrkonjić Grad only three secondary poles are developed: Podrašnica, Bjelajce, and Baraći settlements, which are crossed by a main road. In Sanski Most, more populated, developed areas are wider. They are concentrated along the main roads, more precisely the M15 and R405. For example, in the Tomina settlement, the part near the road is more developed (petrol station, shops, coffee shops, houses) and populated than the upper part (in the hill system) which is depopulated, with fewer and fewer people and no activity. It is also noticeable in Kamengrad.

Sanski Most city is the main activity centre for the whole municipality. Inhabitants go there for shopping, work, medicine, and cultural events, even if the main city and administrative pole for the canton is Bihac. This is not the case for Mrkonjić Grad. People from the south of the municipality tend to go to Sipovo.

In B&H there are several levels of health institutions. The lowest level is the health care ambulance. A team of doctors covers certain parts of the municipality and goes to villages. Those primary services are generally associated with the second level: the health centre. This infrastructure offers general consultations, dental services, gynecological and pediatric examinations.
Both municipalities have a health centre with district ambulances. However, it is generally insufficient to respond to the needs of the inhabitants. There is for example only one gynecologist and women have to wait a long time for an appointment (Milk producer, 47, MG).
Only Sanski Most has a hospital corresponding to the third level. People in Mrkonjić Grad go to Banja Luka to give birth or for intensive care and operations.
Schools up to high school are available in both municipalities. Young adults usually go to the Entity capital to study for example at the university in Banja Luka or Sarajevo.

There are three high schools in Sanski Most, including an agricultural school, and two in Mrkonjić Grad including a mechanical school. Middle schools up to the 9th grade (10-15 years old) are generally located in the centre and the secondary poles (Fajtovci, Donji Kamenrad, and Vrhpolje in Sanski Most; Baraci and Podrasnica in Mrkonjić Grad). Other schools are available in the villages up to the 5th grade (10 years old).
Their distribution is however unequal. After the war, schools were only rebuilt in the most populated areas, leaving a lot of old schools abandoned. Nowadays, these new schools are closing because of depopulation. There are fewer and fewer children in the village as young families move to cities or other countries. In several areas, we heard people say that the school was reduced to one teacher and one child (6, Milk producer, MG) as a milk producer told us: "*Here, there is a school up to the 4th grade but next year, it will close because there are not enough children. Young people are leaving; it has become a village of old people. My son left because he does not believe in the future of the farm.*" (61, Milk producer, SM). School accessibility is also a criterion

that pushes young parents to leave the village. Children in small villages have to move to the main cities to go to middle school or high school. For people living near the main roads, there are buses. However, a lot of villages do not have a decent bus service and are isolated by bad roads and the distance from the main activity centres. In Surjan, in Mrkonjić Grad one person said: "*I do not want to live in the village because when I was a child I had to walk 2 km to Mrkonjić Grad to go to school. I do not want the same for my children.*" (20, Raspberry producer, MG).

Other basic services are sometimes not available. People in villages that are far from the city and main roads are often isolated. They do not have easy access for firemen or ambulances, especially with the snow during the winter (26, sheep seller, MG). The municipalities are building new roads, especially in Mrkonjić Grad where the enterprise of public works MG Mind is present. However, a lot of roads remain bad and the process of building new ones takes time. Sometimes villagers collaborate to collect money and pay for a new road. However, demand is high so the people wait desperately no longer believing in the municipality and government.

Some areas also do not have running water at home. In karstic areas where there are no water sources or accessible underground water, it is a problem (Annexe 2.4). People from these settlements in Mrkonjić Grad, order water from the municipality which delivers it by lorry, especially during the summer. This is also an issue for animal breeders (27, sheep seller, MG). Some of them install barrels to collect the water from the rain. They sometimes use sinkholes that maintain the water for a while and allow animals to drink or bathe (33, Milk producer, MG). In Sanski Most we did not meet anyone with water problems. The municipality has a developed a watercourse network and good water wealth. However, some isolated and arid karstic areas are also present. As we could not access these areas, we do not exclude the possibility that people there face the same problems as in Mrkonjić Grad. The areas without a water supply in Mrkonjić are Gornja Podgorja, Donja Podgorja, Dubica, Surjan, Dabrac, Baljvine, Šibovi and part of Trijebovo (*zaseok*: Čulići and Aleksići) (Municipality of Mrkonjić Grad, 2016).

The electricity network covers both municipalities and all households have a connection. However the of the network is now a challenge: to minimize power losses and avoid problems with dilapidated installations. In Mrkonjić Grad, the Bočac hydroelectric plant located on the Vrbas river has been the most important energy source in the municipality since 1981 and in Sanski Most, the Elektro-Solar central since 2019.

The war is a factor that influenced the destruction and decay of social facilities. Large industries crashed, areas were abandoned and most roads are no longer maintained. Activities are struggling to restart again and develop as most people are leaving or have already left.

III.1.D. A DRAMATIC DEPOPULATION

III.1.D.a. Migrations before the war in 1992

Since the Second World War, Bosnia and Herzegovina has been subject to frequent population migrations. During the period of socialist Yugoslavia migration was directed towards Germany, Austria and other countries (1950-1990), especially during the 1970s and 1980s (Marinković & Majić, 2018). The agrarian reform during that time (1945-1948), known as the "Colonization" affected the decrease of population in villages[3]. People were delocalized: villagers from less developed (poor, barren regions) or passive regions from B&H, Croatia, and Montenegro, were mainly sent to Vojvodina, the most agriculturally valuable zone of Serbia and beyond.

In Mrkonjić Grad for example, significant migrations took place during this period. More precisely, in 1946, 301 households were sent or "colonized" to Vojvodina, which was 2. 29 % of the population in that time (Šovljakov, 2021). Like this, villages from all parts of the municipality decreased in population. During our field work in Mrkonjić Grad, we saw many families from Serbia who came to visit their parents and grandparents. In addition, we met people who had migrated in the 1970s and 1980s when they were young. They all have family or kept their lands in the municipality but are no longer living there.

The civil war in Bosnia and Herzegovina (1992-1995) was another decisive moment of the decrease and changing location of the population. Ethnic cleansing and fighting happened in both cities and villages. It forced a lot of families to leave their homes and migrate. Today, this period is still difficult for people to talk about and events that happened at a local scale are interpreted differently by the three ethnic communities.

III.1.D.b. A new population distribution after the war in 1992

Before the war, the community mix in municipalities was generally balanced (Annexe 3.3). Bosniaks, Serbs, and Croats lived next to each other, as neighbours. Villages were already separated by ethnicity but were close to each other. During the war, many massacres took place in villages. People left their houses under the pressure of the armies. A very large migration took place in this period: half of the population changed their place of residence either inside or outside the country, moving to safe places for their community. Serbs mostly migrated to Banja Luka or Serbia, Bosniaks to Zenica and Croats to Croatia (Field information, 2022). It is actually hard to find data about migrations during the war. In Banja Luka for example, around 70 000 people came to live there during the war. New settlements, formed in suburban areas had to be created at the end of the conflict (Mandić, 2019).

A second wave of movement took place after the war. People waited for the Dayton Agreements in 1995 and the establishment of the Entities borders to make a decision concerning their return home. A redistribution of people mostly based on ethnic criteria then happened. Serbs migrated mostly to the Republic of Srpska and Bosniaks to the Federation. Croatians stayed in the Croatian majority municipalities or moved to Croatia.

[3] This historic period is more explained in the part on agriculture (part 4.2.)

In fact, after the war the country proposed Croatian nationality to all Croats from B&H. The census of 2013 made this redistribution visible (Annexe 3.3). More than 95 % of Serbs now live in the Republic of Srpska for example. In the end, most people did not go back to their original municipality, especially when they belonged to the ethnic minority of the Entity. The process of ethnic simplification has been mostly accomplished and municipalities are no longer so mixed. The country is fragmented according to the three cultural groups but there is still ethnic multiplicity inside some territories, especially in the Federation.

In addition to population changes, administrative borders and organizations changed among the municipalities. In Sanski Most, for example, today's municipality represents only 79.4% (781 km^2) of the original area, which before the war amounted to 984 km^2. Consequently, some settlements also changed, which makes it hard to see population changes at this scale. The municipality borders of Mrkonjić Grad stayed the same (Municipality of Sanski Most, 2014).

Impacts on Sanski Most population

These migrations have happened in the two analyzed municipalities. In Sanski Most for example, the population was initially mixed with 46.65% of Bosniaks, 42.06% of Serbs, 7.17% of Croats and 4.12% of other ethnicities (RZZS[4], 2022). After the war, Serbs who mostly migrated to Banja Luka during the war waited to know to which Entity Sanski Most would be allocated. When it became part of the Federation, most of them did not want to return. A lot of settlements that were initially Serb became abandoned or largely unoccupied Most Croats did not return either. Sanski Most became mainly Bosniak: 92.45 % of Bosniaks, 4.43% of Serbs and 1.74 % of Croats in 2013 (RZZS, 2022) (Figure 21). In total, the municipality lost more than a third of its population (31.33 %) between 1991 and 2013 (Table 1).

Today, in abandoned areas the vegetation has taken over. Durici, Donji, and Gornji Lipnik which were Serbian settlements of between 100-300 inhabitants before the war and are now empty (0 inhabitants) (Figure 15). In those parts, former infrastructures have disappeared and roads are no longer passable. As described in the landscape section, whole settlements have been given over to forests, bushes, ferns, or brambles. For the Serbian or Croatian villages that are still populated, the number of inhabitants is low and there are fewer activities than in Bosniak villages. Schools have not reopened and the population is aging. In some parts, Serbs have sold their lands and heritage (Ilidža and Podlug) (75, Self-sufficient, SM).

[4] RZZS : Institute of Statistics of the Republic of Srpska

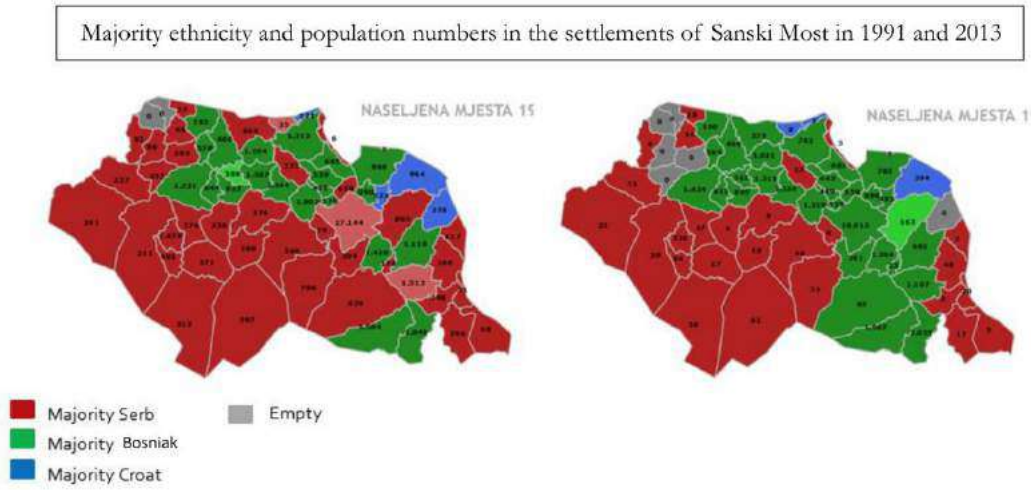

Figure 15: Population changes in the municipality of Sanski Most from 1991 to 2013.
Source: statistika.ba

Impacts on the Mrkonjić Grad population

In Mrkonjić Grad, the war did not lead to many changes in the distribution of ethnicities. The municipality was mainly Serb before the war: 76.97% of Serbs, 11.96% of Bosniaks, 7.82% of Croats and 3.39% of other ethnicities (RZZS, 2022). There are two Bosniak settlements in the municipality: Vlasinje and Baljvine. Muslims from Vlasinje did not return after the war, leaving the area empty (Figure 17). However, people from Baljvine maintained a healthy relationship with their Serbian neighbours and did return. It is a beautiful example of solidarity between the different ethnicities during the war (Figure 16).

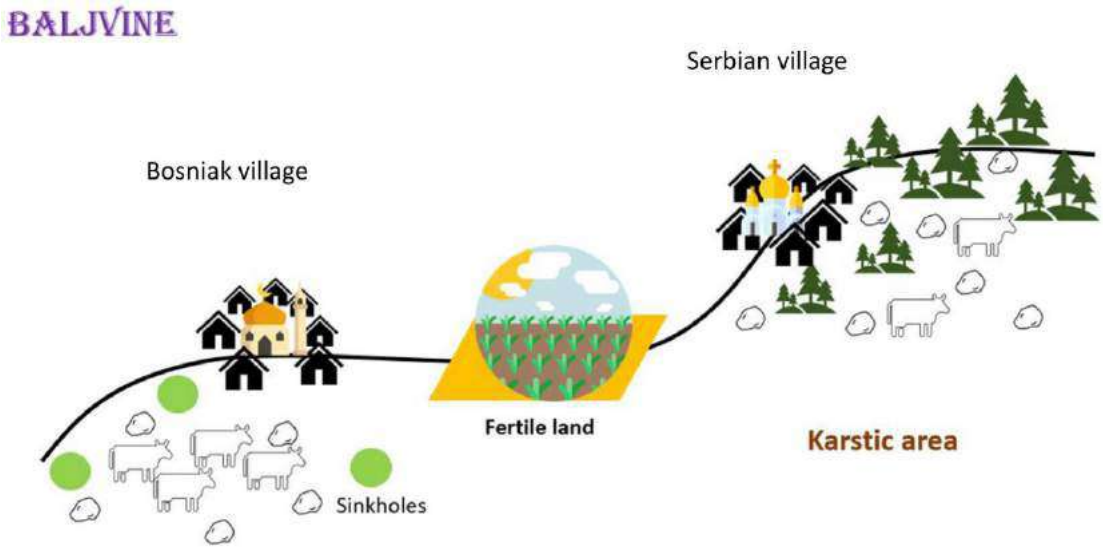

Figure 16: Schematic representation of the Baljvine settlement in Mrkonjić Grad.
Source: Zoé Siegel, 2023

Baljvine is composed of two parts: one Bosniak village and one Serbian village separated by flat fertile land that people share. During the war, people did not fight against each other. They continued to live together until the Croatian army arrived. After the war people from

the two villages returned. Today they maintain good relations as this sentence from a Bosniak illustrates: "*I use the land of my Serbian neighbour, we are friends*" (33, Milk producer, MG: Baljvine). There is also a mixed school with both ethnicities up to the 5th grade. As for Croats, they mostly left the municipality.

After the war, the municipality remained mostly Serb with 96.32% of Serbs, 2.22% of Bosniaks, and 0.93% of Croats. One result of this preexistent majority is the presence of fewer abandoned areas (Vlasinje) than in Sanski Most. Only one small area is completely abandoned (Vlasinje) (Figure 17). In total, Mrkonjić Grad lost almost half of its population (41.83 %) between 1991 and 2013 (Table 1).

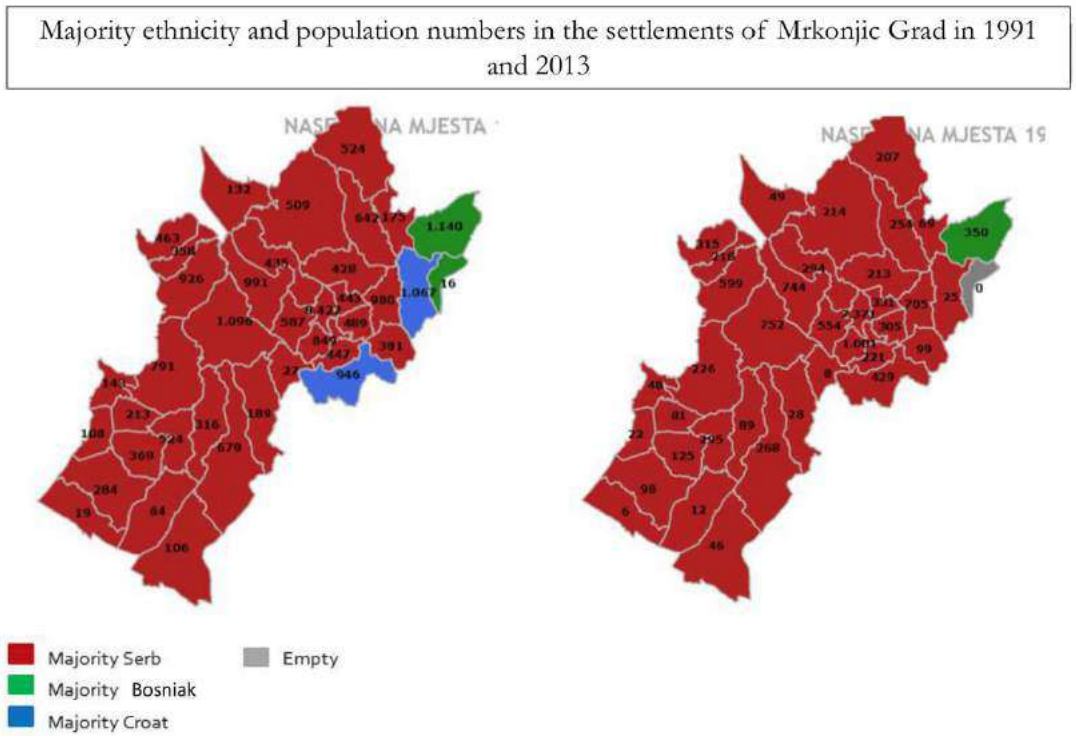

Figure 17: Population changes in the municipality of Mrkonjić Grad from 1991 to 2013.
Source : statistika.ba

If a large number of the former inhabitants has left the municipalities, in some rare cases there were also new people coming in from other municipalities or even countries (ex: Montenegro - 60, Milk producer, SM).

We collected some testimonies on the situation during and after the war. People left quickly under the threat of an attack. They took the bare minimum with them. Upon their return home, most people discovered their houses had been ransacked and destroyed (Figure 18). Their belongings had been stolen and occasionally their fields had been bombed. (36, Milk producer, MG). Those buildings which were still standing were peppered with bullet holes that can still be observed today. People also discovered that their animals had been killed. "*They cut cows in two, I don't understand how it is possible to be so*

cruel" (15, Self-sufficient, MG). Military forces also destroyed infrastructures such as watermills (48, flour producer, MG).

Figure 18: Examples of some houses that were impacted by the war and are still visible in the municipalities.
Source: Zoé Siegel, 2023

The war left a rough, still visible footprint, and since then the country has struggled to move on. The majority of the large industries from the communist period have remained closed and old buildings and factories remain abandoned along the road. Most villages lost ¾ of their population and the number of socioeconomic activities decrease. "*When I was a child, there were more than 100 other children in this village, a lot of activities, small shops, wooden products. Now I am the only one left. Before there were 15 other families.*" (15, Self-sufficient, MG). Some people regret the time of Yugoslavia and we saw that "Yugonostalgia" was strong.

III.1.D.c. Today, a continuous depopulation is occurring in the country as well as a strong rural exodus

After the return from the war, emigration continued. This time for governance and economic reasons. Most young people go to other countries or to the main municipalities of B&H (Banja Luka, Sarajevo, Prijedor, Zenica, Tuzla and Doboi).
People who stay in their original municipality move to the urban areas, often close to the municipality centre. During the fieldwork, it was rare to see young people and children in the villages. However, even in the city centre where most of the population is concentrated, emigration is considerable. Sanski Most is only full of life in summer when the diaspora return. In other seasons, houses are empty and closed up. People generally keep their land and renovated houses to come back to either for holidays (for people abroad), or during the weekends (for people living in a nearby city). During the summer period, some villages

even come back to life After that, only permanent inhabitants remain, often elderly self-sufficient people. In the villages of both municipalities, inhabitants told us about the increasing number of empty houses. In numerous group houses, only one person remains (example: Medna village- zaseok Aleksići).

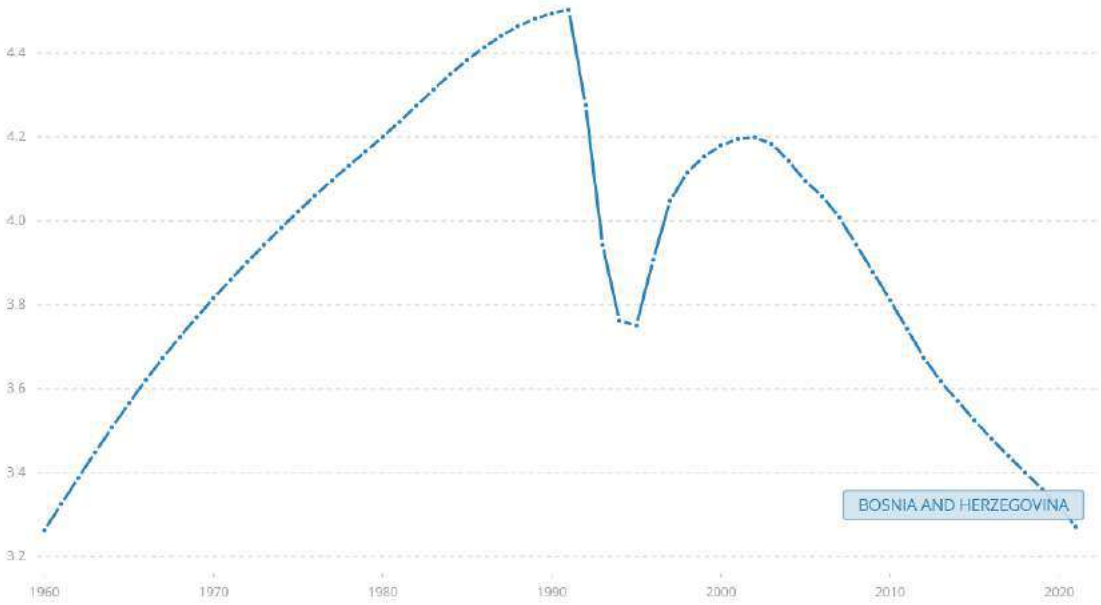

Figure 19: Evolution of the population in B&H from 1960.
Source: World Bank, 2022.
During the war, the population lost about 1/5 of its population. In 2020, the number of inhabitants was equal to the number of inhabitants in the 60s. The country has lost 1/3 of its population since the 80s. The current number of inhabitants is probably underestimated as a lot of people live abroad but have kept their lands in B&H.

Living in small villages became hard after the war. A lot of infrastructures had to be built or rebuilt, and priority was given to the most populated areas. Some people had to fight to have electricity, water, and renewed access to their houses (84, Self-sufficient, SM). It is still ongoing today in some villages, especially for road construction. Moreover, living in villages became shameful for the majority of young people (21, Trout breeder, MG) (3, Sheep seller, MG). In all villages, older people had become predominant and started to be the only permanent villagers. Generally, families stay in places near economical activities, such as sawmills, factories, or near urban areas and main roads (Figure 20)[5].

[5] The map was only computed for Mrkonjic Grad. As the settlement borders varied in Sanski Most between 1991 and 2013, we did not manage to get the shapefiles of these borders.

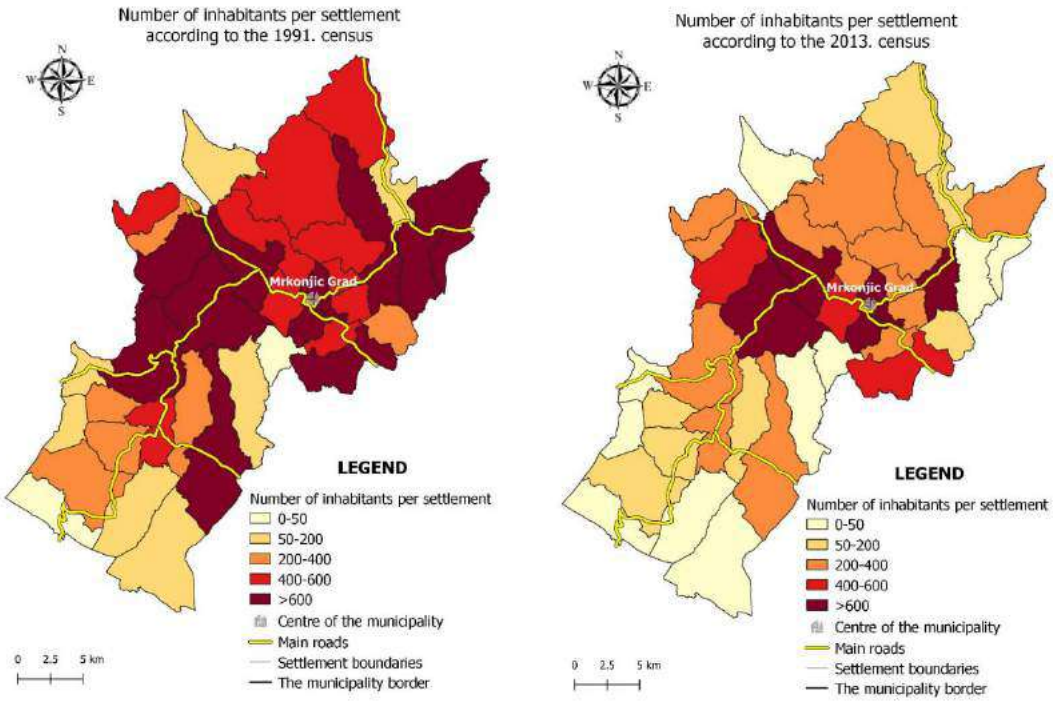

Figure 20: Population repartition and changes in Mrkonjić Grad.
Source: Borka Malešević, 2023
We can see that most people are concentrated near the main roads and the centre

III.1.E. DIFFERENT VILLAGER PROFILES

We distinguished different types of villagers according to their displacement or activities in the village as migration is a significant factor of demography (Figure 21).

- Non-permanent inhabitants, who correspond to people who migrated either abroad, or to a close city.

Gastarbajteri is the Serbian term (derived from German) given to people who have left to live in other countries and who return only for holidays. They generally build large houses. Most of them send remittance to their parents or grandparents who are living permanently in the country.

People from the city: they still own a piece of land in the village but have left to live in the city to have better living conditions. They often return during the weekends.

-The permanent people: all types are not present in every village. It depends on the proximity of socio-economic activities and their accessibility. Less developed areas are generally just inhabited by old people.

People working in a socio-economic activity nearby as for example industry, forestry sector, shops, administrative works…

Agricultural producers[6]: most of them sell either milk or meat.

Older self-sufficient people: they generally returned after the war. Most of their children or grand-children have migrated and return to help during holidays or week-ends. They are now retired.

Figure 21: Different p of people in a village.
Source: Zoé Siegel, 2023

As young people are generally deserting the villages, it has become hard to find workers for the remaining socio-economic activities (65, Milk producer, SM ; 8, Wood factory, MG). The following graph shows the dramatic trend towards an aging population at the national level (Figure 22).

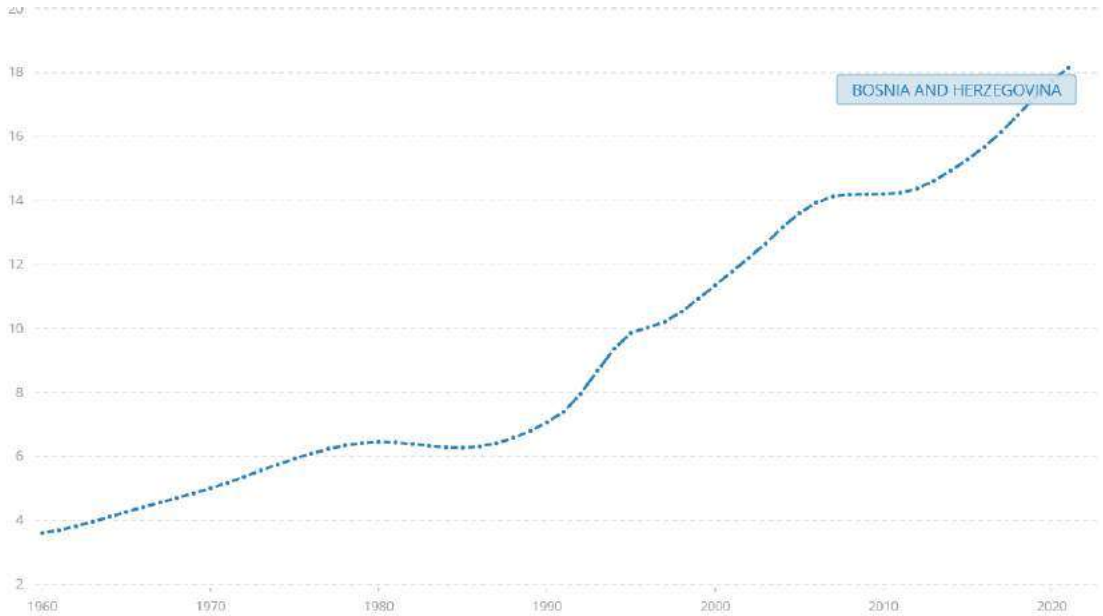

Figure 22: Evolution of population aged 65 years old and above (% of total population) in B&H.
Source: World Bank, 2022

[6] This term will be explained in the agriculture section: 4.2.1

Some areas are only inhabited by older self-sufficient people. Those territories tend to disappear and become abandoned if no one returns to manage them. The future of villages is uncertain, especially for the smaller and more isolated ones.

However, those areas are rich in natural resources and suited for agriculture. All villagers own lands where they produce vegetables, crops and keep a few animals.

III.2. AGRICULTURE

III.2.A. ARE ALL VILLAGERS FARMERS?

A farmer is someone who owns or takes care of a farm (according to the Cambridge dictionary) or a person who cultivates land or crops or raises animals (such as livestock or fish) (according to the Merriam-Webster dictionary). According to this definition all the villagers in our municipalities are farmers. Indeed, people generally own at least 1 ha of land including a garden and a few animals. This number can vary to reach a maximum of 10 ha. Most people have between 3-8 ha and have a bit of everything: a garden, cultivated lands for crops, pasture for animals, an orchard and some forest (Figure 23). They generally produce and transform their productions for themselves, especially older self-sufficient people.

Figure 23: Example of land division in villages (MG: Ocune, August 2022).
Source: Zoé Siegel
Lands are generally separated by lines of bushes or trees. When the lands are on a steep slope, there are terraced.

III.2.B. NO COMMERCIAL AGRICULTURE ON AN INDIVIDUAL SCALE UNDER THE SOCIALIST PERIOD

The communist regime (1945-1990) through two main agrarian reforms nationalized all the large estates (from landowners whether they were using their land for agriculture or not, banks, private companies, religious orders or churches and so on). The regime did not totally abolish private ownership of agricultural lands but limited its maximum size first to 25/30 ha to finally 10 ha of arable land or 15 ha in mountainous areas. (Mandić, 2019). The regime also created new land (amendments, irrigated perimeters, etc.) managed, as was the expropriated land, by "self-managed" social enterprises (cooperatives).

No real commercial agriculture took place in villages at that time. However, many people produced food for themselves while working in industries. Some of them even sold their products to neighbours as an additional source of income. With the arrival of supermarkets and urbanisation, this practice diminished. "*Before, 90% of people were producing food, now there is only 1%. Before the war people bought local products, you knew your clients, you could plan your production.*" (76, sheep seller, SM). The agroindustry and the services for agriculture were much more developed with corresponding employment and residence in the rural areas. "*Before the war, people came down from the hills on horses and carts, transporting three big sacks of crops. They camped in my garden to wait for their flour. The two machines were working all the time. I was producing approximately 1 tonne of flour for each variety of crop (wheat, corn, rye, buckwheat). Now only one machine works sometimes and I only produce 20kg for each variety. Half of the people have left and there is no large production anymore.*" (48, miller, MG).

Today, there is some commercial agriculture, at an individual level but not much. The agricultural production of the country is low and two-thirds of food products are imported. Small production units cannot compete with foreign, more productive and efficient systems and the supermarkets have a strong tendency of buying standardized low-priced products from abroad. (USDA, 2022). The country buys produce especially from Germany, Italy, Serbia and Croatia (Figure 24).

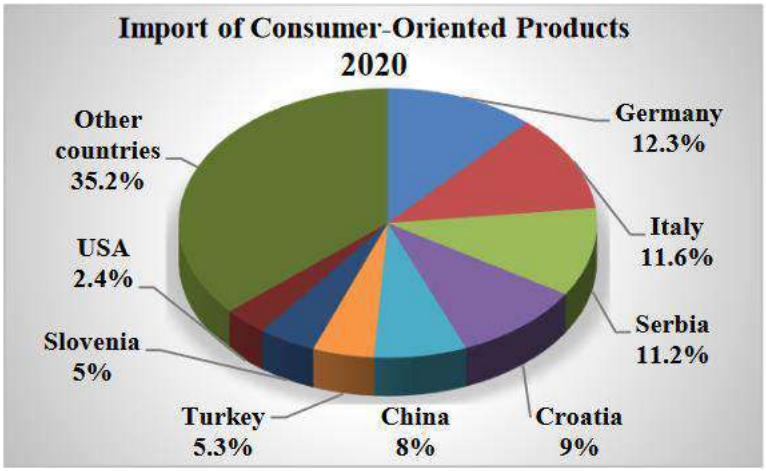

Figure 24: The main origins of imported food.
Source: B&H Agency for Statistics

Animal products (cheese, butter, milk and meat) and local products (honey, river fish, some fruit and vegetables, local produce) are still favored by B&H consumers – notably in specialized shops and short circuits. Milk and its by-products are the only local products commercialized by the supermarkets.

III.2.C. REGISTERED OR NON-REGISTERED? - THAT IS THE QUESTION

III.2.C.a. Several criteria need to be met to be registered

According to the Law of both Entities, the basic form of organization in agriculture is an "agricultural farm" or a "family agricultural farm". Family farms are classified into commercial and non-commercial entities based on several criteria (type of agricultural production, income of the farm, use of agricultural land and labour).

A commercial family farm is a market-orientated farm that has reached a minimum production volume.
A non-commercial family farm is a farm that is not market-orientated and that has not reached the minimum volume of production.

Both of these types of farms, registered in the agriculture register, have the right to financial help/incentives (Republika Srpska Agriculture Law *Sl. glasnik RS*, br. 70/2006, 20/2007, 86/2007 and 71/2009; – Federation B&H Agriculture Law *Službene novine Federacije B&H*, number. 88/07, 04/10, 07/13).

The conditions for registering an agricultural farm mainly refer to:
-basic documents to prove the ownership or lease of certain agricultural parcels;
-documents related to the personal data of the person to whom the holding is registered and other household members.

Therefore, the only requirement for registration is land ownership. By registering, farmers gain the right social security (health) and pension insurance, which is especially important for people whose only job is agriculture. During the fieldwork, we met people who only registered in order to exercise their right to insurance because they are unemployed or do not have enough years of work to receive a pension (36, Milk producer, MG).

III.2.C.b. Advantages: Premium and subsidies

Only with registered status, can agricultural producers apply for subsidies or programs of support for agriculture given by the Ministry or other organizations. Inside the Ministry of Agriculture, Forestry and Water Management, there are special individual agencies (RS) or departments (Federation of B&H) who are responsible for managing the subsidies and payments.

Mrkonjić Grad

Agricultural producers in Mrkonjić Grad can get subsidies on two levels: the Entity and municipality level.
According to the report of given subsidies in 2021 (Ministry of Forest, Agriculture and Water Management, 2021), in Mrkonjić Grad, agricultural producers receive several subsidies. Milk premiums and recourse to per **ha-diesel fuel** are the most represented forms of incentive. Then there are premiums for the cow-calf breeding system[7], premiums for fattened pigs, breeding **heifers**, breeding sheep and goats. Subsidies also exist in the form of support for beekeeping production, funds intended for the improvement of agricultural mechanization and facilities in animal husbandry.

Agricultural producers whose main activity is milk production mostly get subsidies for milk and fuel, with premiums for breeding **heifers**. In total, 67 people had achieved the right to the milk premium in 2021 (List of all beneficiaries who have exercised their rights to the incentive in 2021). Every farmer who sells milk to a legal entity or entrepreneur engaged in milk processing is entitled to a milk premium. Additionally, the farm must produce at least 3 000 litres of milk per quarter.

Farmers within the cow-calf system, meaning the breeding and selling of calves, receive a premium, recourse to per ha-diesel fuel, as well as financial support for the construction of buildings and agricultural machinery. In total 16 people had achieved the right to the premium for the cow-calf system in 2021. Rights to the premium for the cow-calf system is the ownership of at least 12 high-quality breeding heads of meat breeds or 7 combined heads of cattle (meat-milk) (Republic of Srpska government, 2021).

All agricultural producers, no matter which type of production they have, achieved at least right to the recourse per ha for diesel fuel.

The Municipality also allocates funds from the budget for the support and encouragement of agriculture in the municipality. For the development of agricultural production in 2022, the municipality foresaw 239 000 KM[8] (BAM) (a little less than €120 000), which was planned through the Program for the Promotion of Economic Development of the Municipality of Mrkonjić Grad (Municipality, 2022). The assistance from the fund provides monetary assistance for the expansion of livestock, the construction of facilities in agriculture, or the purchase of agricultural machinery.

Sanski Most

Agricultural producers in Sanski Most can receive subsidies on three levels: federal, cantonal and municipality.

According to the list of the users who claimed Federal Financial Subsidies in 2020, agricultural producers in Sanski Most received subsidies for the production of fresh untreated cow's milk, corn silage, barley, oats and triticale, the raising of breeding livestock and for beekeeping (Ministry of Agriculture, Forestry and Water Management of the Unsko-Sanski Canton, 2020).

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[7] Cf section: meat producers
[8] KM: Convertible Mark local.

On the cantonal level (Unsko-Sanski canton), agricultural producers also claimed several subsidies. They were paid for the production of berries (strawberries, raspberries, blackberries, blueberries, aronia), for the breeding of heifers. A co-financing was provided for milk analysis in laboratories and the purchase of fuel. Beekeepers also achieved the right to co-financed research on bee diseases (Ministry of Agriculture, Forestry and Water Management of the Unsko-Sanski Canton, 2019).

The budget of Sanski Most for 2022 also designated funds intended for agriculture: about 500,000 KM (BAM) (a little less than €254 000), was set aside (Municipality, 2022). This was intended for investment projects related to the renewal of livestock through the purchase of new milking heads, and the purchase of new agricultural machinery and attachments, and the diversification of agricultural production.

We can see that financing is different according to the municipality. Sanski Most has a larger budget and seems to have more diverse funds as it gets help from three different levels.

III.2.D. LITTLE COMMERCIALIZED CULTIVATION

In the Mrkonjić Grad municipality, agricultural land occupies 52% (35 583 ha) of the total area. In Sanski Most this figure is 48% (37 750 ha). Both municipalities are approximately covered by the same proportions of agricultural lands. However their compositions differ (Figure 25).

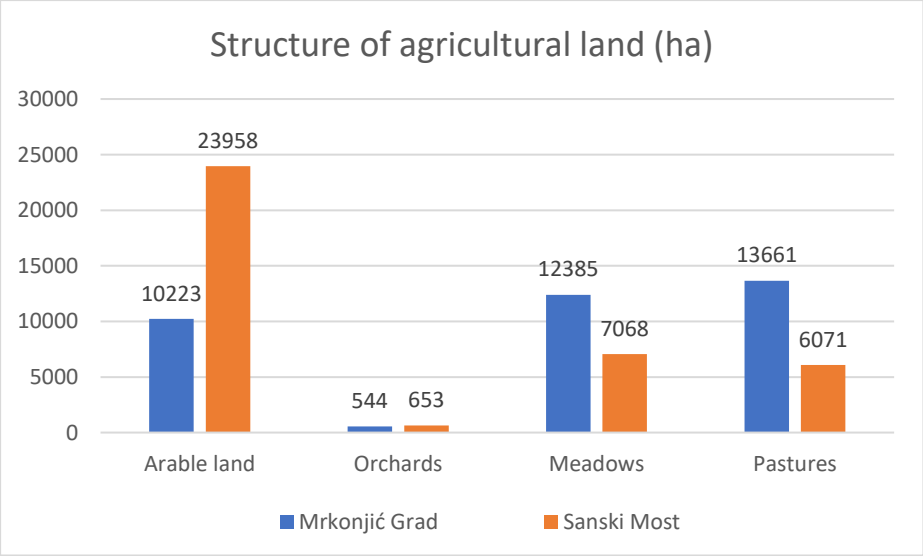

Figure 25: Structure of agricultural lands of Sanski Most and Mrkonjić Grad.
Source: Borka Malešević, 2023. Information: Spatial plan of both municipalities

Sanski Most has twice as much arable land than Mrkonjić Grad which is more given over to pastures and meadows.

III.2.D.a. Crops

In both municipalities, fertile lands are mostly located in the flat humid areas plains/polje. The karstic hilly parts, which are rocky, are only suitable for agriculture when the soil allows it: luvisol, brown valley soil… mixed with the calcomelanosol which is a poor stony soil (Annexe 2.3; Annexe 2.7).
In those altitudes (mean ≈ 500 m), people are used to cultivating crops such as corn, buckwheat, oat and rye. Wheat does not thrive in the associated climate (7, Municipality, MG). They can also use the fertile areas as meadows, to harvest hay for animals and/or use them for grazing. Triticale is also sown for feed. Cultivated areas are more present in Sanski Most, especially because of its large plain areas near the rivers (Figure 30).

People use mainly corn, hay and grass to feed their animals. Their productions vary according to the size of their herd. Some of them buy feed from their neighbours if their own production is not sufficient. Small amounts of the production are used for human consumption, directly or through flour. Even if both municipalities present suitable areas for cultivation we did not encounter anyone registered as commercial. Farmers selling their production generally have a cluster of private clients: mostly villagers who buy crops for their animals. This surplus-seller type (as a main activity) represents only a few people. In Mrkonjić Grad we did not meet anyone selling crops contrary to Sanski Most (64, Corn producers, SM: Podlug and Lusci Palanka).

There are no processed products made from those crops, except bales of straw for animals. There is however, one person in Mrkonjić Grad who produces and sells home-made beer. This person is registered as a commerce and started his business in collaboration with the Pecka Visitor Centre which buys his products (2, Greenway Association, MG).

III.2.D.b. Vegetables

People also have gardens where they generally grow tomatoes, potatoes, cabbages, lettuce, peppers, watermelon, onions, cucumbers, courgettes, beans, pumpkins, beetroot (Figure 26).

People generally do not use pesticides. We only met one person using insecticides on her potatoes. They usually feed the soil with manure from animals. It is then a qualitative organic production. They generally do not irrigate either and let the ambient climate do its job.

Figure 26: Picture of a garden (MG: Bjelajce, 2022)
Source: Zoé Siegel, 2023
In the background we can also see an orchard.

Because of the temperature, some vegetables such as tomatoes and cucumbers, have trouble thriving. The temperature during the night is generally lower than 15 degrees and affects plant growth (7, Municipality, MG). That is why greenhouses were distributed to people in Mrkonjić Grad. The Municipality donated 56 greenhouses in 2013: 16 of 200 m^2 and 40 of 100 m^2. Numerous people in Sanski Most also have greenhouses. The drop by drop system is mostly used as an irrigation system in those infrastructures.

People generally grow vegetables for themselves. Some of them sell their products in markets or have a small roadside stand generating an additional source of income (82, vegetable seller, SM). Other people "with a good reputation" sell their vegetables to private clients (direct sales). They often offer other products such as eggs, milk, honey, juice, vegetable sauces, etc. In certain cases, farms are registered as commercial enterprises and sell milk or animals (74, animal and vegetable seller, SM) (83, Milk and vegetable seller, SM). Small shops (grocery type) in the villages can also buy vegetables from local producers (83, Milk and vegetable seller, SM). People selling vegetables were mainly found in Sanski Most. In Mrkonjić Grad, we did not see any small roadside stands and the people who sell vegetables at the local market, are mostly from other municipalities. We did not meet any people selling vegetables from home either. In this municipality, there is only one person registered as a commerce and who sells potatoes (Desiree variety) (25, Vegetables seller, MG). There is also no cooperative.
In Sanski Most more people sell vegetables. One commercial association named AGRISAN can be found in the centre. This association groups 50 greenhouses and sells vegetable seedlings. When they are not bought by clients, the plants are left to mature the

resulting crop is sold. The association also owns 5 shops where material for agriculture is sold. This organization is registered as a commerce and is the only one selling its vegetables to supermarkets. It started with a fund from the Netherlands. A person surveyed complained that "*It is hard to organize such a project because there are a lot of administrative procedures to follow*". Once registered the enterprise is subject to inspections from the Ministry at the cantonal and federal levels to check the health of the plants (88, Agricultural association, SM).

III.2.D.c. Domestic fruit

Fruit production depends on climatic conditions (temperature, light, precipitation), terrain topography (altitude, slope) and soil type. Fruit production is favored in areas with an altitude of 400 to 1000 meters above sea level. The valleys are not suitable due to higher air humidity (85, Fruit producer, SM). Therefore, the most favorable areas for fruit are over 400 m with a slope so that water does not accumulate (wet areas are not good for fruit) and a gentle wind current. The stretch from Banja Luka to Sanski Most has a warm climate which favors the cultivation of various fruits (85, Fruit producer, SM). Successful production of apples, plums, and pears is possible at a temperature fluctuation during the year of between +35 and -20°C (Keserovic, 2016).

The average altitude in Mrkonjić Grad is 591 m; the relief of the municipality is hilly-mountainous with a moderate climate which results in good conditions for fruit production, as well as in Sanski Most with an average altitude of settlements of 500 m.

In the territory of Mrkonjić Grad, orchards are more developed and widespread, as well as fruit generally. Orchards, mostly plum - either old (30+ years) and new (10 years) – characterize the landscapes of Pecka and Medna (16, Self-sufficient, MG). Other areas rich in orchards are Baraći and Jasenovi Potoci (7, Municipality, MG). Generally, orchards occupy the southern part of the municipality.
In Sanski Most, we observed orchards in the southwest (Jelašinovci), in the southeast (Dabar, Čaplje), and north (Podlug). One large producer and seller of fruit is located in the Fajtovci settlement.
The types of fruit trees present in both municipalities are plums, apples, pears, and quinces. Aronia are present only in Sanski Most.

Plums are one of the hallmarks of the Mrkonjić Grad municipality. The traditional variety of plum is *Savka*. Old orchards can still be found. However, the so-called *Šarka* disease (a disease caused by the Plum Pox Virus (PPV) resulted in the reduction of Savka (7, Municipality, MG).
The municipality created projects for the development of fruit growing and the stimulation of the local economy. The Municipality through collaboration with the IFAD[9] and other foreign funds has distributed plum trees since 2009 (varieties: *Savka* and *Čačanka rodna*) and also chestnuts to encourage fruit growth.
A similar project, in 2016 was initiated to develop raspberry production. Raspberry seedlings as well as the necessary equipment (irrigation systems, hoses, cables, and barrels) were given to interested citizens. In addition, the municipality provided instruction for new producers. For some people, it became an additional activity, to supplement their income

[9] IFAD: International Fund for Agricultural Development

and at the same time use their own land (20, Raspberry producer, MG). The area had a good climate and soil (necessitating just the addition of manure), with no other specific requirements. Until 2019, the municipality had more than 40 raspberry producers, but today only five or six remain. The main reason for the decrease is the low purchase price for raspberries during 2017 (20, Raspberry producer, MG). People abandoned this activity.

The main transformations of fruit are 'rakija' (fruit brandy), juice, and jams. We saw a more diverse and extensive use of fruits in Mrkonjić Grad.

Rakija production

Rakija is a popular drink in the South Slavic areas (Bosnia and Herzegovina, Serbia, Croatia, South Macedonia, and Bulgaria) and also in Greece and Albania. Rakija is a result of the distillation of fermented fruit (most often plums in Bosnia and Herzegovina). *Kotao za rakiju* is the name of the distillation device – the still (Figure 27). It consists of a boiler, a steam pipe, and a refrigerator. Most often, one person in the village owns it and lends it to others (35, Chicken seller, MG). All villagers from the surrounding villages share the still. Rakija making is often a reason to gather family and friends. It is a colourless liquid, and the adding of other ingredients (mulberry or plum branches) results in its typical golden colour. Traditionally, it is stored in oak, barrels from which also adds to the colouration.

Figure 27: *Kotao za rakiju*, the still used to make rakija (MG)
Source: Zoé Siegel, 2023

Rakija is a flagship product of Mrkonjić Grad, more precisely plum rakija. As a result, there is a festival to promote rakija that is held once a year, the so-called *Rakijada*.

The production of rakija is less common in Sanski Most, because alcohol, including rakija, is forbidden by the Muslin faith.

Juice production

In the territory of the municipality of Mrkonjić Grad, we can single out the production of fruit juice as the most common way of using fruit. Since many families own an orchard of varying sizes, they take their fruit to those with squeezing and pasteurization machinery. The juice is for private consumption and is a way to preserve the taste and the nutritional value of their excess fruit. Currently, three producers produce juice in the municipality, as a result of numerous demands. "*We saw that it's really popular and that a lot of people want to produce juice from their fruit, we also own 1 000 granny smith apple trees, so we decided to start it as an additional activity for the family. People bring us their fruit (apples, pears, plums) and vegetables (carrots, beetroot) to make juice. During the season we work non-stop each day, to meet demand*". (1, Juice producer, MG). Juice production is not commercialized, except for the three juice producers.

In Sanski Most, only one big producer of fruit exists. He has 2.7 ha of orchard with a total of 3 500 fruit trees. He produces apples, plums, pears and has recently planted chestnuts. Additionally, he produces raspberries (0.3 ha). The main problems are: the low purchase price, labour shortage, and climate (mainly the early or late frost which adversely affects buds) (85, Fruit producer, SM) (7, Municipality, MG). "*Chestnuts, are more resistant to frost because the bud appears later (it blooms in June), my plan for the future is to plant a lot of chestnuts. A hybrid type of European and Japanese chestnut, which is resistant to root cancer, which affects the European chestnut.*" (85, Fruit producer, SM).
API-MED is a cooperative in Sanski Most which produces and sells honey and juice. It buys fruit and honey locally. It is an example of a possible successful way of organizing local production. It started with 7 local beekeepers in 2005 who wanted a way to sell honey. Today the association has 13 beekeepers and sells its product to buyers from all over the world (Qatar, Arab Emirates, Switzerland). It also sells in B&H in large markets, stores, and restaurants. Raw products (honey and fruit) are bought from producers in Sanski Most in priority. Local people can sell their fruit there. It is a way to add value to those products and avoid waste. People can easily get an additional source of income by selling their excess fruit (66, Honey and juice producer, SM).
Aronia, a fruit of the rose family (*Rosaceae*), is a new, very popular production in Sanski Most (Figure 28). The main reason for the popularity of aronia is its distinct healing properties. We interviewed three producers but they are many more. In a lot of villages aronia plants are visible. Producers make juice from the fruit, which they mostly then sell. However, there is no organized way of selling it. Producers sell through bulletin boards in front of their house or on the internet.

Figure 28: Aronia plants in Sanski Most.
Source for the inserted image: Zoé Siegel, 2023

III.2.D.d. Three main issues for cultivation

Three main issues concerning cultivation were identified during the interviews.

(1) Drought, especially in areas poor in water. Drought has increased in recent years. It is however not at a catastrophic level. People use the water from the municipality to irrigate their crops. Drought is the only climate change that people have felt these past years.

(2) Wild animals. In both municipalities, bears and wild boars tend to destroy crops. Bears especially eat corn and plums. In Sanski Most, beavers also attack crops near the Sana and Sanica rivers (62, Milk producer, SM).

(3) The prices of seed and gardening material is also one of the main obstacles to cultivation (25, Vegetable seller, MG).

III.2.E. 4.2.4 IDEAL LIVESTOCK AREAS BUT DECREASING ACTIVITIES

Both municipalities are known as livestock areas (Table 2). Today, less than a quarter of the initial cattle population remains. A lot of pastures were abandoned leaving room for encroachment and natural forest growth – villagers showed us huge areas of forests that were once pastures filled with livestock (16, People from the city, MG).

Table 2: Number of cattle in Sanski Most and Mrkonjić Grad since 1971

	Census			Estimates (limits in the data because not all people register their cattle)			
Years	**1971**	**1981**	**1991**	**2011**	**2015**	**2016**	**2022**
Mrkonjić Grad	14 371	12 384	10 985	?	4000	3950	2500
Sanski Most	16 856	15 719	12 475	6090	?	?	3000

Source: Federal Institute for Statistics, 2022; Department of Economy and Finance of the municipalities

Censuses for the number of cattle were carried out before 1991 in both municipalities. After this, only estimates were made. These numbers are not completely accurate as people do not necessarily declare their cattle and the number only includes the ones that are registered. In Mrkonjić Grad there is currently 2 500 heads of quality breeding cattle according to the official assessment of the municipality (7, Municipality, MG). In 2011, the municipality of Sanski Most had 6 090 cows. About ten years later, that number had decreased to 3 000 (Municipality of Sanski Most, 2022). Both municipalities lost half of their cattle in 10 years!

Two breeds of cow are present in both municipalities: Holstein and Simmental. These are new, imported cattle breeds. Due to good reproductive characteristics and above all high milk yield, producers substitute them for their old breeds. The domestic *Buša* cattle, which was the dominant Balkans breed, especially in the hilly and mountainous areas, is no longer present in either municipality. They were smaller and produced less milk than the two new imported breeds. In Podgorja, on the karstic Plateau in Mrkonjić Grad the whole village was still breeding them 20 years ago (14, Animal seller, MG).
Today, the purebred *Buša* lives on among the inhabitants of the isolated mountain areas of the Balkans, as well as among modern organic herders, who maintain small or large herds on open (traditional) grazing. The *Buša* belongs to the group of short-horned cattle - Bos *Brachyeros europeus*. It is a domestic ‚mountain cattle breed or Illyrian cattle breed. (Centre for the preservation of indigenous breeds, 2022).

This disappearance of the local breed, like the dramatic decline in livestock is a sign of agricultural crisis in municipal territories whose pastoral vocation is obvious – and in a country with a huge deficit in food production.

III.2.E.a. Milk production: the most developed agricultural activity in distress

In the two municipalities the most represented, commercially orientated agricultural activity is the production of raw milk, and more precisely cow's milk. This is explained by the presence of a guaranteed purchase by national milk factories. They buy milk from all producers, both large and small, who are even more numerous.

In Sanski Most there is the Milksan milk factory located in the centre of the municipality. It buys milk only from around 100 producers from the municipality (88, Milk factory, SM). In addition to Milksan, two other dairies purchase milk: Meggele dairy (located in Bihać city) and Mig Gradačac (located in the Gradačac municipality).
In Mrkonjić Grad three dairies purchase milk: Meggele (Bihać) as in Sanski Most, Šipovo dairy in Šipovo, and Mlijekoprodukt (located in Kozarska Dubica –the largest milk factory in Bosnia and Herzegovina).

Several ways to collect the milk

1. Collecting centres

Collecting centres are to be found in the settlements, either as small individual facilities with milk refrigerators or as part of the farm of one of the milk producers. That farmer collects his own milk, but also that from other producers. Producers bring milk to the collecting centre in buckets.

The factory lorry collects the production at the farm or centre (usually every two days). Collecting centres are mostly used by producers who don't have their own milk refrigerators (small producers with 4, 5 or a maximum of 10 cows) or people who live in places where lorries cannot travel (damaged, small roads, and similar).

2. Collection of the milk directly at the farm

All large producers (15 cows or more) have their own premises with a refrigerator for milk. They collect milk daily and a lorry from the dairy comes directly to their farm each day to take the milk.

3. Milk collecting by the agriculture association

In Mrkonjić Grad, Poljo-Podrašnica, an agricultural association, has a contract with the Mlijekoproduktmilk company. They collect milk for them. The collecting centre is located in Podrašnica, and milk is collected by 4 lorries every day. The refrigeration capacity in the collecting centre is 20 000 L of milk. Daily collections are from 8 000 to 10 000 L. They collect production from 130 farmers (mostly small producers with 4 or 5 cows, but also from the larger ones with 20 to 30 cows). In the end, a lorry from the milk factory comes to the centre and transports the milk to Kozarska Dubica (4, Milk collector, MG).

During the winter period (November to April), companies collect only 50% of summer production figures because the cows have less food and therefore produce less milk (4, Milk collector, MG).

A price calculated according to milk quality

The purchase price of milk is based on several criteria prescribed by the Law and Regulations (Regulations on the quality of raw milk). The main conditions (basic standards for raw cow's milk) are to contain at least 3.20% milk fat, 3% protein, 8.5% of dry matter, and other conditions related to the degree of acidity, or freezing point. Furthermore, milk is classified into classes depending on the number of microorganisms and somatic cells it

has. Four classes of milk are defined (E, I, II, III). Raw milk whose quality has not been determined cannot be bought by milk factories.

Furthermore, the base price is calculated on the percentage of fat and protein, and the monetary value that is defined between the buyer and the seller of milk (mathematical formula defined in the regulations). Samples are taken by experts from each farm.

The price varies according to milk quality but also according to the municipality (Figure 29). We produced statistics from our interviews. We asked producers how much they were paid for 1L of milk.

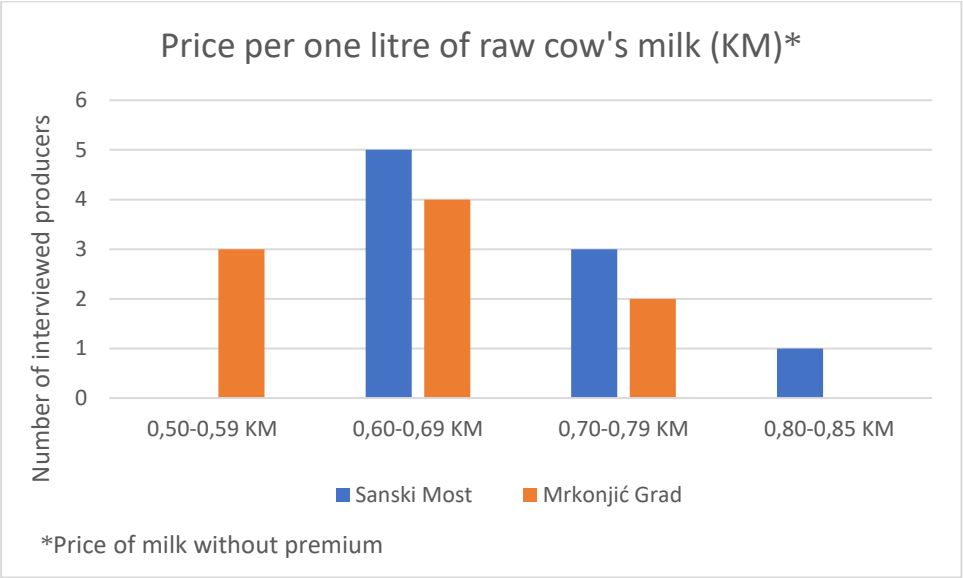

Figure 29: Price repartition for one litre of cow's milk according to the municipality.
Source: Interviews, 2022 Graph: Borka Malešević

The average price for 1 L of raw cow's milk is higher in the Sanski Most municipality (0.69 KM) than in Mrkonjić Grad (0.62 KM). Moreover, prices given to milk producers in Sanski Most do not go under 0.60 KM, contrary to Mrkonjić Grad.

In the Republika Srpska, milk producers have subsidies for milk and for fuel. The subsidy is 0.25 KM per litre of milk (Ministry of Agriculture, Forestry, and Water Management, 2022).
In the Federation of B&H there are no subsidies for fuel, but people receive Federal and Cantonal subsidies. In 2021, milk producers in Sanski Most only received federal subsidies equal to 0.26 KM per litre of milk produced. Cantonal subsidies were given only for laboratory analyses of milk and for the supply of fuel (Ministry of Agriculture, fForestry, and Water Management of Unsko-Sanski canton, 2022).

A drop in milk production

Producing milk as a commercial concern started after the war. Some people started this activity as a full-time activity. This was not the case during the communist period.

In Mrkonjić Grad production rose to 4 million litres in 2009 (Figure 30). At this time, the major buyer of the municipality was a milk factory in Banja Luka. This factory shut down and since then production drastically decreased (10, Milk producer, MG).

In 2016 production decreased by 2.5 million compared to 2010. People bought less milk and the Mlijeko company reduced its number of partners (4, Milk collector, MG). Larger producers were favoured. Milk sales continued to drop and today the Municipality estimates that only 500 000 L are processed in Mrkonjić Grad (Figure 30). Small producers remain in the majority. Around 10 people sell milk as a main activity in the municipality (4, Milk collector, MG) (7, Municipality, MG).

People are feeling these changes such as those responsible for the milk collection centre in Kopljevići. They have been responsible for the milk collection centre since 2000. At that time, 20 producers were bringing in their milk. Today only one or two producers come. Before 500 -600 litres of milk were collected daily and today that figure has dropped to only 50 litres for a two-days period (10, Milk producer, MG). It is the same for the collection centre in Gustovara. They previously had more than 40 producers bringing in milk. Today only 5-6 small producers with no more than 6 cows use the facility (38, Self-sufficient, MG).

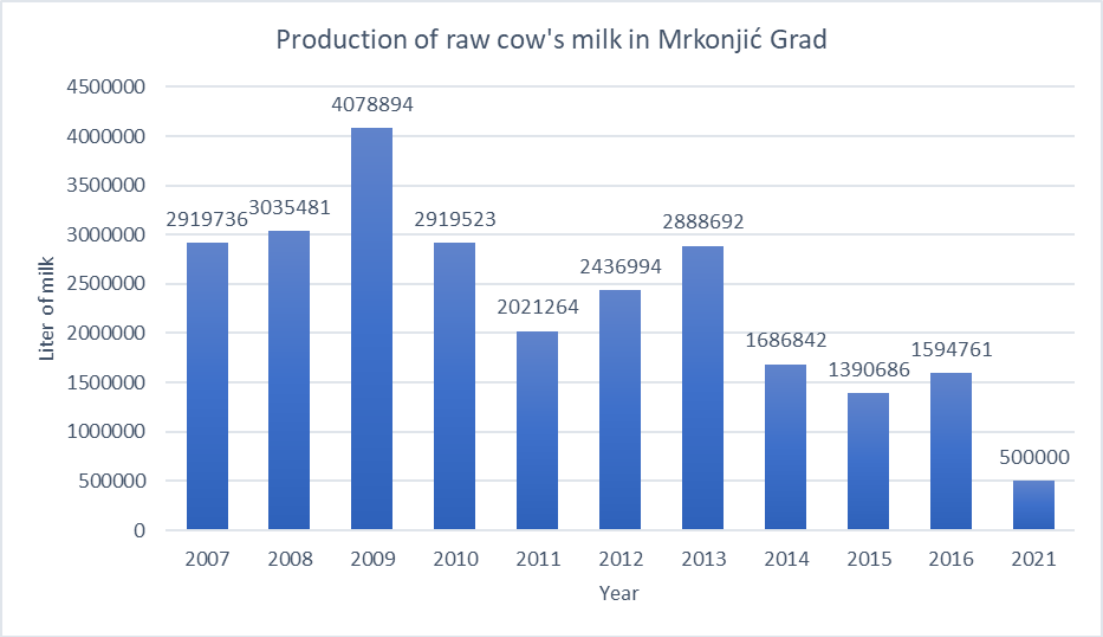

Figure 30: Milk production from 2007 to 2016 in Mrkonjić Grad
Source: Municipality of Mrkonjić Grad- Department for Finance, 2022. Graph: Borka Malešević
The last year was added with the estimates from the municipality

Between 2007 and 2011, Sanski Most produced between 9 million and 9.5 million litres per year (Figure 31). Today, this number has decreased to 7.5 million litres of milk per year.

People in Sanski Most are also aware of this decrease, even if it is less noticeable than in Mrkonjić Grad. In Gorice village for example, there were 15 producers 2-3 years ago. Today there is only 1 (61, Milk producer, SM). In the collection centre in Kamengrad it is the same. There were 18 producers 13 years ago and today only one (77, Milk producer, SM).

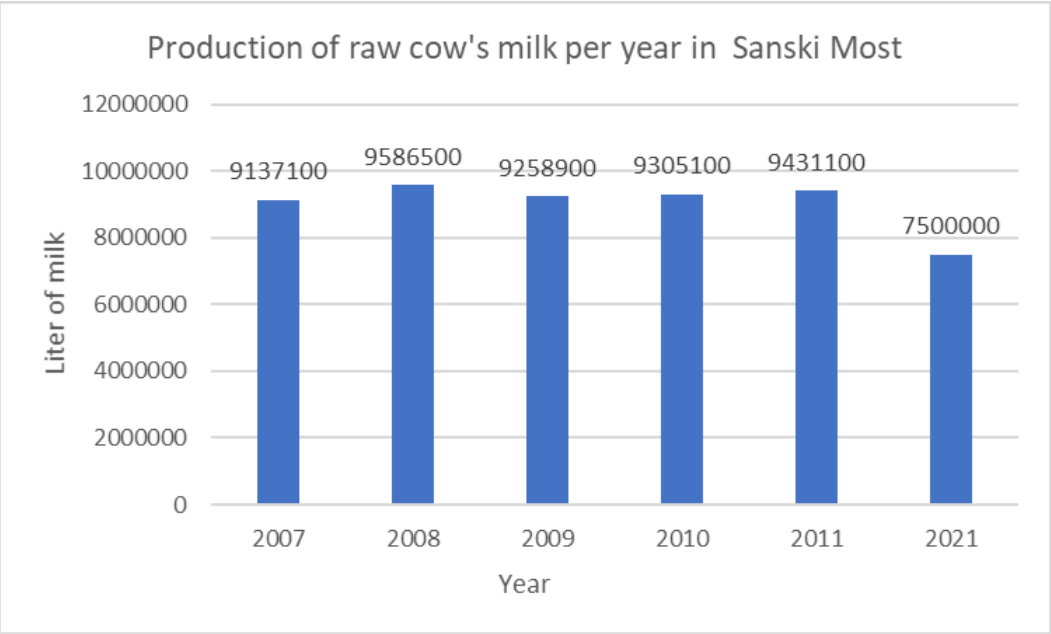

Figure 31: Milk production from 2007 to 2011 in Sanski Most
Source: Strategy of local development of the Sanski Most municipality 2014-2023, 2014. Graph: Borka Malešević

Increase in animal feed: the main issue for milk producers

The farmers have stopped producing milk because of the increase in the price of animal feed over the last few years. The price of corn, oats, concentrate, but also fuel, has recently doubled – while the price of milk stagnates. "*To buy one litre of fuel I have to sell four litres of milk*" (42, Milk producer, MG). It is mostly a problem for people who do not have enough land to produce sufficient quantities of feed for their animals and/or for pasturing. The problem of drought is then more pervasive – diminishing the farm production of feed and the nutritional quality of the pastures. Even larger producers have trouble maintaining their production as they often buy additional feed and concentrates for their cows (6, Milk farmer, MG).
However, the highest number of dropouts comes from smaller producers (≤ 10 cows). Milk production is often an additional activity for them. However, for some it is their main activity and these people struggle to continue with low incomes (36, Milk producers, MG).

All milk producers interviewed have a similar system of managing and breeding cows. Producers feed cows with grass. They generally let the animals graze during the summer and take them to the cow shed for the winter. Producers provide additional food as well: concentrate, corn, barley, rye, oats, or triticale. They feed the cows during the winter mainly with the hay they collect during the summer. The concentrate needed can be bought in agricultural stores or cooperatives. In order to use corn more efficiently producers ensilage it and use it exclusively.

Land management: often divided and dispersed lands

The legacy of the communist regime was that farmers could not have more than 10 ha of property, one of the important issues was, after the war to gain access to more land – renting from neighbours or using abandoned land nearby. Sometimes older people lend their fields because they can no longer cultivate them. However, when there is no close pasture or agricultural land available, people have to buy or rent land in other villages, most of the time in the plain and polje. In some places people cannot cultivate because of the damage caused by wild animals - they have no choice but to buy feed for their cattle (27, Sheep seller, MG).

Renting land owned by the municipality is not common. Some producers said that their demands were rejected by the municipality and that land was leased instead to large, influential producers with political connections (60, Milk producer, SM) (42, Milk producer, MG).

Description of milk producer categories

Based on the interviews we have categorized milk producers according to their number of cows. By comparing information, we estimated the proportion of milk producers that are registered in each category. We compared these results between the two municipalities (Figure 32. People that we listed are people who mainly live from the sales of milk. So small producers are not really represented because most of them sell milk as an additional activity. In Mrkonjić Grad we managed to list all producers with more than 10 cows (around 12 families from a total sample of 17). In Sanski Most it was more difficult to have exact numbers as more producers are present and our estimates comes from a sample of only 15 families.

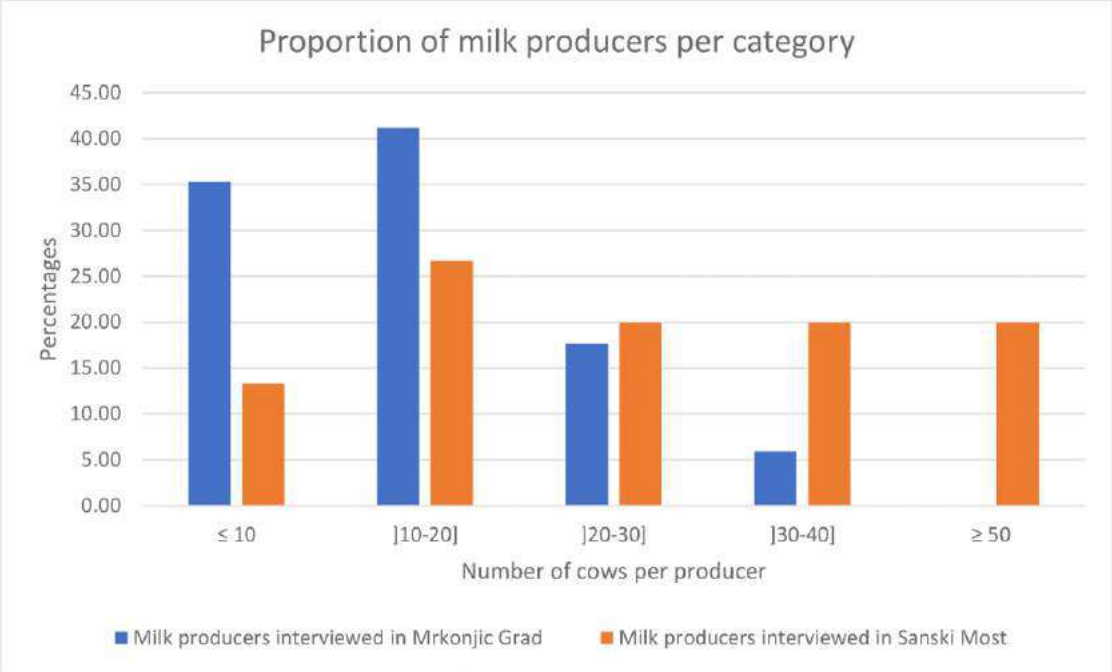

Figure 32: Proportion of milk producers per category (estimates).
Data: Interviews, 2022. Graph: Zoé Siegel

In Mrkonjić Grad the majority of producers (75%) are small and have fewer than 20 cows. No milk producer has more than 50 cows. In Sanski Most, big producers with >30 cows are more numerous (40%) and there are fewer small producers. Large farms generally carry the family name of the owner and employ several workers.

Other milk products

People also use the milk to make cheese, the *kajmak* - traditional cream cheese, generally for personal consumption. Only one small cheese factory is present among the two municipalities.

It is located in Podrasnica in Mrkonjić Grad. The factory was founded in 2021. It is the result of a collaboration between the Municipality, the Government of Sweden, the Ministry of Finance and Local Communities RS, the Investment Development Bank RS, and the UNDP. Two women from Podrašnica are employed producing 2 types of cheese (full-fat cheese slices and full-fat hard cheese). This method of production and types of cheese are not characteristic of the area but the milk is bought from local people. They use 150 L of milk daily (5, Cheese factory, MG).
In Sanski Most, in the Vrše village (settlement of Gornji Kamengrad), one family is registered as an agriculture farm and produces cheese (hard, smoked and soft cheese) and milk products (bottled milk, yogurt, butter). This family sell its produce to people who come to buy directly from their farm.

Both municipalities have experienced a decrease in milk production. In 10 years, production has dropped by around 3.5 million litres in Mrkonjić Grad and by around 2 million in Sanski Most. However, the production remains a significant agricultural activity in both municipalities, especially Sanski Most which is the second largest producer in the Unsko-Sanski canton.

The future of milk production in Mrkonjić Grad is nevertheless in doubt. There are only around 10 big producers and the smaller ones have tended to stop their activity, even though the municipality has better conditions for cattle breeding than in Sanski Most with more pastures and meadows (Figure 30). "*People in Mrkonjić can survive because they have a lot of pasture lands and can feed their animals with grass only, avoiding the purchase of complementary food*" (4, Milk collector, MG). However, this advantage is used by several livestock breeders but mainly for the cow-calf system – a more present and popular system these days in Mrkonjić Grad (7, Municipality, MG).

III.2.E.b. Meat Production, a growing activity but with difficult access to the market

In the rural areas people generally have a few animals that they kill for meat for personal consumption (chicken, sheep, cows, pigs). Pigs are only present in catholic families.

3 selling systems were identified during the study:

Farms

Farms that sell several types of animals and also derived products. They have a bit of everything: chicken, pigs, sheep, and cows. Generally, clients come to their house to buy the products. In some cases, animals are also lent to the neighbors for a reproductive function. Farms like this are present in both municipalities, but are more frequent in RS. People are generally registered as a commerce and this activity usually represents their main work.

Sheep sellers

The best-selling animal in both municipalities is the sheep. People generally have herds that they graze in the surrounding fields (pastoralism). They also feed them with complementary food as they do for cows. People are generally not registered for this activity even if it constitutes their main work (76, Sheep seller, SM). As they cannot access the market because of price competition, they choose not to register themselves. It avoids all the time-consuming paper work and taxes. Large producers have generally between 200 - 700 sheep. People generally sell their sheep to private clients or restaurants. Clients can come from other municipalities. The demand seems to be higher in parts of the Federation of B&H. In Mrkonjić Grad, the main clients come from Posusge in Herzegovina and Sarajevo.

People mostly breed their sheep at home. There are not a lot of shepherds in Mrkonjić Grad. Most of them are in the adjacent municipality, in the Manjača plateau.
We did however meet one nomad shepherd in Podraško polje (in Orahovljani village) (3, Shepherd, MG). During the summer he takes the sheep up to the Dimitor mountains (from May to August). Then he moves to Mrkonjić Grad in Orahovljani (from September until November) and he migrates to Prijedor during the winter period (from December to April) because it is at a lower elevation. He stays with his sheep and has a partner. The man has a tent where he can sleep and has 9 donkeys to transport his belongings and equipment. He started working 20 years ago. It is a family tradition that he followed. He learnt the job from his father. He moved with him when he was a child and learnt from him in the field. He would love his son to perpetuate the tradition but he is not interested. He is actually ashamed of his father's job.

The sheep bred in both municipalities are fat-tailed sheep: the *Pramenka* domestic breed typical of B&H. They are often accompanied by specific sheep dogs: the *Pulin* breed which is a small dog with a curly black coat and the *Tornjak* breed, which is larger and long haired (Figure 33).

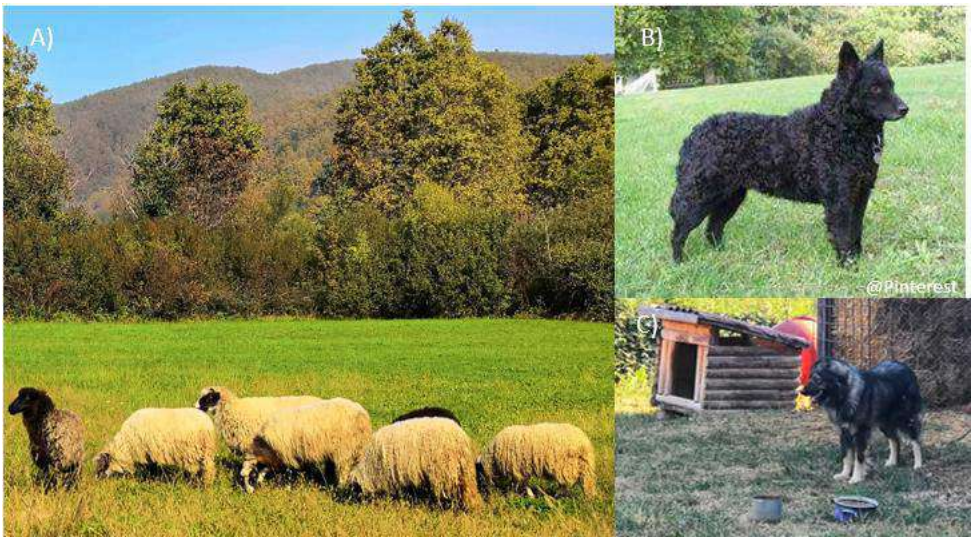

Figure 33: Sheep and sheep dogs from B&H.
Source : Zoé Siegel, 2023
A) The *Pramenka* sheep. B) The *Pulin* dog. C) A cross breed with the *Tornjak* race

People generally produce *priglovci* and jumpers from the wool. (Figure 34). *Priglovci* are socks that women knit with needles. They make them in different sizes. A wooden knitting machine called a *predilica* is used for woollen jumpers. In Mrkonjić Grad, a *priglovci* association exists between some women of the municipality.

Figure 34: Woollen Products (MG).
Source : Zoé Siegel, 2023
The knitting machine named *predilica*. B) A woollen jumper. C) A *priglovci*, the wool sock

The cow-calf system

The cow-calf system is an emerging activity present only in Mrkonjić Grad. 4 families are currently actively engaged. We do not have data for one producer. Two have between 50 and 100 cows. The last one is the biggest producer in the municipality. He has more than 300 cows (Table 3). He is also a politician and we did not manage to meet him.

Table 3: Number of cow-calf producers according to their number of cows

Class	No data	[50-100] cows	≥ 300 cows

Cow-calf system presented by a producer (13, Cow-calf system, MG)

It consists in breeding cows and selling calves. In this case Limousine cows. It is a type of production where you need enough space to leave the cows outside as much as possible.

Cows graze freely in the field and drink from natural springs. They move wherever they want inside the area, which is fenced: in this case 20 ha. They give birth to calves in the field. During the winter the cows are brought into the barn and are fed with the hay collected during the spring and the summer. No additional food is provided.

"*In this kind of production, you don't have so much to do. The most rigorous work you have is to cut grass and collect it. So you simply leave the cows in a natural environment.*" He generally has to hire a supplementary worker for the hay harvest.

The producer does not have fixed clients. He sells his calves to anyone by direct sale on a very short circuit. There are always buyers, because the supply is not great in the region. However, it is not a continuous sale. He might have no clients one month and a lot of them the following month. There is no rule. Most people are from other municipalities and come directly to the farm to buy the calves. The price of one calf is around 150 KM. He occasionally sells cows but will select a bad breeder.

He earns around 30 000 KM per year. It is a profitable activity. He also receives subsidies from the municipality. "*He has everything he needs*".

The only limit that could exist in this activity is at the beginning because money is needed to start.

Our presentation of the system is only based on one complete interview.
In this particular case the producer has qualitative lands which means he can leave his cows at liberty. In other areas with no natural springs for example, it would perhaps be more complicated to implement such a system.

Meat sellers are present in both municipalities but there is no existing market access organization. Breeders sell products to private clients: neighbours, restaurants, or people from other municipalities. There are no constant buyers and therefore no job security. Some people complain because their activity is too uncertain and there is not enough help from the government. "*Before the war people bought local products, you knew your clients, you could plan your production.*" (76, Sheep seller, SM). Today it is not the case. People have difficulty

in anticipating the coming years. A lot of them think that it is not possible to live from agriculture alone.

Animals are not only used for food, they are also pets (horses, cats, dogs).Some people even have bulls to participate in the traditional competitions.

III.2.F. HONEY, A QUALITATIVE PRODUCT WHICH IS NOT HIGHLY VALUED

Honey production is present in both municipalities. People usually produce honey for themselves or sell it from home, in markets or to cooperatives where they exist.

Local Associations exist: *Matičnjak* in Mrkonjić Grad and *Sana med* in Sanski Most. Both have around 100 members. Municipal associations are linked to an Entity association, but this latter does not particularly benefit its members. It is just an administrative representation (44, Honey association, MG). Associations are not of a commercial nature. They are composed of passionate people who collaborate to share their activity and to sell their product at the market.

People producing honey are essentially small producers in both municipalities who have less than 20 hives. They are generally older self-sufficient people. In Mrkonjić Grad, two producers have between 150 and 200 hives (44, Honey association, MG). In Sanski Most, there are around 150 beekeepers including 5 to 6 big ones (66, Juice and honey producer, SM).
In Sanski Most, a cooperative was created in 2005 on the initiative of the bee keepers association: it is called *Api-Med* - the same cooperative which also sells juice today[10] (66, Honey and juice producer, SM). It is a commercial company which also sells derived products such as royal jelly and propolis in pharmacies and markets. They buy honey from producers and have their own brand. They also produce and sell honey for other companies.

Passionate people who often have a large production explain that most of the people do not have the knowledge to maintain hives. They just install them to get subsidies from the European Union (44, Honey association, MG).

Most producers keep bees in one place. However, for higher quality honey they need to move their hives as much as possible, to get pollen from various plants. Passionate people know that and put their hives on trailers that they transport to different places (Figure 35). This practice also results in different types of honey: from meadow, forest, or a mix (73, Honey producer, SM). By moving bees, the potential of each plant and area can be better used (44, Honey association, MG). People move their bees across the country. The bees do not forage plants treated with pesticides and the honey is of high organic quality. Beekeepers take advantage of the abandoned lands where no one lives to install their trailers (73, Honey producer, SM). They often have to install electrical fences against bears. Sometimes they set up in people's fields and these then call the police because they are afraid of the bees. Moving hives to get the best honey possible requires specialist

[10] Cf Fruit section

knowledge. In some families, this activity is a tradition that has been transmitted: "*You have to know how to read nature if you want to be a beekeeper*" (44, Honey association, MG). Hives are moved based on the period of the year, temperature, rainfall, and flowering.

Figure 35: Hives on trailers in the plateaux of Sanski Most.
Source: Zoé Siegel, 2023
Plateaux are often abandoned and surrounded by a lot of vegetation. They represent the perfect location for beekeepers to install their hives. Fences are installed around to keep away bears.

Apis mellifera carnica or *Kranjska sivka*, the Carniolan honeybee is the type of bee kept by the beekeepers. It is a subspecies of the Western honeybee that is found in Slovenia, southern Austria, parts of Croatia, Bosnia &Herzegovina, Montenegro, Serbia, Hungary, Romania, and Bulgaria. This breed is mainly used because it does not need a lot of food during the winter. Considering that B&H has 6 months of winter and cold weather this is a good argument (44, Honey association, MG). Two bee diseases appeared in both municipalities: the American foulbrood caused by the spore-forming bacterium Paenibacillus larvae and varroosis caused by the varroa mite.

The quality of honey is controlled by the Ministry. An inspector from the local veterinary service takes honey samples from a couple of producers each year to analyse its quality. In Mrkonjić 4-5 people are inspected each year. For people who commercialize honey such as API-MED this check is systematic.

Small producers are in the shadow of the large companies which do not tolerate any competition. We heard several testimonies saying that some of them had tried to buy honey from small producers at low prices in order to resell the products or to use them as samples in the laboratory analyses. (44, Honey association, MG). They send a false sample allowing their honey to be approved and then sell fake honey afterwards: a mix of sugar and honey which means that they have larger quantities (66, Honey and juice producer, SM). They can then sell honey at lower prices (ex: 5 euros per jar). No one can compete with this falsified offer on the market. High quality honey is less profitable. The problem is that inspections are not carried out directly at the source. (44, Honey association, MG).

A control was carried out last year, but the results were not published (66, Juice and honey producer, SM).

Even the law does not protect the honey quality. Diastasis is one of the main elements that is analyzed in order to check the quality of honey. In the specifications, a minimum value equal to 9 is indicated whereas a quality honey is recognized by diastasis greater than 50 (66, Juice and honey producer, SM). Honeys in between these values are then not penalized.

Small producers make direct sales. Their honey can also be found in handmade and organic product shops, which are emerging in the country: 2 exist in Banja Luka. However, in both studied municipalities shops with local products do not exist. People can find these products at festivals or at the local market.

Mrkonjić Grad has several areas that are favorable for honey production (the locations of the main producers). Honey-producing areas stand out in the western and southern parts of the municipality: Podrašnica, Podbrdo, Čadjavica, Medna, Jasenovi potoci, and Pecka. That is in the plain and hill systems in between the Manjača, Dimitor, Lisina and Ovčara-Mliništa mountains: and the Sana, Korana, Medljanska, and other rivers. Medna is a settlement at the foot of the Dimitor mountain, and its name means "honey-bearing place" a place with a lot of mellifluous plants. "*Medna is like a valley. At the bottom are meadows with forest on the low elevation and it is not too high so bees can also reach the forest*" (44; Honey association; MG). The north (Plateau of Manjača mountain) has less favorable conditions for honey production, as it is a karstic plateau with no surface water. Mrkonjić Grad has more than 40 types of mellifluous plants.

III.2.G. AQUACULTURE, ANOTHER POSSIBLE FARMING ACTIVITY

Fish breeding is present in both municipalities. In Mrkonjić Grad, in the village Oćune, at the foot of Lisina mountains, one trout producer has several pools for fish production (21, Trout breeder, MG). In Sanski Most, at the Spring of the Zdena river, there is a small restaurant with pools for the production of fish (58, Trout breeder, SM). Both breed trout. Other municipalities such as Prijedor, Ribnik, Foca, Derventa, Doboj and Jajce have more activities related to fish. In RS, carp are preferred to trout and in the Federation, it is the opposite.

People usually use water from natural springs/rivers that they divert to fill their pools where they breed fish. Both of these fishpools are the result of the motivation and hard work of their owners. In Mrkonjić Grad, a fishpool was made through the transformation of an old barn, with the water coming from the springs of the Lisina mountain. At the Zdena river, the Zdena spring is the main and only source of water with three pools for fish and a small restaurant where fresh fish are cooked and served to guests. Both of the producers sell fish privately to people, markets, restaurants. They do not have permanent buyers.

Even if the surrounding area provides good conditions for trout breeding (clean and abundant water, no pollutants), several problems are obstacles to the sustainability of the activity: absence of government support; uncertain clientele; difficulty in accessing the market; price competition and so on. These producers mostly make private sales within a short circuit.

There are also problems for the infrastructure and accessibility of the ponds. In Mrkonjić Grad, the installation is in the mountain: the roads are bad and it is difficult to access electricity. The food for fish has also become more and more expensive and so it has become more and more difficult to make a profit. Finally, some problems are linked to the climate. In Sanski Most, the water level decreased this year, allowing vegetation to take over the basin.

III.2.H. CONCLUSION

After the end of socialist Yugoslavia (and the civil war), it was hard to transit from nationalized agriculture with very small individual properties, to an efficient family farming system. People had few references to start agriculture as an economic activity even if they practiced self-sufficient farming. This difficulty is still observable today. People struggle to commercialize their productions without pre-existing buyers. Milk factories were the only buyers who allowed people to live securely from an agricultural activity. However, with the rising prices of animal feed and the stagnation of the milk price, this certitude changed. API-MED in Sanski Most also buys products from the local population but it principally allows people to get an additional source of income from their fruit, or honey for example. Only a few large producers of honey take advantage of the structure. Other existing projects such as the cheese factory in Mrkonjić Grad and the AGRISAN agricultural association in Sanski Most, are the result of foreign initiatives.

Except for milk production, all other agricultural activity has access to the market. People registered as a commercial entity can sell their products in supermarkets but their prices would not compete with those from the large food processors, both national or international. Moreover, the government does not favour local production. Around 60% of food is imported and the resources of B&H are then not valued. The only way to sell agricultural products is to sell them privately to people: from home, from roadside stands, or in local markets but the demand and sales in these short circuits is a bit erratic. For some activities, it is almost impossible to live from it, such as vegetable and crop cultivation (people generally already cultivate these products for themselves). One way is to diversify the proposition and sell additional products. Selling meat is more profitable and the demand is generally strong. However, with the rising prices of animal feed, the same problem is observed as in milk production. People stopped their activity because they are no longer profitable. Even large producers struggle. Only producers who feed their animals in a pastoral way and on their own land manage to sustain their activity (for example with the cow-calf system).

The future of this small agriculture is more than uncertain. The small surplus selling model of this fragmented land tenure and personal-consumption agriculture is probably living its last days with the current generation of older farmers. Young people are generally not interested in this activity or life in isolated rural areas without access to the basic public services such as health, or education. In Sanski Most where an agricultural high school is present, a lot of children seem to be interested by the domain during the visit but few of them are finally allowed by their parents to go there. Most students inside the school plan to work in another sector after their studies. (52, Agronomy student, SM).

However, we met some young agricultural producers, motivated to work in this domain and stay in the country. All the natural conditions are present for those activities and passionate people are present in both municipalities.
Farming still has a shameful reputation, but – if we look at other European countries – this might change quickly.

III.3. FOREST

III.3.A. TWO MUNICIPALITIES RICH IN FORESTS

Forests occupy an important place in both municipalities. According to the state inventory made between 2005 and 2009, forests and forestland in Mrkonjić Grad cover about 42 % of the municipality (Forestry company, 2012) and 46 % in Sanski Most (79, Forestry company, SM).

However, the depopulation and a decrease in agricultural and livestock activities since 1991 has resulted in a natural growth of the forests, visible in both municipalities, at the expense of arable and pasture lands. For the needs of the spatial plan, in both municipalities, the percentage of forests was calculated to have more recent data. As a result, in Mrkonjić Grad according to the new data based on the current situation, forest cover (including transitional bushy areas) occupies 76.55% (51 271,89 ha). In Sanski Most, by the same estimate, forests and forest land occupy 62.2 % of the territory (Annexe 38).
Forest is 20% more than expected, with young and coppice forests.

These new forests are not managed and they are for the moment of poorer economic quality, i.e. very dense coppice forests of oak, hornbeam, beech, maple, etc. Not only arable and pasture lands were taken over but also the courtyards of houses that are so completely overgrown that the houses are no longer visible (Figure 36). This growth is a common narrative of the people still living in these areas.

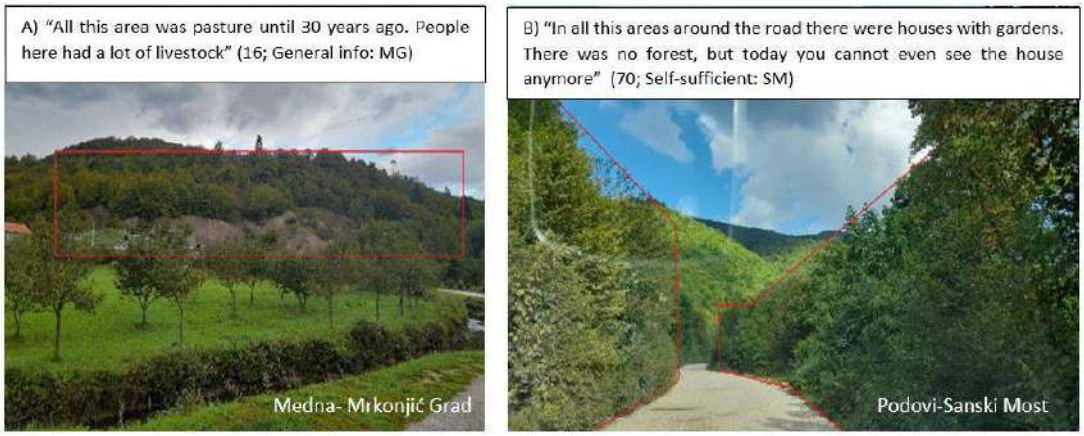

Figure 36: Testimonies of young forest apparitions over these past 30 years
Source: Borka Malešević, 2023
A) Pastures that have disappeared. B) Once there were houses by the side of the road, today there is a forest.

However, even if those new forests are not exploitable, they are diverse (Figure 37).

Vegetation inventory made on the road side in Bosanski Milanovac (SM, 2022)

Beech tree (+++)

Maple tree (++): mostly *Acer campestre*

Hazel tree *Corylus avellana* (++)

Walnut tree (+)

Oak tree (++)

Dogwood *Cornus sanguinea* (++)

Basswood (+)

Ash tree (+)

Old man's beard *Clematis vitalba* (+)

Ferns (++)

Bosanski Milanovac is located in the abandoned land units, on the plateau of Sanski Most. Trees, bushes and ferns have taken over on the former pasture lands. Former patches were already present and have become denser. Approximate coordinates: (44.768968, 16.546534)

Figure 37: Principal vegetation observed in Bosanski Milanovać, some plateaux of Sanski Most. Source: Zoé Siegel

Generally, both municipalities have similar management system of the forests, coming from the late Yugoslavian period – probably the most ecological in all Europe driving a multiage multispecies forest. This "close to nature" management system had persisted despite the collapse of the regime, the civil war and the administrative separations.

In both territories, clean beech forests with fir and spruce are the most present and valuable.
Beech forests with fir and spruce are the typical forests of the limestone-dolomite area of the internal Dinarides, to which the forest areas of both municipalities belong. At the same time, these forests are economically the most valuable in both municipalities (developed, high-quality forests) (FMB[11] Mrkonjić Grad, 2012; FMB Sanski Most, 2013). In the territory of Mrkonjić Grad, these forests occupy the western, southwestern, and eastern exposures - the mountain areas of Mliništa-Ovčara and Lisina. Inside beech forests with fir and spruce, thermophilic pine forests (*Pinus sylvestris*) appear, which occupy warmer exposures. In the territory of Sanski Most, these forests are spread over the area of the Grmeč mountain. (31; 79, Forestry company, MG; SM).

At higher altitudes, with colder exposures, deciduous beech forests are widespread. In Mrkonjić Grad they are spread over the northern and northeastern slopes of the Lisina, Dimitor, and Manjača mountains. Beech forests in Sanski Most occupy the northern,

[11] FMB- Forest Management Basis

southern, and central higher municipality areas (FMB Mrkonjić Grad, 2012; FMB Sanski Most, 2013).

Forests of sessile oak and hornbeam are present in the lower parts of the slopes, in warmer and lower positions in both municipalities, but without significant representation in both municipalities.
On the territory of the Mrkonjić Grad, thermophilic beech forests spread over the warm slopes of the Vrbas canyon and the Crna canyon.

In these different types of forests some rare trees appear as individuals, like the yew tree, bear hazel, maple tree. These species are protected by Forest Law and it is forbidden to fell them. They are identified by forestry workers and listed with their positions to protect them during forestry exploitation.

Riparian forests were also observed near water streams, mostly composed of alders (*Alnus glutinosa*) and willows (*Salix alba L.)* (Figure 38).

Figure 38: Picture of a riparian forest, more particularly a flooded forest (MG: Medna, September 2022).
Source: Zoé Siegel

All forests are still characterized by natural regeneration. Forest changes as a consequence of climate change (temperatures and precipitation, etc.), is, fortunately still not visible. However, in future, droughts and high temperatures (predicted by the climate models) might mean slower growth, physiological changes, and more diseases, and possibly large fires. Higher temperatures can lead to beech tree diseases because they do not like too much sun, and the sun can impact the inflammation of the tree bark (31, Forestry company, MG).

For now, the main natural problems are insects (bark beetles) and small fires, particularly generated by people who try to clean meadows and pastures. (79, Forestry company, SM).

III.3.B. A MAINLY STATE-OWNED FOREST WITH BLURRED BOUNDARIES

In both municipalities, the ownership structure is to the advantage of the state and the municipality. State forests have the largest share: 88% of the forests in Sanski Most and 81% in Mrkonjić Grad. Private forests in Sanski Most have a share of 12 % and in Mrkonjić Grad 19% (79, Forestry company, SM) (FMB Mrkonjić Grad, 2012).

However, an accurate delimitation between public and private forests is difficult due to a none updated and incomplete land registry. In addition, private forests are related to smaller parcels and the unresolved question of ownership is common (data on the heirs and the new owner have not been updated). According to the estimates of the new survey in the municipality of Mrkonjić Grad, the average size of the forest parcel under private ownership is 0.48 ha (FMB Mrkonjić Grad, 2014).

In both municipalities in the upcoming period, it will be necessary to separate state and private forests, identify owners, determine borders, and resolve legal property ties. Because of these unsolved questions, problems in forest management are present, as is the attempted illegal logging on the borders of private and state forests, due to unclear boundaries (79, Forestry company, SM) (31, Forest company, MG). As a result, usurpations (appropriation of state forests) are present in both municipalities. In Mrkonjić Grad, 25 ha has been usurped and approximately 190 ha in Sanski Most. (FMB Sanski Most, 2013) (FMB Mrkonjić Grad, 2011).

These are the most important and commonest problems in forest management in both municipalities even if those numbers are negligible.

III.3.C. A FOREST MANAGED BY A PUBLIC ENTERPRISE

III.3.C.a. The upstream of the sector controlled by the Ministry

The ownership, management, and use of forests fall under the exclusive jurisdiction of the entities. The competent ministry is the "owner" of the forest, the Ministry of Agriculture, Forestry, and Water Management. In the Federation of B&H, the same Ministry is also present at a cantonal level, and represents executive authority.
Planning, management, and all forest-related activities are defined and prescribed by the law. In RS there is the Forest Law at an entity level, while in the Federation of B&H, the Federal Forest Law has not existed since 2009 (annulled because it violated the interest of local communities). Currently, cantonal laws are used instead.
The Ministry is responsible for implementing laws, adopting strategies, and all planning documents related to forests. It is also responsible for the management of national parks.

A forest identified as a natural resource by the Forest Law in both Federal entities cannot be subject to concession; it is only possible to grant permission for its use/exploitation based on a contract.

III.3.C.b. Forestry enterprises present at different scales

One Forestry enterprise at the entity level in RS and 8 cantonal ones in the Federation

In both Federal Entities there are public enterprises for the management and exploitation of the forests. The user of the forests in the RS is the *Šume Republike Srpske* public forestry enterprise (Forests of the RS), which has a Ministry contract for 50 years (European Forest Institute, 2015). The same model of organization is present in the Federation of B&H, at the cantonal level with cantonal public forestry enterprises, and contracts with the cantonal Ministry. However, this organization is not fully implemented in two cantons where forests play a minor role (Canton 2 and Canton 7). In the Unsko-Sanske canton, the public forestry enterprise is called *Unsko-Sanske šume*.

Forestry enterprises divided into smaller companies

According to the law of the RS, the territory is divided into forest areas to facilitate the management of forests. The same division exists in the Federation: a division was made in 1961 and is still maintained in today's management of forests (79, Forestry company, SM). Therefore, public forestry enterprises (Šume RS; Unsko-Sanske šume) are divided into several organizational units, which manage one or more forest areas.
-Šume RS (Entity level in RS): The organizational structure consists of 27 forestry companies that manage the forest locally, in municipalities. Five centres also belong to the enterprise. They take care of karst management issues, seed production, research, development, etc. (Forestry enterprise *Šume RS*, 2022).
-Unsko-Sanske šume (Cantonal level in Federation): It is divided into 8 units. 6 are forestry companies, and 2 are working on afforestation and other forest activities (79, Forestry company, SM).

The Lisina company in Mrkonjić Grad and the Sanski Most company in Sanski Most

In Mrkonjić Grad, the forest area, which coincides with the administrative border of the municipality, is managed by the *Lisina* forestry company, one of the 27 forestry companies contained within the public forestry enterprise *Šume RS*.

In Sanski Most, the managing area does not correspond to the municipality borders. A forestry company called Sanski Most, a unit of the *Unsko-Sanski šume*, manages the area of the whole territory of Sanski Most as well as parts of the territory of Ključ, Bosanske Krupa, and Bosanski Petrovac municipalities (Annexe 5.1). This corresponds to the former delimitation during the socialist period.

The forestry companies Lisina and Sanski Most are responsible for managing the forests under their jurisdiction. They are in charge of:
-the cultivation and protection of forests,
-the utilisation and circulation of all products of forests and forestland,
-the maintenance of forest communications protection,
-the improvement of useful functions of forests,

-the management of protected areas and forests, and special purpose forestland,
-the breeding and use of game (hunted animals).

For game breeding and hunting, the responsibility is transferred to hunting associations, under the Ministry's approval. The forestry company *Lisina* in Mrkonjić Grad manages both state and private forests, while the forestry company in *Sanski Most* manages only state forests. Privately owned forests are under the jurisdiction of the cantonal forestry enterprise.

The forestry management base - common directives to be respected in all municipalities

The prime document in forestry, the so-called forestry management base (*šumskoprivredna osnova*), regulates forest management. This document is valid for 10 years. In the RS (Mrkonjić Grad), the creation of a forest management base document is under the responsibility of the Research and Development Centre within the public forestry enterprise Šume RS. Preparation starts two years before the expiration of the existing one. In the Federation (Sanski Most), the forestry company Sanski Most collects data for the production of the forest management base, after which a tender announces the selection of a company authorized to produce this type of document. The Ministry must approve the forestry management base for it to be valid (17, Forestry Company, MG).

III.3.C.c. Forestry companies as both managers and loggers of the local forests

Forestry companies are managers and loggers of the forested areas they are responsible for, but remain under the jurisdiction of the public forestry enterprise at a higher level. Forests as a resource are fully under the supervision of higher organizational levels, where the municipality (as well as forestry companies) itself has almost no jurisdiction. Actions cannot be taken without approval from a higher level.

The forestry companies make a felling plan each year based on the forestry basis and adapted to the area. The Ministry has also to validate it. This plan is done for the year to come.

In both municipalities, as previously mentioned the same management model is used: the so-called “selective system” and “grouped system”.

A selective system means selecting trees to exploit to maintain optimum conditions after felling, based on four principles. (1) The growth principle refers to the need to secure new tree growth and leave favorable conditions after human activities; selecting trees for future growth and removing everything that hinders them. (2) The second principle is related to the health of the trees: it is necessary to remove infected or diseased trees. (3) The third principle refers to the spatial arrangement of trees to avoid open forest areas. (4) The fourth principle is the economic principle related to selection according to the value of the tree (17, Forestry company, MG).

The grouped system divides an area into groups. Logging is done in only one group until it' is no longer possible, after which nothing else is done in that group while natural regeneration has not finished. In addition, of tree-diameter is a criterion for cutting, for example, trees with a diameter of up to 50 cm thick are never felled. The felling object is often a tree with a diameter of 80 cm (17, Forestry company, MG).

In terms of management, and legal regulations, the rules, and conditions are the same for private and state-owned forests.
The percentage of forest available for felling depends on the type of tree population and its size. This number is defined in the management plan. There is a percentage of how many trees can be cut from that supply in 10 years. For example, for beech only 15 % can be cut down over a 10-year period. It is the owner's decision to cut all of that in one year or to divide between the remaining 9 years. But he cannot cut more (17, Forestry company, MG).

Since communist Yugoslavia the forest is, as it was mentioned before, multiage and multispecies – which is the best selective method and support for a resilient forest. "*A very important thing to say is that our forests are still in good natural, healthy conditions. They still have natural regeneration and when we lose that we will have a big problem. When you plant a lot of the same trees in one big forested area, you are making an area with just one species and with the same age structure and then you don't have diversity*" (17, Forestry company, MG). Managers also leave old trees for bird and insects (79, Forestry company, SM).

The company is responsible for felling, the sale of wood assortments, workers' salaries and so on. Both forestry companies generally hire external companies for logging and the transport of logs.

During the former regime, the forestry companies had sufficient workers, machines, and facilities, and did not need to hire external companies. Local people had the opportunity to work in the wood sector, have a job close to their home, and agriculture was an additional activity. For example, in Lušci polje, at the foot of the Grmeč mountain, people were actively working for the forestry companies. There are many such examples in both municipalities (79, Forestry company, SM). The forestry companies were important developers of the local economy, and local people benefited from the wood sector.

Management structure

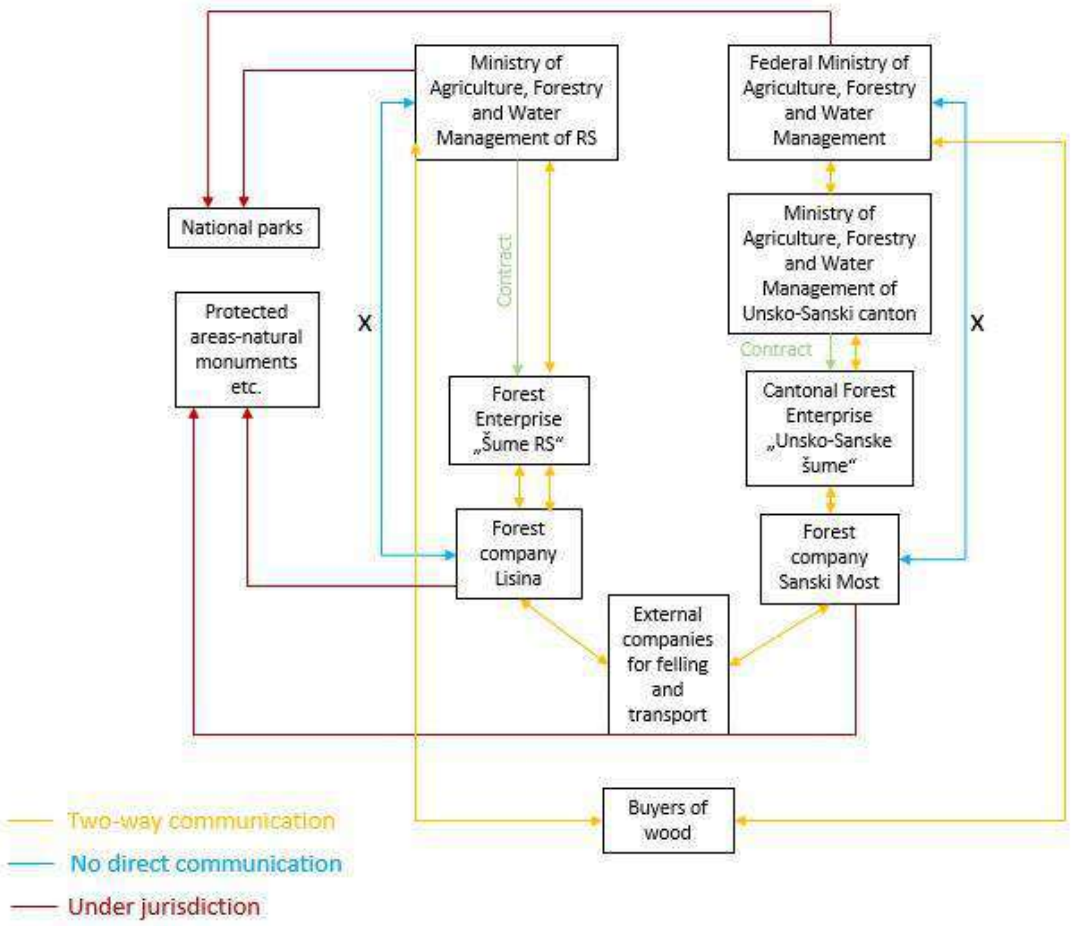

Figure 39: connection between the different actors involved in the wood sector.
Source: Borka Malešević, 2023

III.3.C.d. Private forests also managed by the forestry companies

The Forest Law prescribes the same rules for private and state forests, without any differentiation. This places significant constraints on private owners.

The forestry company *Lisina* in Mrkonjić Grad is responsible for technical work in privately owned forests, while in Sanski Most responsibility is under the public forestry enterprise of the canton.

Technical work refers to the preparation of a felling plan. According to the Forest Law, owners should contact the forestry company if they want to cut trees. They must obtain a permit from the forestry department. The *Lisina* forestry company recorded an increase in private owners who had turned to them for cooperation (17, Forestry company, MG).

However, many people cut their forests on their own since wood is the main source of heating in both municipalities. According to our observations and interviews, people cut smaller not larger diameter trees (Figure 40).

Figure 40: Wood cut by villagers to heat their homes (SM: Vrse, September 2022)
Source: Zoé Siegel, 2022

III.3.C.e. A fair distribution of the wood

Forestry companies are responsible for the felling of wood and its transport from the forest to the road. Customer trucks further transport the wood to their factory.

Forestry enterprises define buyers of wood assortments, based on regulations. Points are allocated to the factories which need wood according to different criteria: the size of the wood company, its type of production, the number of employees, etc. The wood is then distributed according to the number of points that the buyers have (32, Wood factory, MG).

As a result, big companies with a higher volume of wood processing will get more wood products than small ones dedicated to primary production: for example, sawmills. The owners of sawmills that we met generally complained about the lower quantity of wood that they got (32, Wood factory, MG).

Wood is not locally distributed. Companies have clients countrywide and apply the rules at this scale. Significant wood processing does not take place in the municipalities where it was exploited.

III.3.C.f. Money distributed to several actors, at different scales

Money earned by the forestry company is put into a shared account with the forestry enterprise at the highest level. The company can only spend sums that are allowed by the latter. Forestry companies also pay the Ministry and the Municipality. In Sanski Most the company gives 4% of its income to the Ministry at the cantonal level, 1% to the Ministry at federal level and 5% go to the municipality (79, Forestry company, SM). The company in Mrkonjić Grad gives 0.3 % to the Ministry and 10% to the Municipality (17, Forestry company, MG) (Annexe 5.2).

Municipalities can use that money to improve infrastructures, schools, agriculture projects, etc.

III.3.D. WOOD THAT IS NOT VALUED INSIDE THE COUNTRY

III.3.D.a. Primary transformations

Sawmills are present in both municipalities. About 10 in the in Mrkonjić Grad territory, and 5 in Sanski Most, concentrated in the plain. There are also pellet producers: 1 in Baraći in Mrkonjić Grad and 2 in Sanski Most. We also met villagers owning a small private sawmill in Mrkonjić Grad, essentially to prepare wood for heating. It was actually a former sawmill supplied by the forestry company. In both municipalities, sawmills are not very developed. They produce basic products such as timber, boards, battens, firewood (64, Wood factory, SM) (24;32, Wood factory, MG). One sawmill also produced machine-turned wooden decorations and sold furniture.

In the box below is the interview of one sawmill worker which gives an idea of how it works.

Sawmill organization presented by a worker (24, Wood factory, MG)

They have 15 to 30 workers, depending on the season.

The sawmill buys wood in Mrkonjić Grad from the *Lisina* forest company, but also from 5 other municipalities (Potoci, Drnić, and Ostrelj for example,). They hire a company to transport the wood from the logging yards to the sawmill.

About 2000 m^3 of wood are bought from the *Lisina* yearly: usually fir and spruce of the 1st or 2d class quality.

They produce timber, boards, battens, firewood. They also assemble and glue wooden parts. Daily, they process about 15 m^3 of wood.

They have standard products (battens, boards) but they mostly process wood based on client orders. They do not have a big warehouse so they do not stock much.

Buyers are mostly from aboard. Firewood is exported to Germany and Austria. Other products are exported to Germany, Serbia, Austria, Italy and other countries. Local people usually buy products when they are building houses for example, but they do not constitute the main client base. The sawmill generally *has its own trucks to transport the products.*

All the sawmills we visited mostly export their product, especially to Germany and Serbia. Products are primary transformed.

However, in the summer of 2022 some measures were taken by the government. The Council of Ministers of Bosnia and Herzegovina adopted a decision to ban the export of pellets and firewood according to 13 custom codes, for 90 days on the 15th of June 2022. The Governments of RS and FB&H imposed this ban for several reasons. The wood market of B&H has a lack of wood assortments due to higher exports, which causes problems in meeting domestic needs. It is a long-term problem. In 2022, the price of wood products, especially pellets, doubled and exports increased in the first quarter of the year, due to the global energy crisis. Too much exportation would disrupt the B&H market, the lack of firewood, high prices, and the inability of the inhabitants of B&H to secure firewood due to the shortage and high prices (RS Chamber of Commerce, 2022). Both entities agreed to ban the exports to protect the B&H market and domestic customers. In this way, the country tried to ensure domestic needs for pellets and firewood at prices acceptable to the population of B&H. After the expiration of the 90-day ban, the ban was prolonged until January 31, 2023. Only the export of chopped wood was allowed due to the stock quantities. In the field during the summer a pellet producer told us that: "The *price for pellets is high now and will remain like that, but people think it will be cheaper in September so during the summer people still don't buy*" (8, Wood factory, MG).

Carpentry companies are present in both municipalities. They generally import their wooden products from other countries to build materials such as coffins and furniture in Mrkonjić Grad (23, Wood factory, MG). There are foreign companies present as well.

B&H, which is rich in forest, loses value on its wood. Only products with a low level of transformation are exported. Higher wood processes are done abroad who then sell their products to B&H at higher prices.

III.3.D.b. Various artisanal objects made mostly by Serbian villagers

Several objects are made from wood in villages. They are mostly crafted by Serbian people for religious ceremonies: engravings representing biblical scenes or characters, paintings on wood, the *kadilica* to diffuse incense in churches (Figure 41).

The rakija bottle is also an artisanal object made of wood (Figure 41). One man in Mrkonjić Grad who works in a sawmill designs them. His grand-father started to make and sell rakija bottles. He then transmitted his skills to his son who started to produce furniture. Today the family business has evolved but the man, who learnt from his father and grand-father still makes rakija bottles. With the new technologies, they are easier and faster to create. It takes one day to make a bottle while it took his grandfather 1 month. His son will also continue this activity. The exterior part of the bottle is generally made of ash or walnut. The interior is made of maple. Today, they have machines to carve decorations automatically on the wood (32, Wood factory, MG).

Some people also make practical objects such as clocks or the *predilica* knitting machine to make woollen clothes.

Figure 41: wooden artisanal products.
Source: Zoé Siegel, 2023
The top picture features a *kadilica* used to diffuse incense. On the bottom section are the different steps in making a rakija bottle.

Those artisanal products are sold by artisan villagers from home. Most of the time they constitute a hobby instead of a commercial activity. No artisanal shops exist in either municipality.

III.3.E. FORESTS UNDER THE FSC CERTIFICATE

Until today, 61% of the territory of B&H has the FSC certificate (96.82% of the forests!). The Forest Stewardship Council (FSC) is an international, non-governmental organization dedicated to promoting the responsible management of the world's forests. The whole territory of the Republic of Srpska is certified contrary to the Federation where seven cantons out of ten have the FSC certification (FSC Adria-Balkan, 2022).

Both analysed municipalities have FSC certificates. The FSC certificate is obtained after meeting ten principles. However, only 9 of them can be enforceable in Bosnia and Herzegovina (principle 3 and a small part of principle 4 (4.8) cannot be used in the country[12]) (FSC International Centre, 2019).

In the RS, the certification procedure started in 2005 by the public forestry enterprise *Šume RS*. At that time only 4 companies were awarded the certification, including Mrkonjić Grad. Since 2008 it has been attributed to all of them. The certificate is currently valid until 2023 in the RS (*Šume RS*, 2022).
The Unsko-Sanski canton is one of the seven cantons with the FSC certification. It was awarded it in 2010 after 3 years of procedures. The current certificate lasts until 2025 (79, Forestry company, SM).

Both municipalities have to protect 5% of their forests according to the principles and criteria of the FSC. Those areas are classified under the title of High Conservation Value Forests (HCVF).
They have been localized but their establishment is more or less advanced according to the municipality. In Mrkonjić Grad, areas only have the "proposed", status and no protection measures have been adopted. Limits are also not well defined. (17, Forestry company, MG). Whereas in Sanski Most, areas have been accepted and protection measures started.

Areas that have been singled out in the territory of the Sanski Most forestry company (Annexe 6.2):

- Sanica river spring , *HCVF category 4*[13]
- Dabar river, spring and canyon *HCVF category 4*
- Bobija virgin forest, *HCVF category 1*
- Bliha river waterfall and canyon the, *HCVF category 4*
- Zdena river Spring including the Bobijaško oko pit, *HCVF category 4*

[12] Principle 3: "Rights of indigenous people". Principle 4.8: "*Traditional knowledge and intellectual ownership are protected and can be used only with the approval from the owners and local communities are compensated through previous agreements for the use of traditional knowledge and skills*"
[13] Explanation of categories can be found in the document of ProForest, 2003.

- Seed stands, *HCVF category 1*
- Koračnica Memorial Park, *HCVF category 6*

Areas that were singled out by *Lisina*, Mrkonjić Grad (Annexe 6.1):

- Dubička gora- Manjača Mount, *HCVF category 1*
- Šibovi area (45 ha), *HCVF category 1*
- Balkana area, *HCVF category 1*
- Magistral road Mrkonjić Grad- Banja Luka, *HCVF category 4*
- Areas proposed for *HCVF category 6*: Štrbina - historical importance, Mliništa - cultural and historical importance, Zelinkovac - spring and cemetery, top peak of Lisina - cultural and sports importance, Balkana Lake - touristic importance, the hunting lodge, Ponor - historical and touristic importance, Bočac - fortress, Medna - religious importance, Ivovac - historical importance, and Gustovara - historical importance.

The springs of the Sana river were also proposed for protection, but in 2013, they became protected as a natural monument.

III.3.F. FORESTS RICH IN NATURAL RESOURCES

III.3.F.a. Several uses of the forest

Resources collected by villagers

The forestry enterprise controls the use of the forest. There is a department inside the enterprise and the forestry companies which identifies which species are present and can be exploited. The public enterprise then makes contracts with companies who use those resources in production. The forestry company is obliged to deliver those products for them and are paid according to a price list. Local people are also supposed to pay 10 % of the value of the products they gather but there is no effective control system in place. It is not a priority for forestry companies. The most important thing is that they j do not destroy plants. For now, there is no problem (17, Forestry company, MG).

People generally gather some resources in the forest, for themselves or to earn additional income. We made a list from the interviews of what people gather:

-Mushrooms
-Rose hips, generally to make infusions and jam
-Hawthorns *Crataegus*
-Blackthorn *Prunus spinosa* to eat or make jam
-Walnuts
-Herbs to make infusions
-*Juniperus communis* berries used for their medicinal properties

Hunting

The forest is also used for hunting. The Hunting Association is responsible for managing and regulating game. There is one Hunting Association at the level of each entity, divided into associations at the cantonal and municipal levels. Hunters pay to use the forest: 10% of this income goes to the Ministry in Mrkonjić Grad (Annexe 6.1). We do not know the exact proportions for Sanski Most. They have to pay the Ministry at the cantonal and federal level. In return, the Ministry finances some material.

Hunting management is regulated based on a document called "*The hunting basis document*", that is valid for 10 years. Each year, the association draws up a hunting plan specifically for its municipality, that has to be approved by the Ministry/ies. The Ministry regularly controls activities in the field. Strict rules have to be met to become a hunter. It is a long process. The Association is well organized. Members are divided into groups of maximum 15 people and are spread in different hunting areas in the municipality. Specific material has to be brought, as well as a specific hunting dog. Members hunt during the week-end, on foot. They have to plan what game they want to hunt (31, Hunting association, MG).

The Hunting association earns money from membership and from the game that is commercialized. People have to pay a certain price according to the species they want to hunt. Large mammals such as bears and wolves are considerably more expensive than deer or wild boar. Quotas also have to be respected according to the population inventory in the municipality. Game that is the most hunted are generally wild boars and deer. The biggest source of income of the Hunting Association are the hunts organized for tourists. Foreigners who come to hunt are supervised by the association, and pay higher prices for the animals they kill. The hunt is only allowed from watchtowers in those cases. As the exportation of dead animal is forbidden in B&H, they have to stuff the animals to take them home as trophies, which also generates income. Hunting themed restaurants also sell meals made from game but mostly in big cities (31, Hunting association, MG).

For predatory species such as foxes or jackals, hunters are paid to kill them and regulate the population. Hunters are also responsible for carrying out an inventory of all game populations in the municipality. They then calculate quotas from those numbers. For some species hunting can be stopped for a year if the population is too low (for example rabbits in 2022). Other animals are hunted according to the ministerial hunting calendar, where reproduction periods for all game are listed. Hunters also feed the animals. They do not feed animals simply to maintain populations and attract animals, but also to distance them from houses and cultivation (31, Hunting association, MG). In Sanski Most the association bought 10 ha of land to plant corn and orchards (120 apple trees) to produce food for animals. They also buy additional food, such as salt (they bought 1 t of salt this year) (68, Hunting association, SM). They feed bears the whole year. However, some researchers in Banja Luka told us that it can disrupt their physiological cycle and that bears have been observed during the winter when they should be hibernating.

The whole municipality is a hunting ground. The Hunting Association in Mrkonjić Grad manages 65 000 ha. Some specific locations exist where hunting is prohibited. In the Vitorog Mountains there are 5000 protected ha. The government decided to protect animals permanently there given the presence of a number of bears and wolves There is also a 4000 ha area in Velika Gradina Mountains where hunting is not permitted. (31, Hunting association, MG) (Annexe 6.1).
In Sanski Most the association manages 55 000 ha of hunting lands. One area in the Grmec mountains is protected from hunting (Annexe 6.2).

Some species are protected and therefore it is forbidden to hunt them. The lynx for example is permanently protected in both entities. Bears have been protected in the Federation for 15 years. However, damages to cultivation has been on the increase these past years and the federal government has asked the cantonal governments to draw up new management plans. Since the bear population has increased, hunters are currently trying to gain permission to hunt them again. In the RS, bears can still be hunted but only during a strictly controlled period of the year.

III.3.F.b. Rich biodiversity

People agree that "*biodiversity has increased*" (population and species diversity) these past years in their surroundings. They see wildlife coming closer and closer to their homes. Lot of interviewed people have seen bears near villages or deer or foxes in their gardens during the day. In Sanski Most, people saw beavers reappear after the war. There has also been the apparition of new invasive species such as the jackal.

However, inventories are not widespread in the country and there is no continuous monitoring of them. Location data of the different species present in B&H exist only in protected areas or other specific areas. Numerous families such as plants, invertebrates or small mammals are not well represented. There are few naturalists. We only noted the presence of reptile, mushroom, fish, large mammal and bird specialists for the whole country (Researchers of Banja Luka, 2022). The animals that are the most closely monitored are actually those that are hunted or fished.

A national Red List of species does not exist. There are two distinct lists with two distinct methods: one for each entity (51, Ministry, MG). The Red List of wild species and subspecies of plants, animals and fungi was adopted in FB&H and the Red List of Protected Species of Flora and Fauna of the Republic of Srpska in RS. In RS, the status of endangerment of individual species is not given and the Republic Institute (Institute of Natural and Human Heritage), a main actor, does not have enough resources to update the Red List (51, Ministry, MG).

The geomorphology of the municipalities has provided numerous diverse habitats with their adapted species.

In caves, numerous bats are present, as well as some specific amphibians such as *Protheus anguinus*. In the Dabar caves in Sanski Most, 6 different species of bat were identified. Most of them are Vulnerable or Endangered at the international level. Only one is Vulnerable (VU) in the country: *Myotis capaccinii* (IUCN, 2009) (Lista Faune USK 2020). Numerous underground networks remain unexplored and could shelter unsuspected species.

In Mrkonjić 1500 species of mushrooms are concentrated in one specific area: the Lisina mountains.

Large mammals such as bears (*Ursus arctos*), lynxes (*Lynx lynx*) and wolves (*Canis lupus*) are present in both municipalities, mostly in the mountainous areas (Annexe 6.3). Jackals have recently arrived in the municipalities. They come from Croatia and constitute an invasive species in B&H competing with fox and spreading to urban areas (Researchers from Banja Luka, 2022). Wildcats are also present in the country.

The diversity of habitats in the municipalities provides shelter for numerous bird species. There are more than 150 species in Sanski Most (87, Bird watcher, SM). 107 bird species are present in Lisina mountains. The capercaillie *Tetrao urogallus*, which is Critically Endangered (CR) at an international level is present in both municipalities: in the Grmec mountains in Sanski Most and in Mlinista in Mrkonjić Grad. Its population can still be hunted (28, Hunting association, MG).

In canyons chamois and eagles are present (28, Hunting association, MG) (Lista Faune USK 2020).
Rivers also possess a rich biodiversity. Bream (*Abramis brama*), prussian carp (*Carassius gibelio*), carp (*Cyprinus carpio*), barbel (*Barbus Barbus*), the silver carp (*Hypophthalmichthys*), the zander (*Sander lucioperca*), catfish (*Silurus glanis*), tench (*Tinca tinca*), etc. are some common fish present in the Vrbas river for example (18, Fishing association, MG). *Salmonidae* such as trout and the Danube salmon are also found in the most qualitative rivers. They are present in both municipalities in the Sana river. The Danube salmon *Hocho hocho* is endemic from the Danube basin and Endangered at the international level. It therefore represents an important species for the country and the territories studied (Figure 44).
The presence of beavers and otters are also an indicator for the health of the rivers. They are present in Sanski Most.

Near Balkana lake in Mrkonjić Grad, one endemic, little known, leech species is present: *Dina sketi* (Dmitrovic & Pesic, 2020). A specific morph (*erythronotus*) of the lizard *Lacerta agilis bosnica* has also been observed there (Buric & Jelic, 2011). However numerous public works are currently taking place in Balkana lake to develop the area for tourists which is having an impact on the natural habitat of those species.
The endemic gastropod *Belgrandiella bozidarcurcici* is present in the Vrbas basin in Mrkonjić Grad (Dmitrovic & Pesic, 2014).

III.3.F.c. Protected areas

During the period from 1991-1995 over 100 areas in Bosnia and Herzegovina were under protection (51, Ministry, MG). After the war, the country adopted new regulations and laws, and reset all protected areas. Today, protected areas are defined and are under the jurisdiction of the two Entities. There is no national nor common strategy nor institution for their management, nor any harmonized laws.

In the Republic of Srpska, the Ministry for Spatial Planning, Ecology, and Constructions & the Republic Institute for the Protection of Cultural-Historical and Natural Heritage, are the main authorities involved in the establishment of protected areas. The Institute is responsible for analyses, preparation of plans, and proposals for the registration of these sites.
In the Federation, responsibility falls to the Federal and Cantonal Ministry for Environmental Protection and Tourism. A specialized Institute does not exist.
Implemented protected areas are defined by the spatial plan of entities. Their objective is to meet the percentages required by the European Union (51, Ministry, MG).
Management of protected areas is given to the Forestry Enterprises.

In the Republic of Srpska, 2.93 % of the territory is under protection (73 023 ha.). Thirty-three areas are protected: two strict nature reserves, three national parks, sixteen

natural monuments, three protected habitats, six nature parks, and three resource management areas. (Republic Institute for the Protection of Natural and Cultural-Historical Heritage, 2022).
In the Federation 14 areas are under protection: one national park, four natural monuments, two natural parks, five protected landscapes, and two Ramsar areas.

Around 3 % of the whole country is under protection, which places B&H as the country with the lowest percentage of protected areas, compared to its neighboring countries in Europe (for example, Croatia has over 35%). Although by applying European regulations, B&H has committed itself to protecting around 17% of the national territory, the EU recommending that each country protect at least 10% of its surface. Currently, the protection of the territory is a really slow process in B&H. It is the result of a lack of an information system (outdated data on species, populations, areas for example) and of financial and human resources (51, Ministry, MG).

Only one protected area, listed as a National Monument, is present among the two municipalities. It is the Sana Springs, located in the south-west of the municipality of Mrkonjić Grad (Pecka settlements) (Annexe 6.1). This site of 360 ha also straddles Ribnik municipality. The management of the area was only given to the *Lisina* forestry company which manages the territory of Mrkonjić Grad. This management is shared with Boro Marić from the Greenway Association, the owner of the Pecka visitor centre who deals with the touristic aspect: managing infrastructures, maintaining cleanliness, promoting the site, educating the public and so on. The Forestry Enterprise looks after the health of the forest.

The establishment of this protected area is a long story that we have transcribed below.

The story of the Sana Springs (2, Environmental NGO, MG)

Before the protection of the Sana Springs, a project to protect an area in Lisina Mountains emerged (2013-2014). Boro Marić and environmental NGOs showed the Republic Institute an area rich with many varieties of mushrooms, that they could protect. The Institute proposed adding to this area the village of Šibovi, to form a natural Cultural Heritage area. However, people complained, especially people living in Mrkonjić Grad who had property in the village. "*They thought that in the future they would have to pay to enter the area. People refused and they even [threatened to use] guns*". First Boro wanted to create a Visitor Centre with European funds but did not succeed. He then started to gather data about mushrooms in the municipality and search for another place all the while disseminating information on Red Listed mushrooms.

His second option was Pecka, a more accessible site with no water issues. It was child friendly and suitable for educational purposes. It was less limited. "*They took away our Mountains but not our knowledge*".

Planning to protect the Sana Springs (including an area close to the Visitor centre) they wanted to include the canyon. Because of the existing dam it was refused, and today only the springs are identified as a Natural Monument (Figure 42). There are actually two canyons where the Sana river flows: the first one at the hydro electrical power plant and the other just beyond that. Another dam is planned but there is environmental mobilization again, including plans for the destruction of the one that has already been built: "*The dam in Sana river has a concession for 30 years so why not destroy it at the end and include the canyon in the protected area?*".

Other areas are proposed for protection in Mrkonjić Grad.

Proposed areas for protection in Mrkonjić Grad (Spatial plan of RS until 2025)

- Canyon of the Vrbas river

The canyon, itself has a rich biodiversity and unique geomorphological, geological, and natural characteristics. This is why the Vrbas canyon (from Banja Luka to Jajce) area was proposed for protection as early as 1955.
According to the spatial plan of the Republic of Srpska until 2025, the most important planning document, the Ugar-Vrbas-Crna Rijeka canyon is planned for protection as a protected natural area (*IUCN category V*).

- Podrašinačko polje

It is proposed for Habitat Management Area status (*IUCN category IV*).

- Proposed for Nature parks (*category VI a*) :

Šibovi-Lisina-Balkana Area

Osmača-Tisovac-Čemernica Area (this would include part of the Čemernica Mountain in Mrkonjić Grad)

Sana - upper stream was also proposed for the Nature park status

- Proposed for Forest park status (*VI b*):

Zelenkovac

III.4. WATER

III.4.A. WATER MANAGEMENT

III.4.A.a. Public management by the ministries and the municipalities

Water management organization is similar to the management of other natural resources. It falls under the control of the Federal Entities who are the owners of the water components. These elements cannot be sold but can be the subject of a concession. Water management is regulated by the Water Law (RS Water Law of RS F B&H Water Law).

The Ministry of Agriculture, Forestry, and Water Management (Federal Entity and cantonal level) is responsible for water. Requests for all types of concession are submitted to this Ministry. It is responsible for:
-preparation of strategies and development policies,
-water management plans,
-monitoring water resources conditions,
-proposing laws,

-supervision of lower organizational units, etc.

Contrary to the forest sectors, water departments are present in the administrative structure of the Municipalities. Its role is to build and manage infrastructure to ensure water supply and quality (collectors for purification) to the population.

III.4.A.b. One company in RS and two agencies in the Federation as the main water managers

In addition to the Ministry, there are lower organizational units that deal with water management issues: in RS it is the *Vode RS* public enterprise (RS Water) ; in the Federation, two agencies are present: the Agency for the Sava water area and the Agency for the Adriatic Sea water area.

The public enterprise and agencies are responsible for applying the management plan of rivers. They deal with:
- water protection,
- watercourse regulation,
- management of the information system,
- preparation of proposals on the river status,
- operations on public water resources following the Water Law; organizing the management of water facilities and systems; freshwater aquaculture, gravel and sand mining activities; extraction of clay and kaolin, collection, purification, and supply of water, etc. (*Vode RS*; Agency for Sava water area, 2022)

Status are attributed to rivers to reflect their quality: level 1 being the best quality possible for a river. According to the law, the better the river, the fewer activities are allowed there.

Water management structure

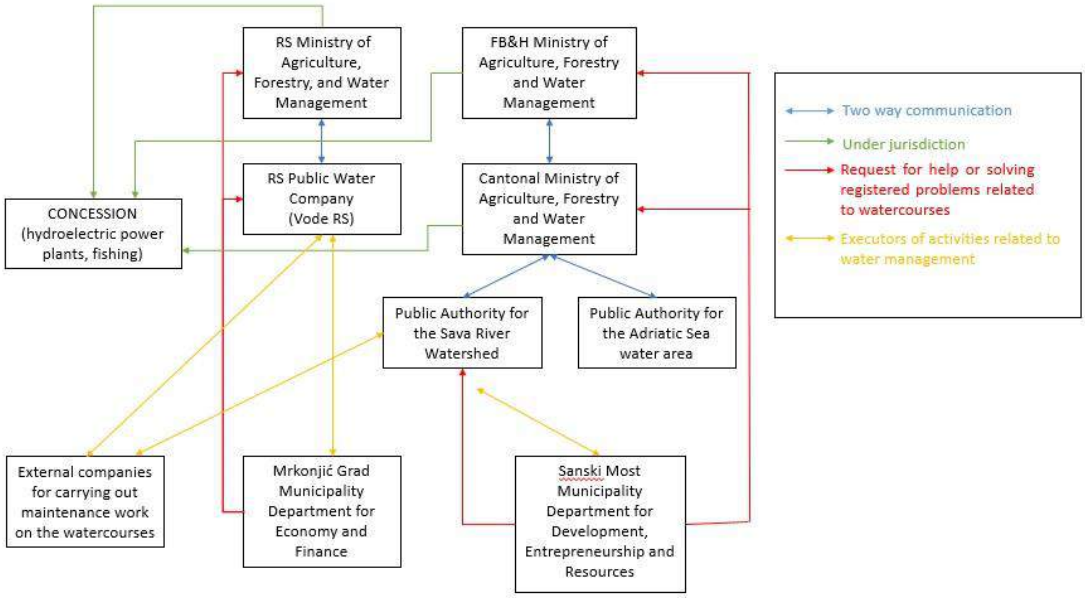

Figure 43: connection between the different actors involved in water management.
Source : Borka Malešević, 2023

III.4.A.c. Fishermen as additional controllers of fish populations

Commercial fishing is prohibited in the whole country except in the Sava river.

The Fishing Associations which exist are sports-recreational associations. They pay the government to use rivers as concessions. Sometimes, certain sections of the rivers may already be held as another private concession and the beneficiary can then decide on the conditions under which it is possible to fish. In Ribnik for example one owner forbad fly-fishing on his concession to the detriment of the fishermen who deplore this decision (18;78, Fishing association, MG;SM).

Associations are present in both municipalities. They existed before the war but were dissolved during that period. In Mrkonjić Grad the association was reconstituted in 1997, while in Sanski Most it reopened more recently, in 2020. Illegal fishing was rife and fish stocks have had to be replenished 9 times to restore the fish population to former levels in the municipality. Fishing as an activity is much more present in Sanski Most with 1100 members in the association compared to only 19 members in Mrkonjić Grad (18;78, Fishing association, MG; SM).

Management plans are made for 5 years in the Federation and 10 years in RS (by the Ministry). A yearly plan is also made for each municipality with quotas according to the present population (18,78, Fishing association, MG; SM).

The association earns the majority of its income from the licenses it delivers (yearly or daily). It then pays 10% to the state level association and a part to the ministry (10% in Mrkonjić Grad). The Ministry reimburses 50% of this tax for fish reproduction for example. Hydroelectric power plant owners are also supposed to contribute funds as they are responsible for disrupting the river. However, this is not always done.
Inspections are carried out by the Ministry. They generally send experts from the University to carry out research on the rivers. They calculate the fish population and inform the association on areas where artificial reproduction is needed. Experts come every year.

The association has to monitor the river and make observations on for example poor water quality, or fish death numbers etc. and then send a report to the Ministry. They are also responsible for the control of fishing (18;78, Fishing association, MG; SM). As a touristic activity, in Sanski Most, the fishing Association is trying to develop fly-fishing in the Dabar river confluence area in the Sana River. In Mrkonjić Grad, the fishing association is planning to develop a fishing school for children.

Fishing is prohibited in some parts of the rivers: generally confluences and the areas near bridges. They generally constitute zones of reproduction for fish. *Salmonidae* for example are found mostly in the confluences, where the temperature is lower: the smaller streams are colder and have more O^2 as they are more dynamic (78, Fishing association, SM).
In Mrkonjić Grad, it is forbidden to fish in the Medljanska and Ponor rivers (Annexe 6.1). In Sanski Most it is forbidden over the whole course of the Zdena river; in the Bliha river from its confluence in Sana to the Husimovci; in the Sanica river from its confluence in Sana to the Hrustovački bridge; in the confluence of the Dabar and the Sana river, and in the City centre (Annexe 6.2) (18;78, Fishing association, MG;SM).

Fish are divided into two types: *Salmonidae* and the others. *Salmonidae* are considered as better quality and less common fish. They are caught by fly-fishing. The others are generally caught by spin fishing. Places for fly-fishing are more limited as an open space is needed. For example, people do not do fly fish in Mrkonjić Grad, except in Balkana lake, because large rivers flow mostly through canyons. However, they can go to other municipalities such as Sipovi and Ribnik. To fish in the other Entity fishermen have to pay a supplement (around 5 euros).
The Danube salmon is considered the most qualitative fish in the country and fishing quotas are limited (Figure 44). In Mrkonjić Grad, only 1 salmon can be caught per fisherman during the year.

Figure 44: The Danube salmon *Hucho hucho*.
Source: Lazo Cuso, 2022 (MG)

The principal threats to the fish population are river pollution and the hydroelectric power plants which break up the rivers. Some illegal commercial fishing also occurs, in the Vrbas river for example (18, Fishing association, MG).

III.4.B. SEVERAL THREATS TO RIVERS

III.4.B.a. Wastewater

Both municipalities have a problem with wastewater drainage which is the source of river pollution (Municipality of Sanski Most, 2014) (Municipality of Mrkonjić Grad, 2022). The public sewerage network does not cover many households, and purification before discharge into the rivers is not always done (example with the Crna river). This is due to an undeveloped wastewater management system (48, Flour producer, MG). However, it is also closely related to the general organization of housing: the construction of houses without prior connection to the public sewage system. In villages for example, private septic tanks are used (Figure 45). Pollution alters the quality of the water.

Figure 45: Illegal waste deposit located just above the Vrbas canyon (MG, 2022).
Source: Zoé Siegel, 2023

III.4.B.b. Coal mines

Both coal mines in the municipalities are located near rivers (Figure 46 & Figure 48).

Sanski Most

In Sanski Most the LAGER coal mine situated in Kamengrad has been present near the Bliha river since 2015 (Figure 46).

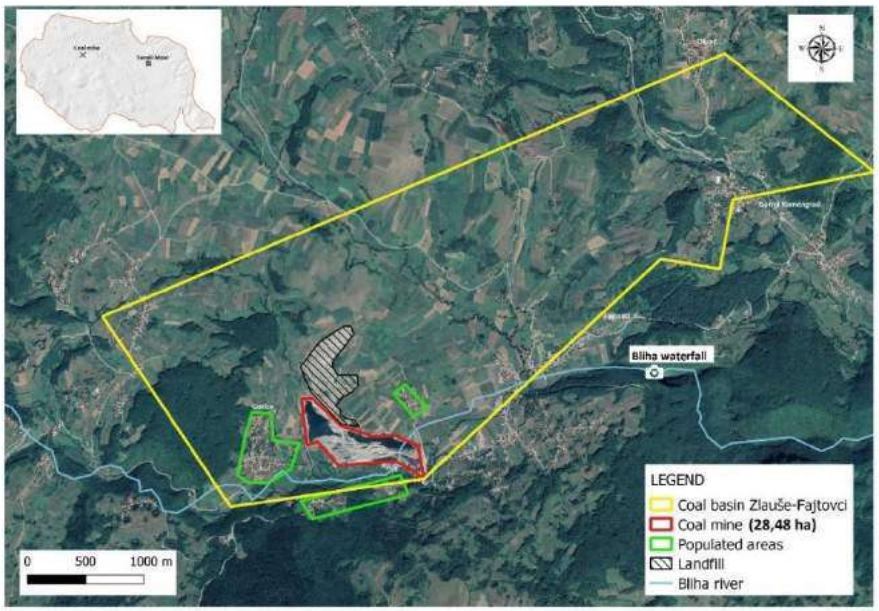

Figure 46: The LAGER Coal Mine in Sanski Most and its surrounding elements.
Source: Borka Malešević, 2023

This proximity is a problem because the mine releases waste into the river, creating pollution. Those operations are not in accordance to the laws and permits. A documentary was made to denounce the impacts of the mine on the river and the low levels of punishment meted out by the inspectorate[14]. "*There are inspections but the penalty prices are too low compared to the richness of the owner, so the owner continues. The inspectorate is corrupt and the owner is powerful and has a strong team of lawyerss.*" said one inhabitant of Sanski Most (67, Fisherman, SM).

The colour of the river has frequently turned grey as a result of pollution from the mine (Figure 47). This is particularly visible at the Bliha waterfall, a site that used to be protected as a Natural Monument (category III) in 1968 during the Yugoslav period. Today, its status is unclear[15] but the place remains a valued natural touristic site for the municipality.

Figure 47: Bliha waterfall before and after the pollution from the coal mine (SM, October 2022). Source: Eko akcija group

Mrkonjić Grad

The coal mine in Mrkonjić Grad is small and its exploitation restarted recently. It is located close to the Medna valley. The Grabovac stream flows through the mine and joins the Medljanska river a few hundred meters downstream, which is a confluence of the Sana river (Figure 48). According to the latest analysis, the water is highly polluted and the structure of the stream has also been destroyed. These disturbances threaten to endanger the flora and fauna in the water and in the environment. It could also prevent the local population from safely using the water for their direct or indirect use.

[14] Documentary: https://www.youtube.com/watch?v=OG1L5jrEdNs
[15] The permit has not been annulled, but there are no new documents on its protection.

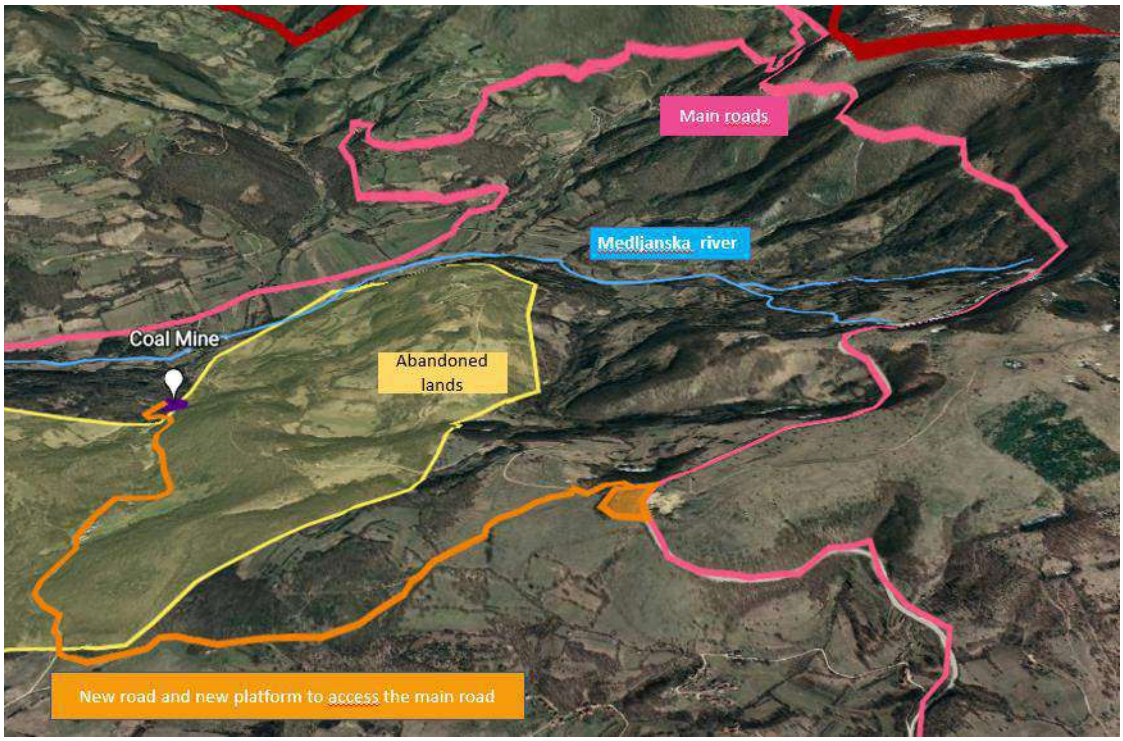

Figure 48: The Coal Mine in Mrkonjić Grad and its surrounding elements.
Source: Zoé Siegel, 2023

III.4.B.c. A complex situation in Sanski Most

In Sanski Most numerous second homes were built close to the river. People have built fences even though the river banks are supposed to be accessible to the public. This prevents fishermen from fishing in those places. Moreover, these houses have been built on previously flooded areas which normally serve as a flood plains to prevent villages from being flooded. The houses that have been built there are not adapted to those possible events and numerous people complain about it. People built their houses 20 years ago and there were no professionals at that time capable of analysing the situation. A flood occurred in 2014 and traumatized people who want the Municipality to take measures (67, Fisherman, SM).

To answer these complaints, the government decided to construct concrete banks in certain places and modify the natural shape of the river. They also thought that dredging the river bed would be a solution to limit the level of water.

However, by carrying out these interventions, they are destroying the tuff of the rivers, a calcareous concretion which is typical of those rivers. It comes from the dissolution of carbon ions which precipitate by associating with plant debris, microalgae, shells etc. (Figure 49). These formations take hundreds of years to be shaped and allow the river to be more dynamic and the water to be oxygenated. A lot of fishermen fish at those places because fish are more plentiful.

Figure 49: Tuff of Sana river (October, 2022)
Source: Zoé Siegel

Instead of taking measures against the building of second homes the water management company which is responsible for the management of the rivers and risk management, decided to adopt those solutions. By changing the natural composition of the river, the whole river dynamic is disturbed, as well as its adapted biodiversity.

An activist group has been created to denounce these environmental crimes. They demonstrate and post pictures on Facebook. They believe that the building of concrete structures and the digging of holes in the river is a deliberate strategy from the company aimed at reducing the status of the rivers in order to be able to build hydroelectric power plants in the future (for example the Sana river is a level 1 river where it is forbidden to build hydroelectric power plants) (67, Fisherman, SM).

III.4.B.d. Hydroelectric power plants

Hydroelectric power plants were developed in the country to offer an alternative energy source to coal-fired power stations. The European Commission supported this project and numerous installations were planned (Figure 50). However, these projects have had a huge impact on river dynamics as rivers are broken up multiple times. River biodiversity, such as fish, and macroinvertebrates are also disturbed. Some humid areas, which are already internationally threatened, were cut off from their water source.

People then started to react and a campaign was created to protect rivers in the Balkans: Save the Blue Heart of Europe.

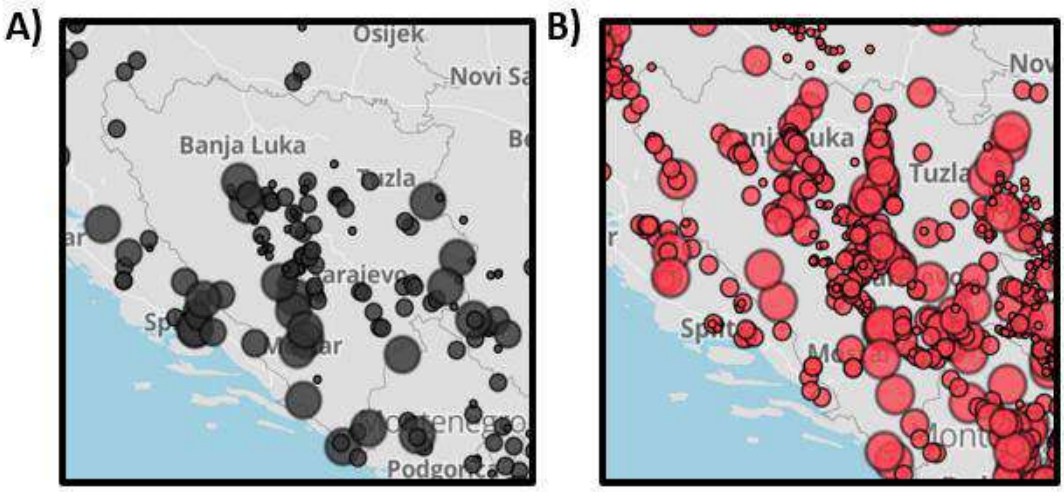

Figure 50: A) Current hydroelectric power plants in B&H B) Planned installations.
Source: Save the Blue Heart of Europe campaign, 2022

Progress was made and in June 2022, a significant turning point in the matter of mini hydroelectric power plants took place. The House of Peoples of the Parliament of the Federation of Bosnia and Herzegovina adopted Amendments to the Law on Electricity, prohibiting the construction of small hydropower plants with an installed capacity of up to and including 10 MW. As a result, according to the draft of the new Concessions Law of the Una-Sana Canton (2022), the subject of the concession cannot be streamed for the production of electricity. In RS progress resulted from the adoption of the Declaration for the protection of rivers by the National Assembly in 2021 and with the adoption of the new legislation on renewable energy sources in February 2022. With this Law, the incentive for constructing small HPPs was cut.

In both municipalities, hydroelectric power plant concessions on most of the rivers had previously been granted, with power from 0.50 MW to 12 MW. Now only Mrkonjić Grad is menaced. In Mrkonjić Grad concessions for mini hydroelectric power plants were given for the rivers Sana, Ponor, Medljanska, Crna, Vrbas, and Sokočnica. Before 2020, the territory of Sanski Most, concessions were given for the rivers Sana, Sasina, Kijevska rijeka, Sanica, Bliha, and Dabar (Annexe 7). In Mrkonjić Grad, one hydroelectric power plant, located near the Sana springs prevents the area from becoming widely protected. Other planned dams could also prevent new protected areas from being set up, especially in Sana canyon.

III.5. INDUSTRIES

III.5.A. CONCESSIONS & NATURAL PUBLIC RESOURCES

The country does not generally sell its lands but sells concession to people to exploit/use them.

A concession means providing a national asset for use by another person for some activity. The subject of the concession can be the construction of physical or social infrastructures, tourist infrastructures, rivers (fishing, hydro-energy, water supply, or fishpools), agricultural land, exploitation of resources, hunting, etc. Almost all concessions are under government jurisdiction (government of RS and F B&H), except the concession for the construction of communal facilities. The government can transfer responsibility to the municipality for the construction of tourist infrastructures, cultural and historical facilities, etc. Concession for the forest is forbidden as is state-owned forest purchase in both entities.

Concessions are regulated by the Concessions Law, at different levels (The Concessions Law RS, F B&H, Unsko-Sanski Canton, 2022). The law defines the type of concession, who grants it, and the procedure for obtaining it.

The procedure for obtaining a concession (all types) is described in several steps:

1. The Ministry can grant concessions for some areas or a demand can be made by a bidder. To negotiate with a self-initiated bidder, the Ministry must first obtain the consent of the Commission for Concessions.

   In order to submit a request for a concession, the applicant should submit basic information about themselves, the subject of the concession, location, economic justification, scope of use, a brief description of the conceptual project, method of financing, method of resolving property relations and other data.

   An impact study also needs to be done. It is carried out by independent companies. However, it is often not so detailed. People are supposed to have access to this document before the concession is attributed but most of them are unaware of its existence. An expert opinion on the impact study, made by the Institute of Natural and Human Heritage is also given before the acceptation of the project in RS. The Institute does not exist in the Federation. It is the Ministry of Tourism and the Environment which holds this role.

2. The Ministry prepares an economic justification study, or the bidder needs to prepare it. The study is sent to the Concessions Commission for consideration.

3. If the study is approved, a tender for the award of the concession is announced.

4. Then, the government (RS or F B&H) awards the concession to the most favorable bidder who has fulfilled all the criteria.

This means that municipalities and local communities do not have a significant role or impact on the final decision. They can only express an opinion or comment on the economic study, before the public inspection adopts the project.

In both municipalities, concessions related to natural resources are given for the exploitation of mineral raw materials, rivers (hydroelectric power plants, fishing, fishpools), agricultural land, and hunting, which are government-approved.

III.5.B. COAL MINES AS A DIRECT AND INDIRECT SOURCE OF POLLUTION

Bosnia and Herzegovina still depends on its coal resources as an energy resource. It has 5 thermal power plant stations which run on lignite and are heavily polluting – at the local level and as emissions of CO_2. This pollution is particularly due to the age of the stations which are in poor condition and suffer from energy losses.

Coal mines are present in both municipalities.

III.5.B.a. The "LAGER" Coal mine (Sanski Most)

The coal mine is located in the Kamengrad settlement, near the populated agricultural village of Gorice. It is a surface mine, set in the middle of populated areas, close to a managed agricultural area (Figure 46). In 2015, a concession was issued for the exploitation of coal within an area of 1067.27 ha in the Zlauše-Fajtovci region. A concession was granted for 30 years. Currently 28.48 ha is being exploited (Figure 51). The mine was passive until 2022, when it started to export coal to Serbia because of the energy crisis. Currently, there are also plans to reopen the whole underground.

The owner bought arable lands from villagers which had been cultivated with crops for cattle: mostly Serbs that had left after the war. People could not complain since, the decision was made without them. Today, the inhabitants of Gorice complain about the constant noise of the mine and the dust it generates. "*There is dust all day, you can no longer hang your washing outside to dry.*" (69, Self-sufficient, SM).

Farmers also complain because they no longer have lands to produce corn for their animals. "*One of the reasons I stopped my milk production is the coal mine, it took over a lot of arable land that we can no longer cultivate and we lost pastures as well.*" (69, Self-sufficient, SM).

During the transport of coal, lumps fall from the lorry and people from the surrounding area find this dangerous.

Figure 51: Part of the LAGER coal mine in Sanski Most. Machines are in constant use.
Source: Zoé Siegel, 2022

III.5.B.b. The Coal mine in Medna (Mrkonjić Grad)

The coal mine is located in the Medna settlement between the Ražovina hill in the east and Brežina in the west. It is in the middle of the forest, so not visible from the surroundings (Figure 52). The area is sparsely populated, but there is agricultural activity nearby: fruit growing, animal husbandry, and also forest exploitation and management (private and public). The nearest houses are about 250m away and the shared public spaces and the centre of the village with the Church is only about 500m from the mine. The water of the Grabovac, which passes right next to the mine, is used for drinking by the entire village, and it is currently very polluted. Downstream is the river Medljanka, which is used mostly in agriculture and for watering livestock. The water flows into the Sana, which is a river with water of the 1st order of quality according to the Decree on the Classification of Waters and Watercourses of the RS. The few villagers complain about the mine, but this is mainly concerning the degradation of the road due to the passing of heavy vehicles. For the needs of the exploitation, a new road at the foot of the hill was constructed through the forest, and the course of the small stream Grabovac was altered.

The concession was granted for a period of seven years and an exploitation area of 5 ha. However, soil analyses (with smaller exploratory digging) have identified several interested sites in the area in the past years (65, Sheep seller, MG).

Figure 52.: The coal mine in Medna (Mrkonjić Grad).
Source: Zoé Siegel, 2022
NB: It was hard to take a picture as people were present.

III.5.C. FACTORY POLLUTION

III.5.C.a. The RS silicon factory in Bjelajce (Mrkonjić Grad)

The Silicon factory is located in the Bjelajce settlement, next to the regional road (R412) that goes through the settlement and is surrounded by inhabited houses and agricultural areas (Figure 53). The factory is only several meters away from the nearest houses, the elementary school (200 m), shops, restaurants, agricultural lands and crops. It is located in a rural area where no significant pollutants were present before its construction.

The RS Silicon is a foreign-owned factory, a part of *Metalleghe Spa Italy*, founded in 2012. The factory started operating in November 2015 in Mrkonjić Grad. It produces silicon metal, with an annual production capacity of 15.210 tons of Si-metal (Pešević & Knežević, 2017). The main resources that the factory uses from the municipality are the labour force, water, and wood. In production, large amounts of wood are used to heat the furnaces. The factory currently employs more than 100 people from the municipality.

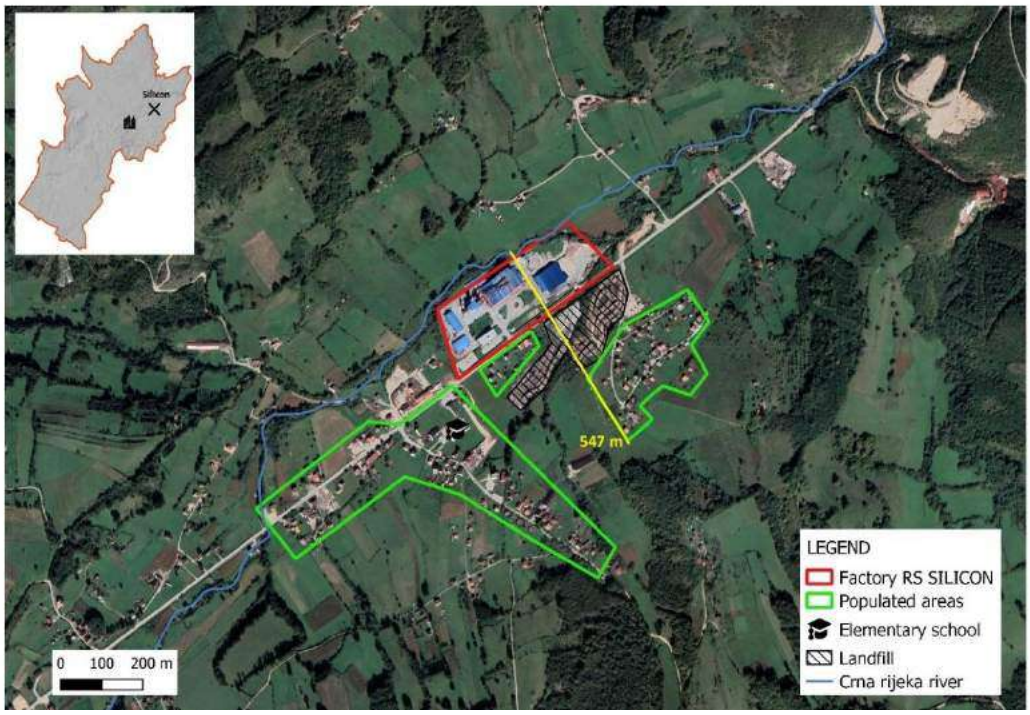

Figure 53: The RS Silicon factory in Bjelajce in Mrkonjić Grad.
Source: Borka Malešević, 2023

The main impact of the factory is air pollution, and a large quantity of waste gasses (CO, SO_2, NO_2, etc.) (Pešević & Knežević, 2017). Air quality monitoring is apparently not done.

During fieldwork, we observed large amounts of smoke and a noxious smell in the area of the factory. In addition, the factory is very noisy which disturbs the peace in this tranquil rural area. People who live nearby, identify the main problems as being: smoke, dust, and noise. People also cultivate their gardens and orchards, but they have noticed that their crops dry out and are covered in dust, which dissuades them from consuming those vegetables (15, Permanent people, MG). People in this area also produce milk and cheese, and then sell it at the local market. However, since the factory has been operating, people are reluctant to buy from these producers, which results in the loss of farmers and in people moving away from Bjelajce.

Across the street from the factory, there is a landfill for waste generated during production, and houses are only a few meters away. Heavy vehicles generate dust there. Moreover, a small lake was there before but which has since disappeared, filled in by waste from the factory (40, Self-sufficient, MG).

IV. DISCUSSION/CONCLUSION: IDENTIFICATION OF THE ENVIRONMENTAL CHALLENGES

Bosnia and Herzegovina is a country which is rich in natural resources. It is covered by 63% of forests, and contains many healthy rivers and has a geomorphological composition which means the country is rich in mineral resources and biodiversity. The management of this environment is still influenced by the past socialist system. Most of resources are state-owned. The Ministry of Agriculture, Forest and Water Management is responsible for the organization and control of those sectors. It has contracts with several enterprises for the management of forests and rivers/lakes (Figure 54). It grants concessions for people who want to use the "public" territories. Fishermen pay to fish in the rivers, hunters pay to hunt in the forest, people pay to gather a certain quantity of mushrooms. The ministry elaborates regulations and strategic plans with those users and controls their activities. It also grants concessions to people to exploit some areas: to build hydroelectric power plants, to produce electricity, dig mines and quarry rock to exploit mineral resources. There is a strong top-down governance in the country. Entrepreneurial activities are also hard to develop. Moreover, the access to the market is difficult, especially in agriculture where around 60% of the food is imported.

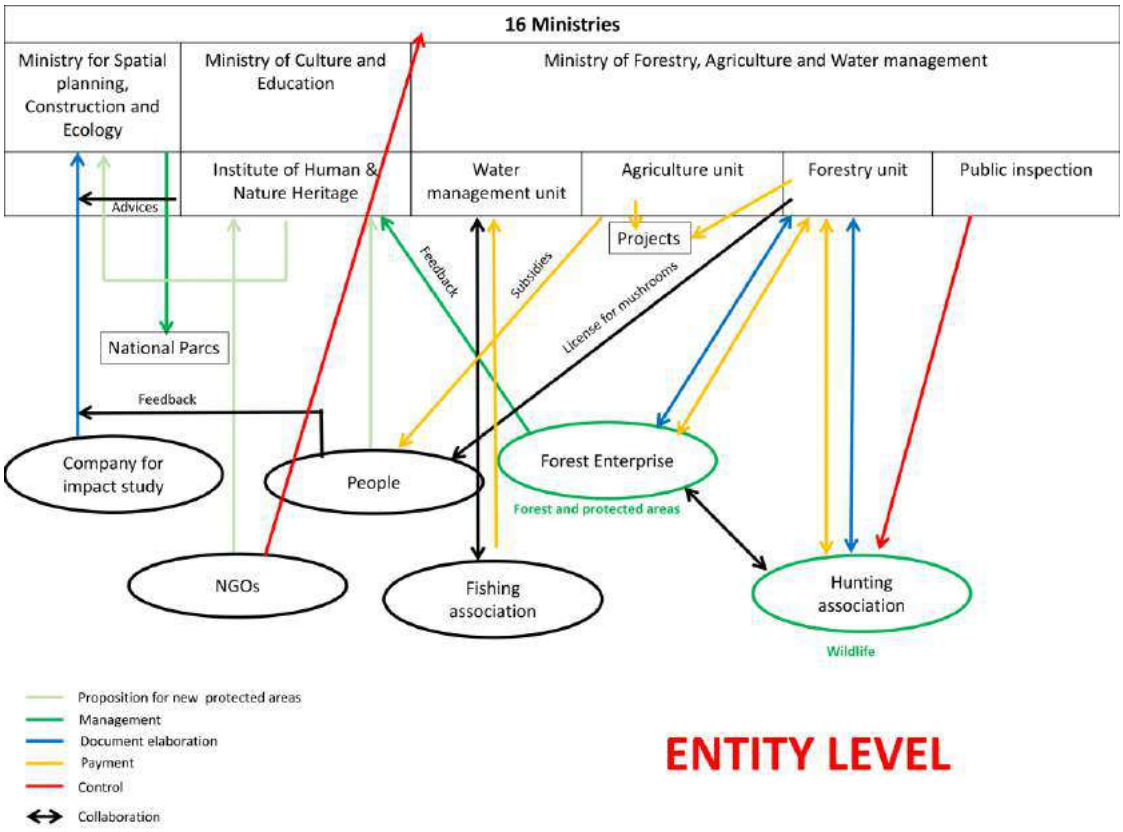

Figure 54: Institutional organization of natural resources management in the RS.
Source: Zoé Siegel, 2023

In the Federation of B&H, the organization is similar to RS. The only changes are the addition of a cantonal level with a variable number of ministries and the names of these ministries.

Some effective sections of the management system of the former regime are still functioning in both Entities. This is the case of forest management and it's "close to nature" concept, probably the most durable way of managing forests in Europe. However, the ranking of the country is low due to corruption and there is a lot a criticism regarding the overall organization of the political-bureaucratic system, which is extremely complex and polarized. B&H remains one of the poorest countries in Europe with only 6000 €/head p.a; in 2021 – compared to the 33 900€ of the European average.

Infrastructures such as roads, waste discharge and the mains water network are still undeveloped in both analysed municipalities. It is one of the push factors for migration to the cities and abroad - a strong depopulation is ongoing, especially in the countryside.

This has an important impact on natural resources. Rural areas emptying because of a strong rural exodus. The open and anthropic landscapes from former agrarian systems tend to disappear, covered by vegetation which is taking over. Many areas have already turned into forests, ferns or brambles. Some regions where the civil war was particularly intense are still dotted with empty villages and destroyed, unoccupied houses.

In the forestry sector, some surveys (USAID, 2020) indicate that the main anthropological threat at the country scale is illegal logging and corruption from the state. However, it was not observable at "our" municipality scale. Some minor areas might be illegally cut by some inhabitants who encroach on public forests, as borders are blurred. This also happens because the management structures have insufficient resources to control all private forests. However, we could not verify if other abuses of the system were taking place. It is a sensitive subject and we could not access some forested areas. In management structures both workers and budget are often insufficient.
The forest is one of the main resources in B&H and of both municipalities. However, it is not valued much in the country. Basic or no transformations are made in sawmills which exporting wood abroad - while most furniture companies in B&H import wood products from those same countries. Added value on the Bosnian wood is then lost.

In other public lands, concessions seem to be the main danger for the environment. Several quarries exploit bauxite, dolomite or limestone in both municipalities for use outside the municipalities, even if some of them are used to build new roads. However, in certain cases they damage the landscape. Workers often use the same roads as the population for the transport of rock and are accused of damaging them. This is also the case for coal transportation which also dirties them.

Coal mines are present in both municipalities and are responsible for several environmental impacts. Coal-fired power plants are a huge greenhouse gas emitter in the country but there are none in the municipalities studied. The main impact of the open pit mine in both municipalities is water pollution. Dust coming from digging also had a local pollution effect (people, houses and crops).

Other sources of pollution are observable in the municipalities. Waste management is poor and there is a waste and plastic pollution contaminating the whole wild food-chain. Some industries such as the Silicon Factory in Mrkonjić Grad also pollute the air, with no protection for the surrounding population or the environment. All this affects the well-being and even the health of people who avoid in some cases the commercialization of food products.

In rivers, several threats in addition to coal mining and waste exist at a territorial scale. Numerous second homes were built near rivers, in spaces that were used in the past as a buffer for flood. Those houses and installations are not fit to withstand those possible events and those responsible for water management have decided to take several measures: concreting the banks of some river sections and removing tuff (deposits of calcareous soil important for river dynamics and biodiversity) to deepen the riverbed. These solutions alter the course of the river as well as its ecological dynamics.
Hydroelectric power plants are another threat to rivers. A high number of those infrastructures were planned all over the country, breaking up the flow of one river multiple times. In Mrkonjić Grad the construction of one of these facilities prevented the establishment of an extended protected area. 4 other mini hydroelectric power plants are planned in this municipality which would disrupt the dynamics of the Sana river, one of the most qualitative rivers in B&H.

Concessions are one of the main environmental threats in B&H. They are controlled by the government and would not be an issue if used in a reasonable way. The problem is the excessive number of them, as well as the resulting economical derives. The chosen location and the type of exploited resource is also a challenge. Impact studies are mostly ignored in the construction of those facilities. Environmental protection and waste treatment measures, when identified by impact studies are not respected. As the quality of the environment is one of the country's assets, the cost-benefit relationship of certain concessions is questionable. The local population are in general not aware of new concessions and are often exposed to the abuses of those facilities: air or water pollution, disturbance of their resources such as cultivated areas, fishing and hunting.

In addition to that, foreign companies tend to monopolize the market. A lot of private companies settled in B&H and bought concessions for a certain period of time. Others, both national or foreign have import orientated businesses which creates unfair competition with local producers who have difficult access to the market or do not have sufficient resources to add value to their primary products. Agriculture is one of the most affected sectors. People receive subsidies from the municipality but with the increase of input prices these past years, these activities are at stake. Numerous agricultural producers have given up on their activities. Producers also complain about the absence of a regular clientele that renders the job uncertain. Only the milk sector is developed because national companies exist, but with a strong decrease in activity in the past years. Collective organizations are also rare and almost always induced by foreign organizations. All the natural elements are reunited in both municipalities for a good and sustainable agricultural production (people do not use pesticides or fertilizer, the climate is good, water is accessible in most areas). There is no comprehensive public policy and choice for the sector.

Despite these issues, positive points were also noticed. Biodiversity is rich in both municipalities and people are noticing that "*it has been increasing these past years*". Some international endangered species are present in both municipalities and their populations are not at risk there. Rivers are healthy and forests are diverse and not fragmented. No urgent big threats were noticed except to rivers. Illegal hunting which is also mentioned as a threat at a national level does not seem to happen in either municipality. There is a big lack of data concerning many taxa. Finally, it is worth noting that climate change is hardly noticed by the people interviewed, even if some are preoccupied by some droughts in the past years.

Moreover, we met people concerned by environmental issues on both territories. We talked to several young adults who liked their lands and had started an agricultural production. Some teenagers were also motivated to take the family business over. Forest managers are deeply involved in the good management of this resource. A local environmental movement is also present in the region fighting against useless or detrimental projects especially concerning rivers and their biodiversity in Sanski Most. In Mrkonjić Grad the *Greenway Association* is present in Pecka and is responsible for the management of the protected area. They make aware people of the importance of the natural resources present in the municipality and promote their conservation. It is actually a great example of a local structure which brings economic and cultural dynamism to the territory. Partnerships are made with the local population and the municipalities to promote local production and rural tourism. This shows the importance of collective actions for a sustainable management of the territory.

A link between biodiversity, climate and agro-environment exists at a territorial scale. Several connections can be made in the studied territories. Mines that are dug to extract coal destroy some ecosystems and particularly pollute rivers. Those minerals are used to produce energy in power stations, which pollute. There is then a connection between threats to biodiversity at a territorial scale and threats to climate at a national scale. Hydroelectric power plants which were set up as an alternative energy source, beneficial for the climate, happen to have an impact on river dynamics and biodiversity. The natural regeneration of the forest at a territorial scale is beneficial for the climate but some open ecosystems tend to disappear because of this phenomenon. Moreover, the high rate of food importation in B&H disadvantages local production. Those importations induce, at an international scale, more CO_2 emissions than local sales would emit and indirectly influence the loss of open ecosystems.

Finally, we summarize all these elements in

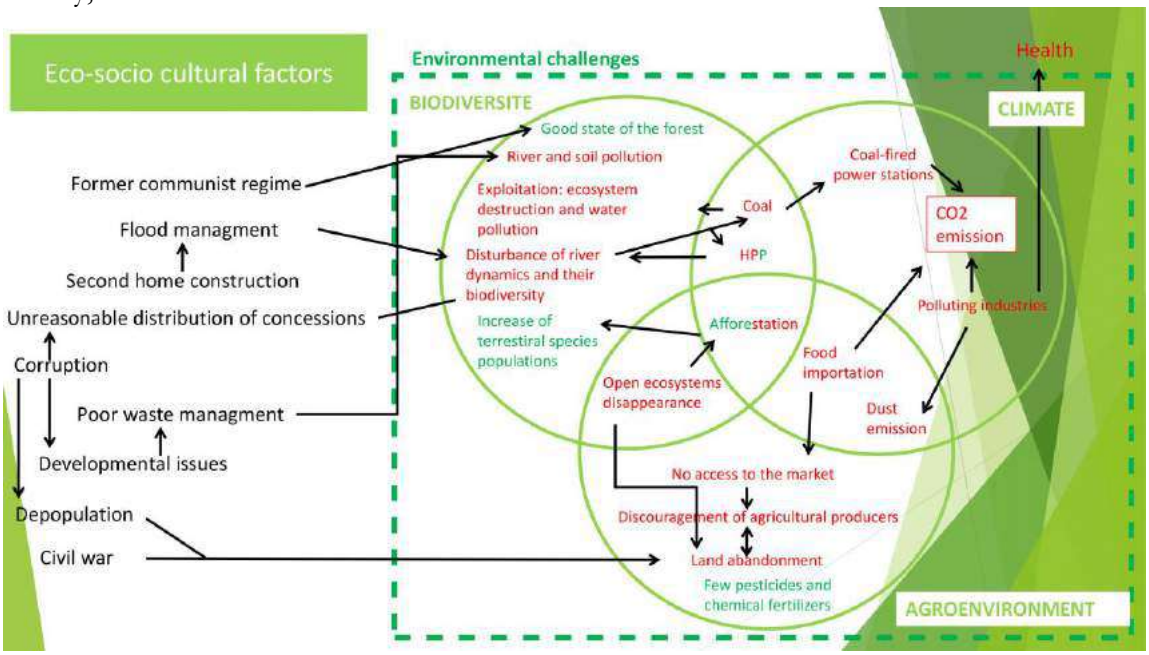

Figure 55, below:

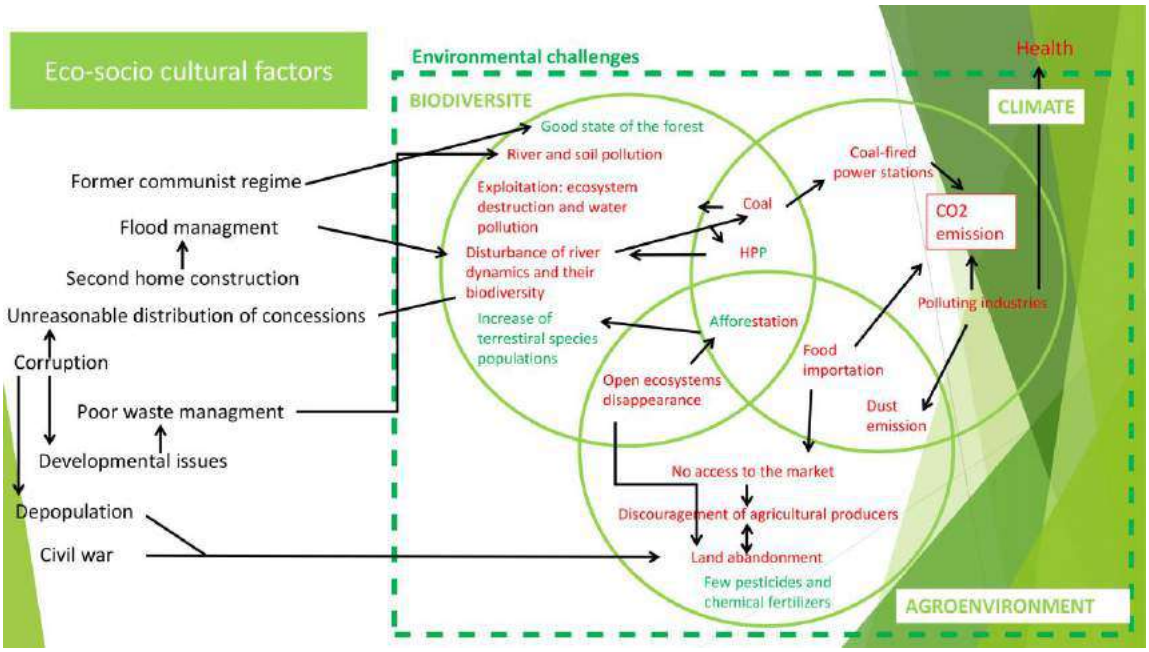

Figure 55: Nexus of the Biodiversity/Climate/Agriculture challenges and their connections to eco-socio cultural factors.
Source: Zoé Siegel, 2023

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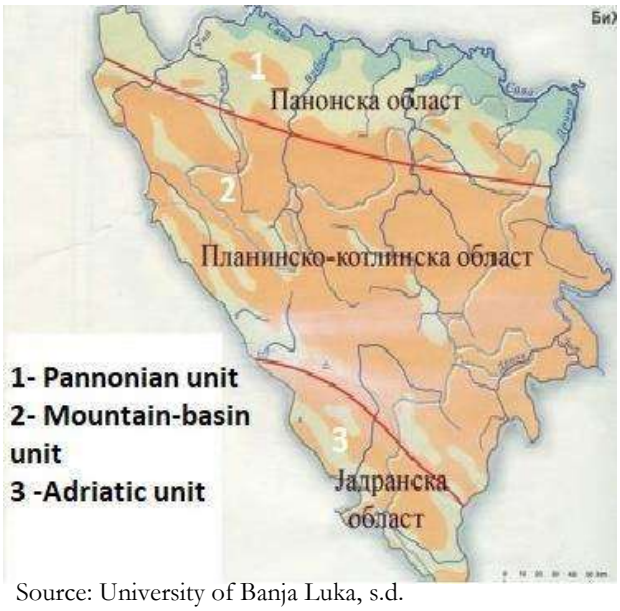
VIII. ANNEXES

ANNEXE 1: LANDSCAPE PROPERTIES OF B&H

1 Map of the 3 morphological units of Bosnia and Herzegovina



Source: University of Banja Luka, s.d.

2 Map of the Pannonian basin which is part of the northern part of B&H: the Pannonian unit.

Source : mapsontheweb

3 Map of Bosnia & Herzegovina land cover

Source : Wintmer & O'Loughlin, 2009

4 Mountain basin areas description

In relation to the natural-geographic characteristics, several zones are distinguished:

1. Bila and the field of Western Bosnia. They represent typical karst regions where mountains are mostly built from limestone with karts fields (polje) that lie between them. The highest mountains in this zone are the Grmeč, Klekovača, Vitorog, Cincar, Dinara with the Livanjsko, Duvanjsko, Kupreško and the Glamočko polje in between.

2. Basin-valley area of central Bosnia. It covers part of the upper vallies of the Vrbas, Bosna and Drina rivers

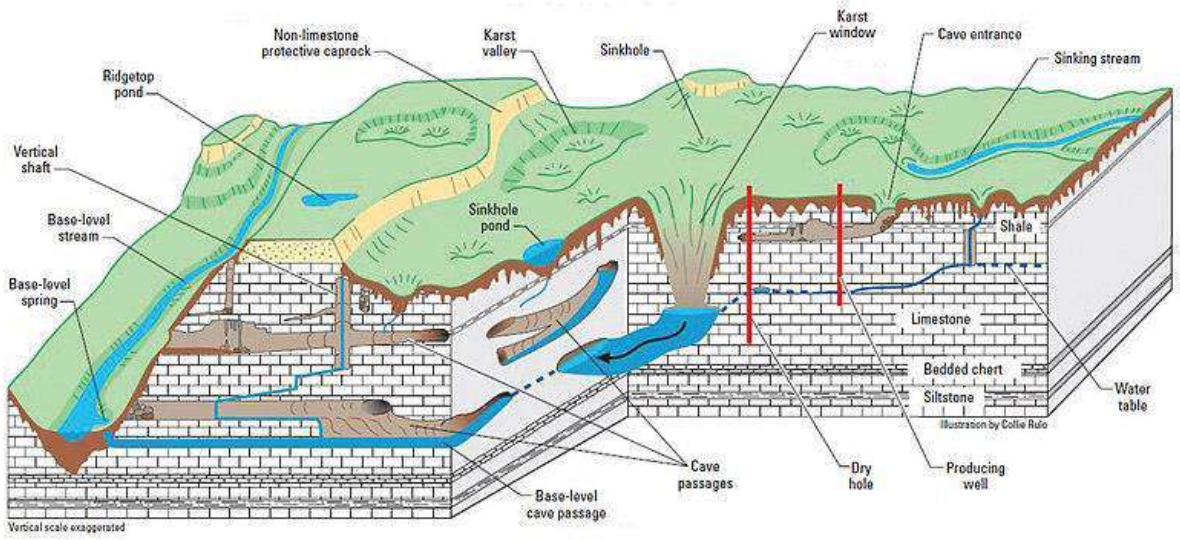
3. The Ore and Flysch mountains.

4. High Bosnian-Herzegovinian karst area.

5. Romania-Podrinje mountain-basin area (University of Banja Luka, s. d)

5

Karstic structures



Source: Taylor *et al.*, 2008

In the geological sense, karst terrain is mainly made of limestone and dolomite rocks (also gypsum, stone, salt, clay), which are soluble rocks. The karst process involves the action of water and carbon dioxide on limestone and dolomite rocks. Water alone is a weak solvent, but in combination with carbon dioxide from the air, carbonic acid is formed: the solvent power is 100 times greater. The water with carbonic acid dissolves the rocks and creates cracks through which it sinks. Because of this process karst terrain has an absence of permanent surface streams. The surface is frequently bare or has scant soil cover.

As a result, rainwater sinks underground. The infiltrated water from the surface flows through 3 zones: water goes to unsaturated or vadose zones (pores not permanently filled with water) to saturated or phreatic zones (pores permanently filled with water) by a vertical movement. It crosses the transitional area between them which is called the flood zone or epiphreatic zone (Prelovsek *et al.*, 2011).

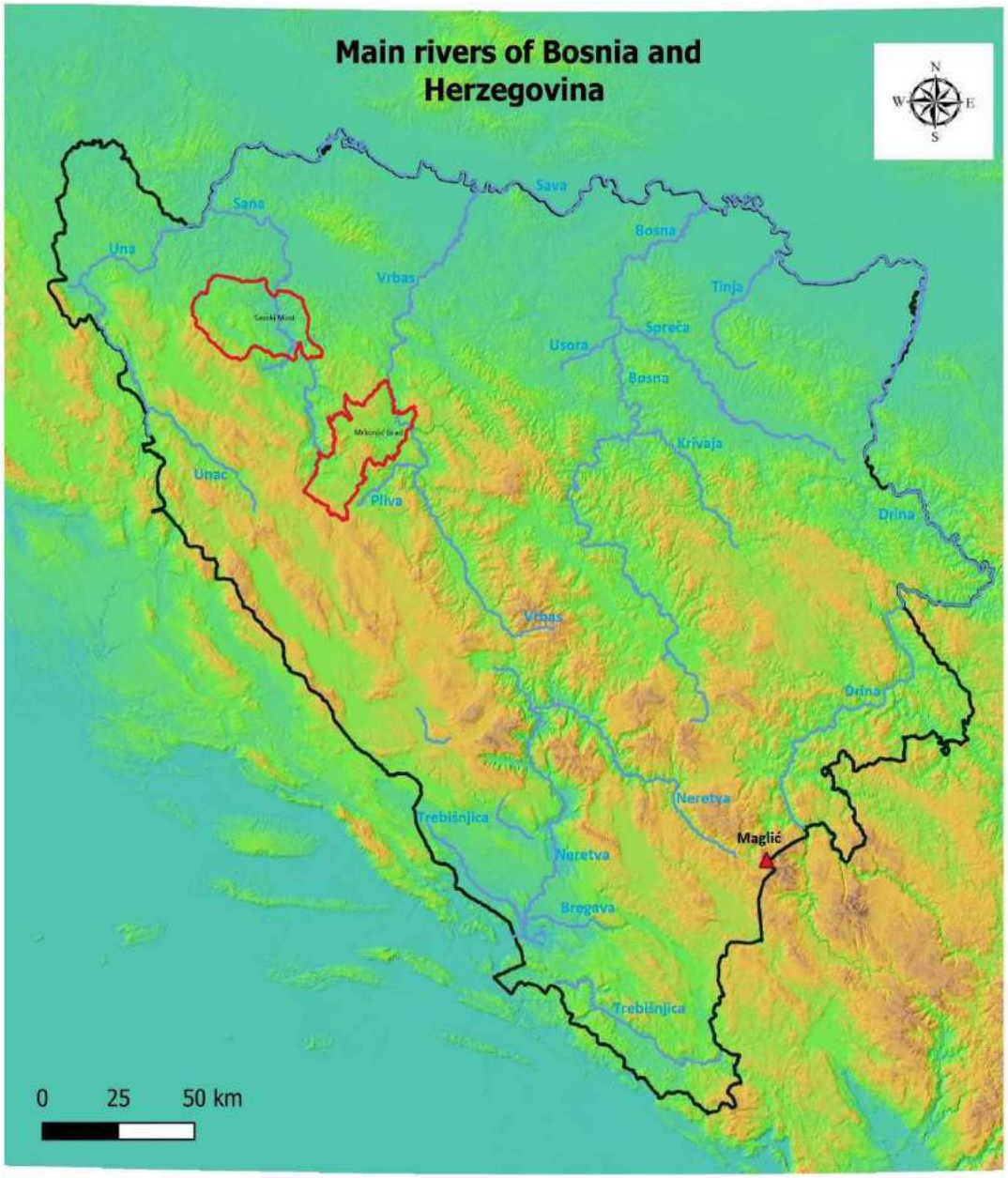
6

European watershed

Source : www.reddit.com

7

8

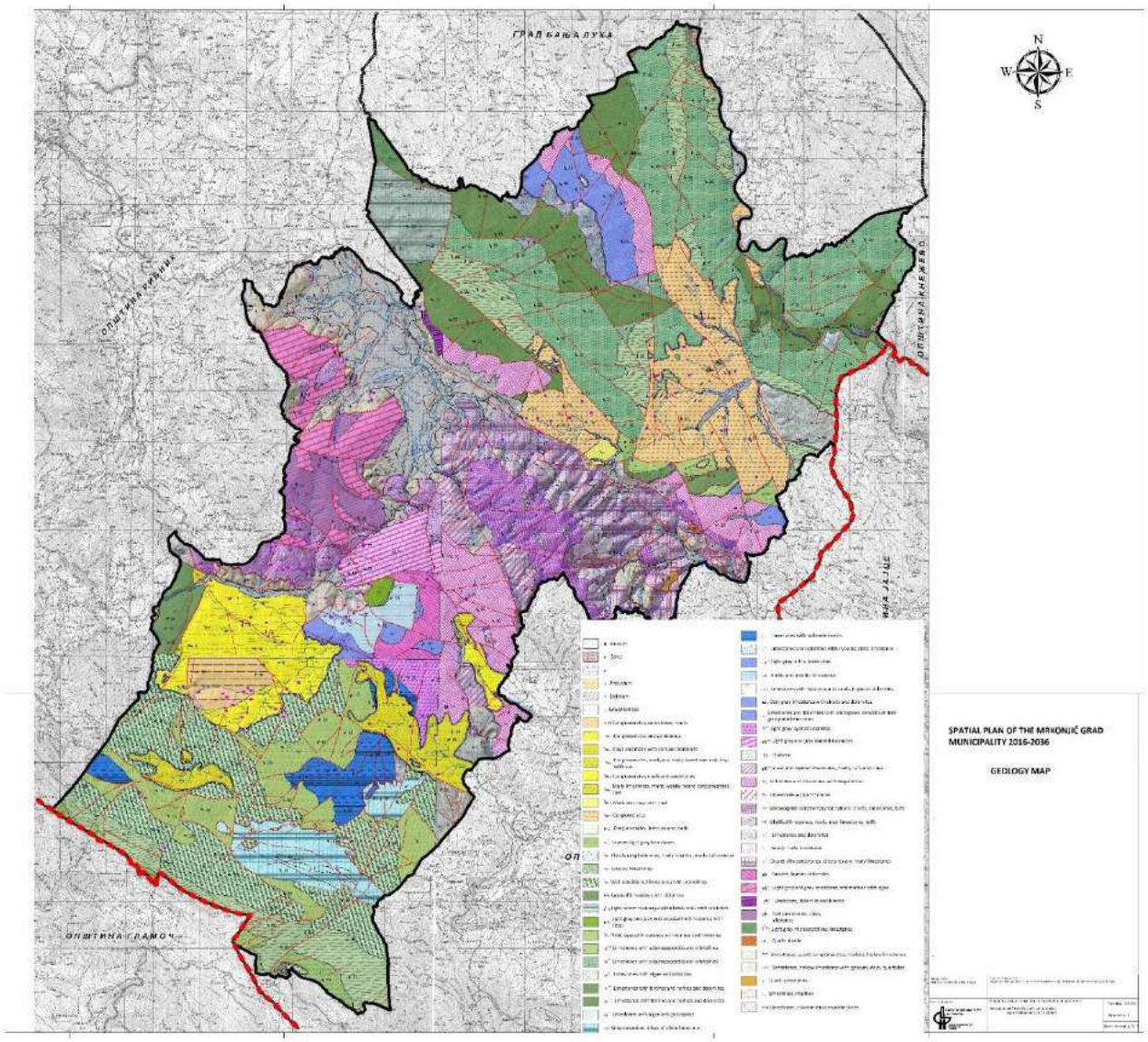


Source : Borka Malesević

ANNEXE 2: LANDSCAPE PROPERTIES OF THE TWO MUNICIPALITIES

1 Geological maps

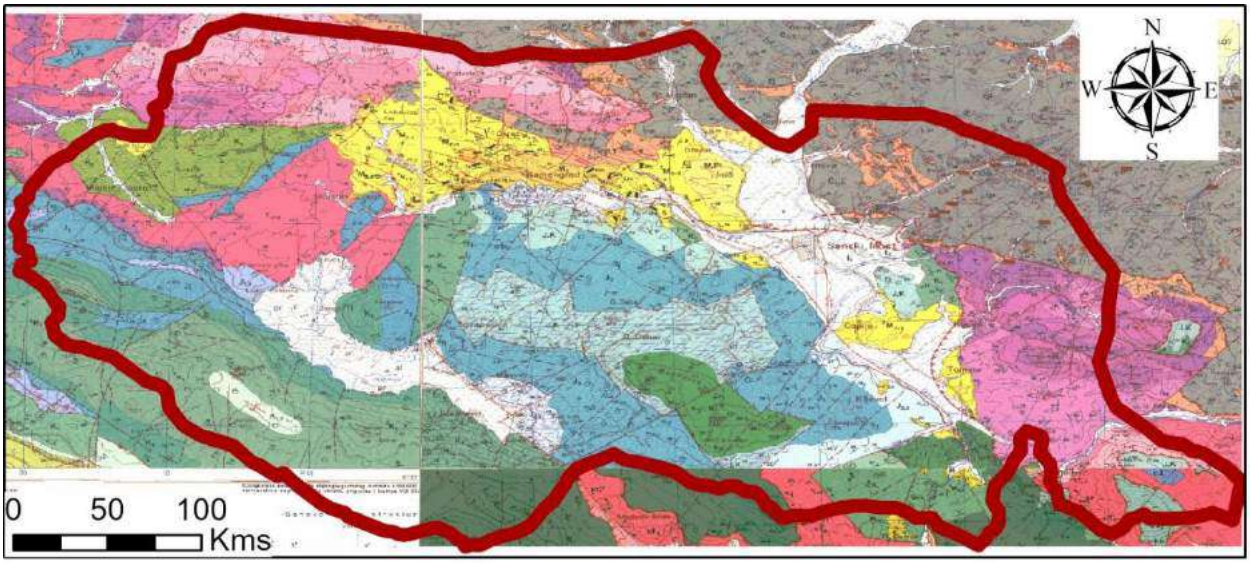
Mrkonjić Grad



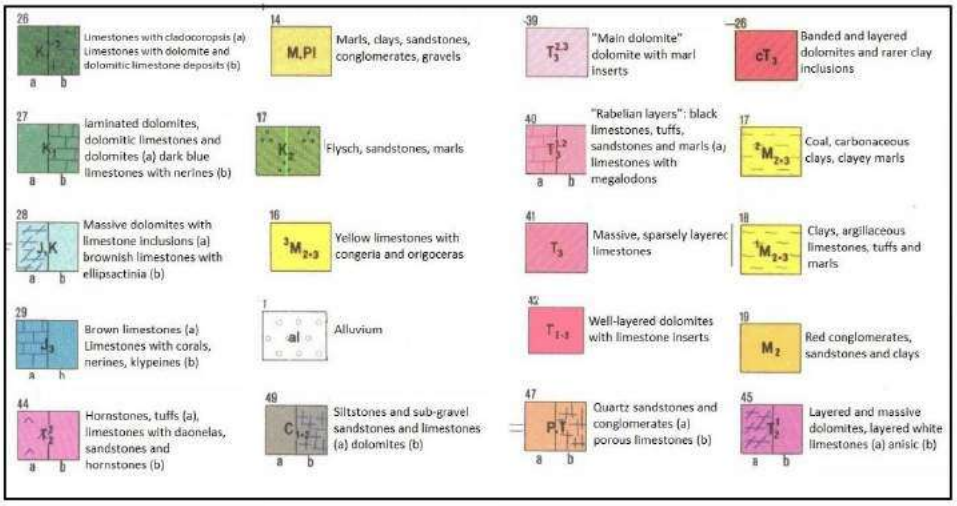
Source: Spatial plan Mrkonjić Grad 2016-2036


al. aluvium
s Scree
b
pr. Proluvium
d. Delivium
t. Lower terrace
M.Pl. Conglomerates, sandstones, marls
Conglomerates and sandstones
Clays and marls with coal and bentonite
Conglomerates, marls and marly limestones and clays with coal
Conglomerates, marls and sandstones
Marly limestones, marls, weakly bound conglomerates, coal
Marls and clays with coal
Conglomerates
Conglomerates, breccias and marls
Layered light gray limestones
Flysch: conglomerates, marly micrites, marls, calcarenites
Layered limestones
Well-conditioned limestones with orbitolines
Layered limestones with dolomite
Light brown microcrystalline limestones with orbitolins
Light gray and gray microcrystalline limestones with algae
Thick-layered limestones with nerines and tintinines
Limestones with salpinogoporella and orbitolines
Limestones with salpinogoporella and orbitolines
Limestones with algae and oribtolins
Limestones with tintines and nerines and dolomites
Limestones with tintines and nerines and dolomites
Limestones with algae and gastropods
J.K. Gray dolomites: inlays of white limestone
Limestones with dolomite inserts
Limestones and dolomites with klypeins: plate limestones
Light gray oolitic limestones
Oolitic and pisolitic limestones
Limestones with hydrozoa and corals, in places dolomites
Dark gray limestones with cherts and dolomites
Limestones and dolomites with orbitopsels: deposits of dark gray plate limestones
Light gray layered dolomites
Light gray and gray banded dolomites
Diabase
Sheet and layered limestones, marls, tuffs and clays
Dolomites and limestones with megalodons
Limestones with ammonites
Volcanogenic-sedimentary formations: cherts, limestones, tuffs
Silicified limestones, marls, marl limestones, tuffs
Limestones and dolomites
Sandy-marly limestones
Quartz-silty sandstones, siltstones and marly limestones
Banded, layered dolomites
Light gray and gray limestones and marbles with algae
Limestone, dolomite and breccia
Red sandstones, clays, siltstones
Light gray microcrystalline limestones
Quartz diorite
P.T Sandstones, quartz conglomerates, marbles, hollow limestones
cP.T. Sandstones, hollow limestones with gypsum, clays, quartzites
Quartz porphyries
D. Limestones, marbles
S.D Limestones, chlorite-sericite-calcite slates

Sanski Most



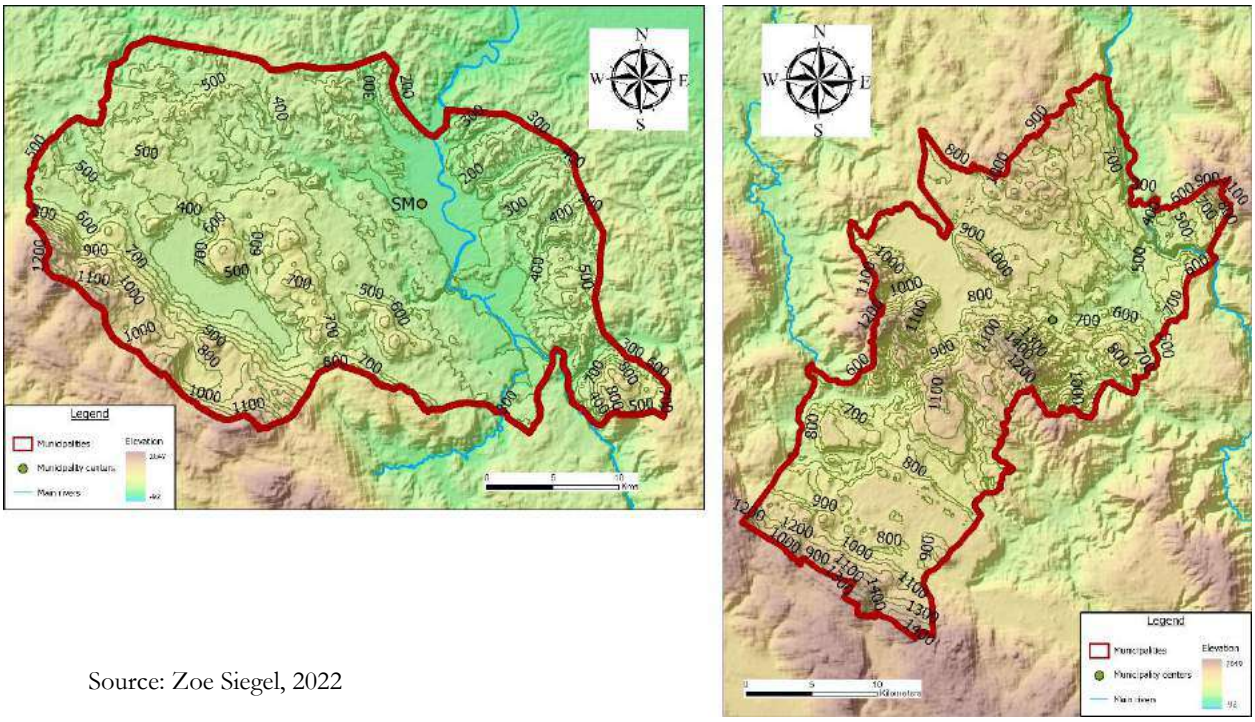
LEGEND



Source: Spatial Plan Sanski Most 2022-2042.
Reconstituted map: Zoé Siegel

2

Topographic maps

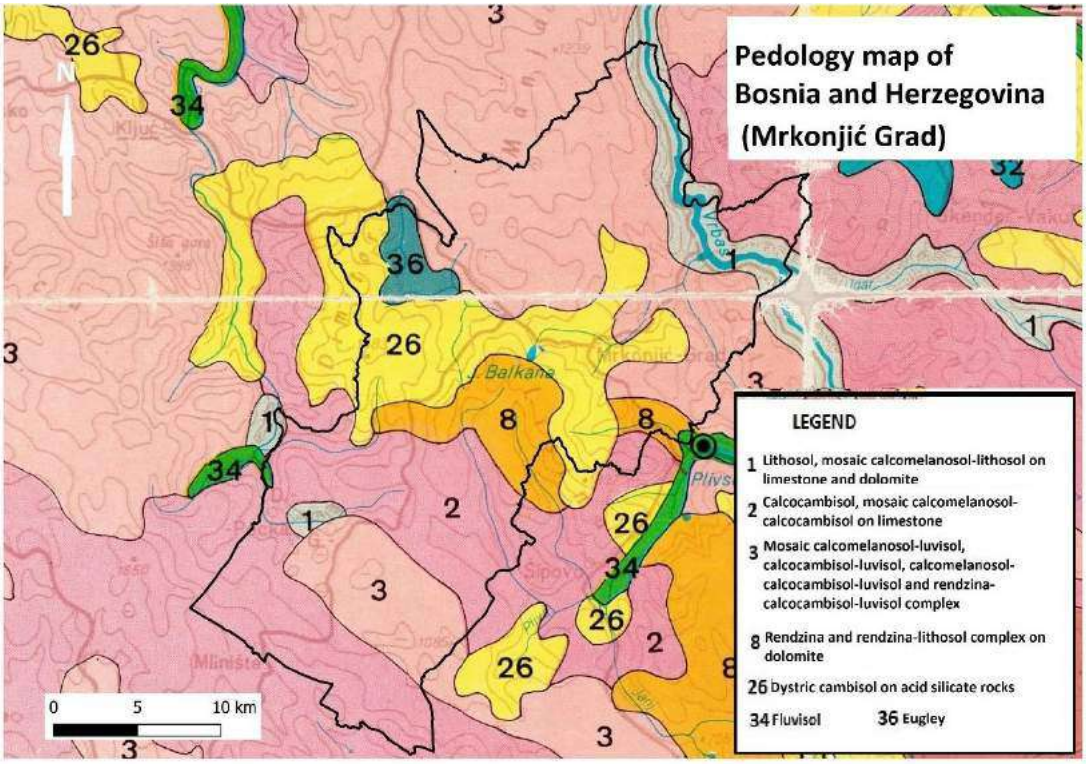


Source: Zoe Siegel, 2022

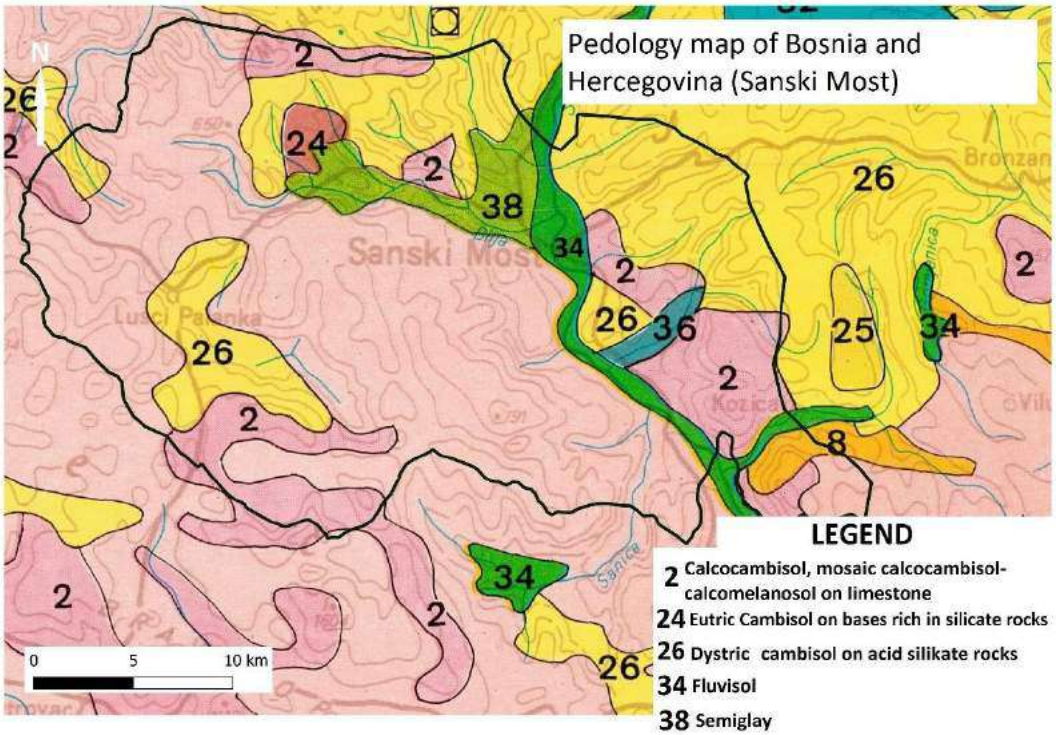
3

Pedology maps

Mrkonjić Grad



Sanski Most



Source: Faculty of forestry of Sarajevo, 1980

Definitions

Calcomelansols (limestone-dolomite cherts) are very shallow stony soils. They are black and powdery in structure under grassland vegetation. The main characteristics are high rockiness, shallowness, drainage, very high summer temperatures, and very high aridity. They are spread at an altitude of 1000 m.

Rendzine is formed on weathered limestone-dolomite deposits, thicker marls, and moraines with carbonate deposits. It lies on mountains and plateaus from 800 to 1200 m above sea level. Because of their shallowness and skeletal aspect, it is predetermined for forests.

Luvisol is formed from brown soil. The subsurface layer is more clayey and less water-permeable than the surface layer. These soils are poor in phosphorus and require agrotechnical measures: calcification, phosphatization, and humifaction. They belong to soils of medium fertility.

Valley brown soils are spread in the valleys of recent diluvial rivers and streams.

Dystrict cambisol (dystrict brown soils) occurs on acidic rocks. It has a depth of 40 to 70 cm. It contains 3-5% humus, it is poor in phosphorus. Brown soils are favorable for growing potatoes, rice, barley, and oats.

Alluvial (fluvisol) soils were formed on the alluvial deposits of the Drina, Bosna, Neretva, Una, Sana and Trebišnjica rivers. Due to flooding during each season, the soil is filled with new sediments, so the soil cannot be fully developed.

Clay soils (eugley, semiglay) were formed under the influence of underground water, which is present at a depth of 80 cm. They are widespread in the lowland, transitional, and lowland-hilly terrains of Bosnia and Herzegovina. **Eugley** occurs in swamps. **Semiglay**-These are the soils of river valleys, so the appearance of water is topographically conditioned.

Rocky soils (lithosols) are young undeveloped soils. They were developed on compact rocks, consisting mainly of disintegrated particles larger than 2 mm and do not exceed a depth of more than 20 cm. Lithosols are unfavorable for agricultural development but are used to a small extent for afforestation

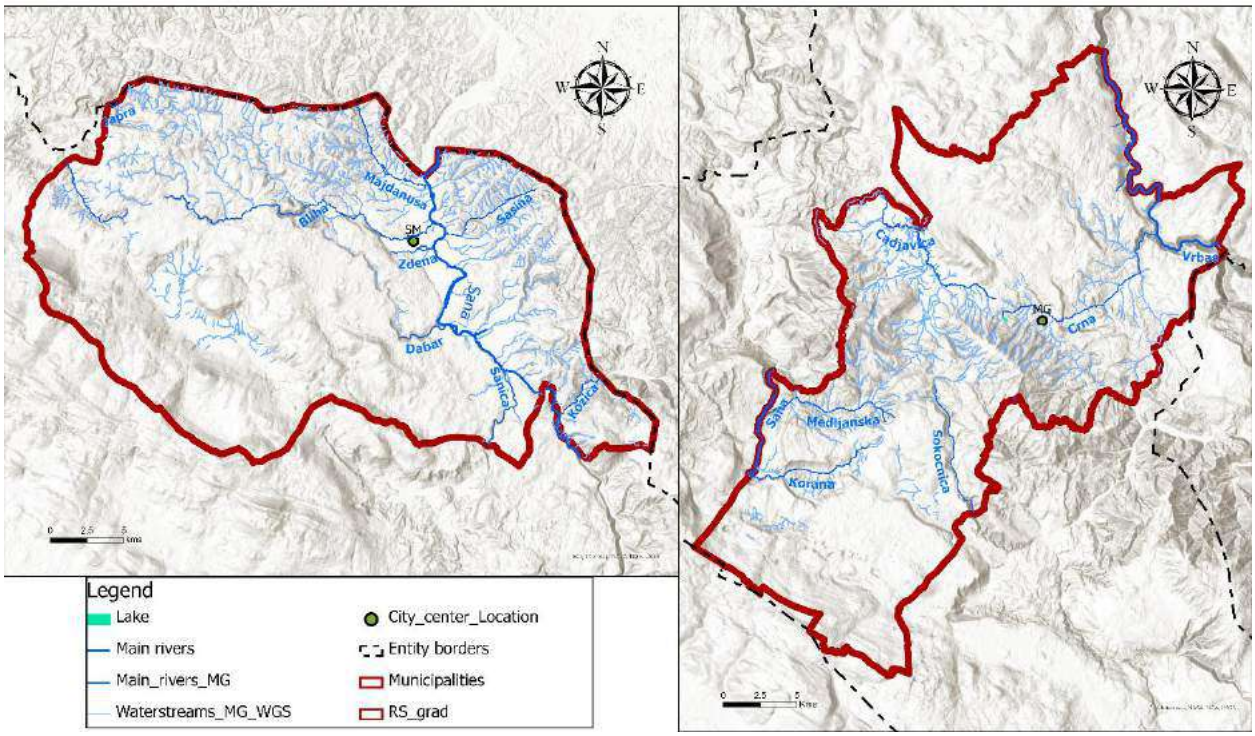
Calcocambisol (brown soils on limestone and dolomite) is a type of soil that develops on limestone and dolomite, at different altitudes, but mostly in the mountains and mountainous areas that are often rocky and stony. The production characteristics of this type of soil are conditioned by the depth of the soil, rockiness, slope terrain, and the surface of elementary soil areas. Deep and medium-deep calcocambisols found in lower gentle positions are used as arable land, otherwise these soils are overgrown with forest.

Eutric cambisol (eutric brown soil) is developed on basic rocks of magmatic origin, as well as on limestone and dolomite. It is most widespread in hilly and mountainous areas. This soil is suitable for agriculture, but it is mostly forest land.

Source: https://www.visitmycountry.net/bosnia_herzegovina/bh/index.php/geografija/27-vmc/geografija/228-tla-bosne-i-hercegovine

4 Hydrology maps

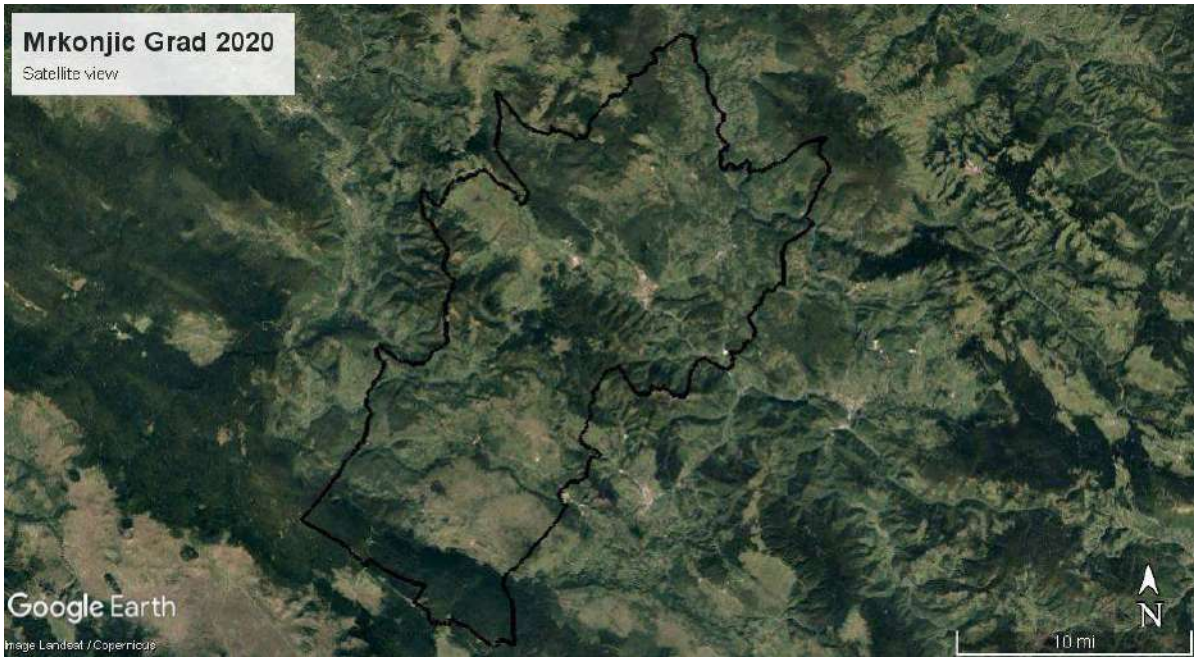
Hydraulic system in the municipalities of Sanski Most and Mrkonjic Grad

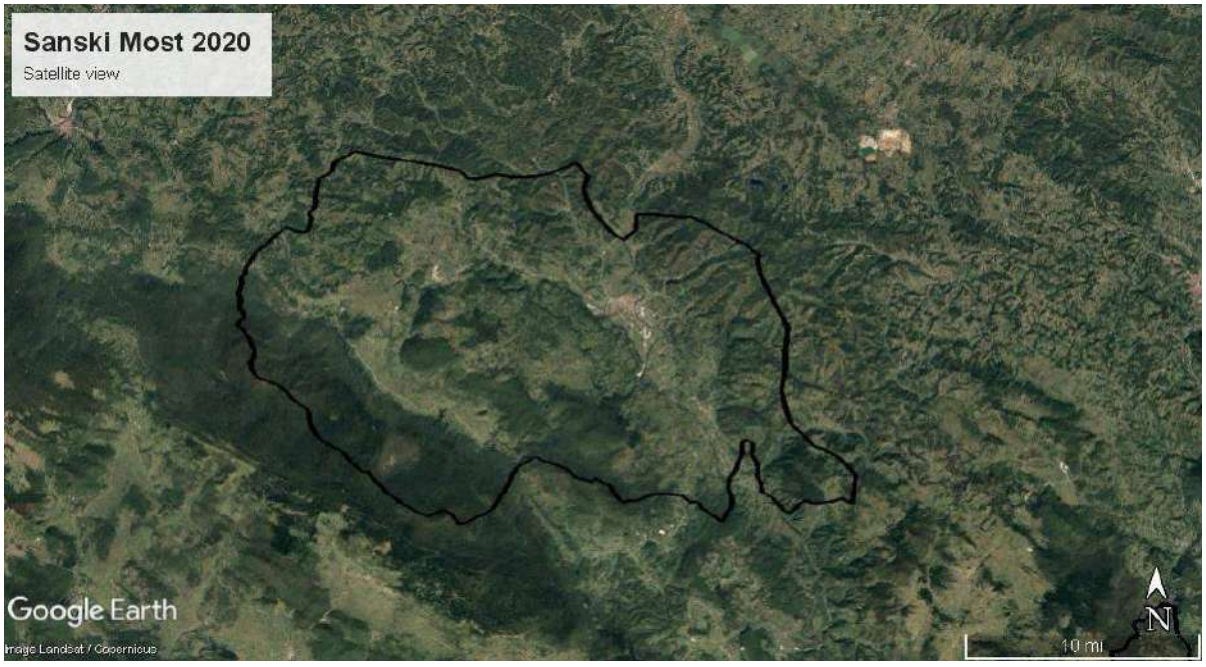


Source: Zoé Siegel

5

Satellite images

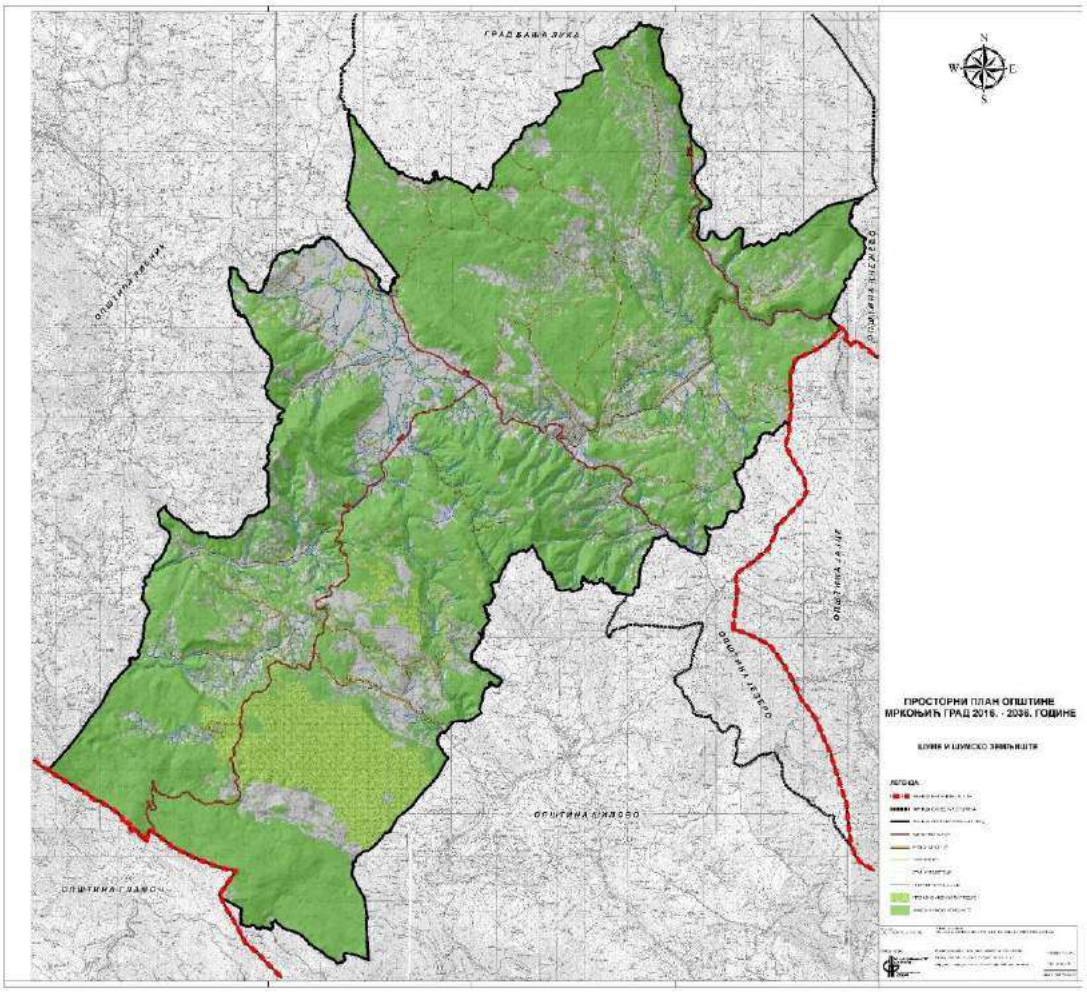




Source: Google earth, Zoé Siegel

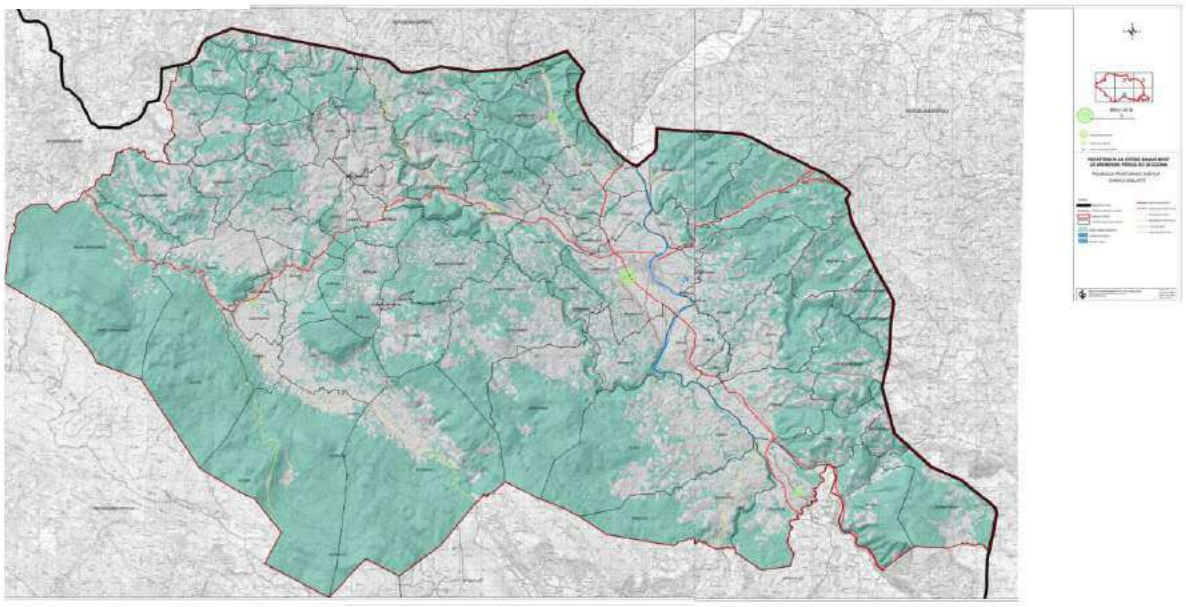
6 Maps showing forest coverage

Mrkonjić Grad



Source: Spatial plan Mrkonjić Grad 2016-2036

Sanski Most

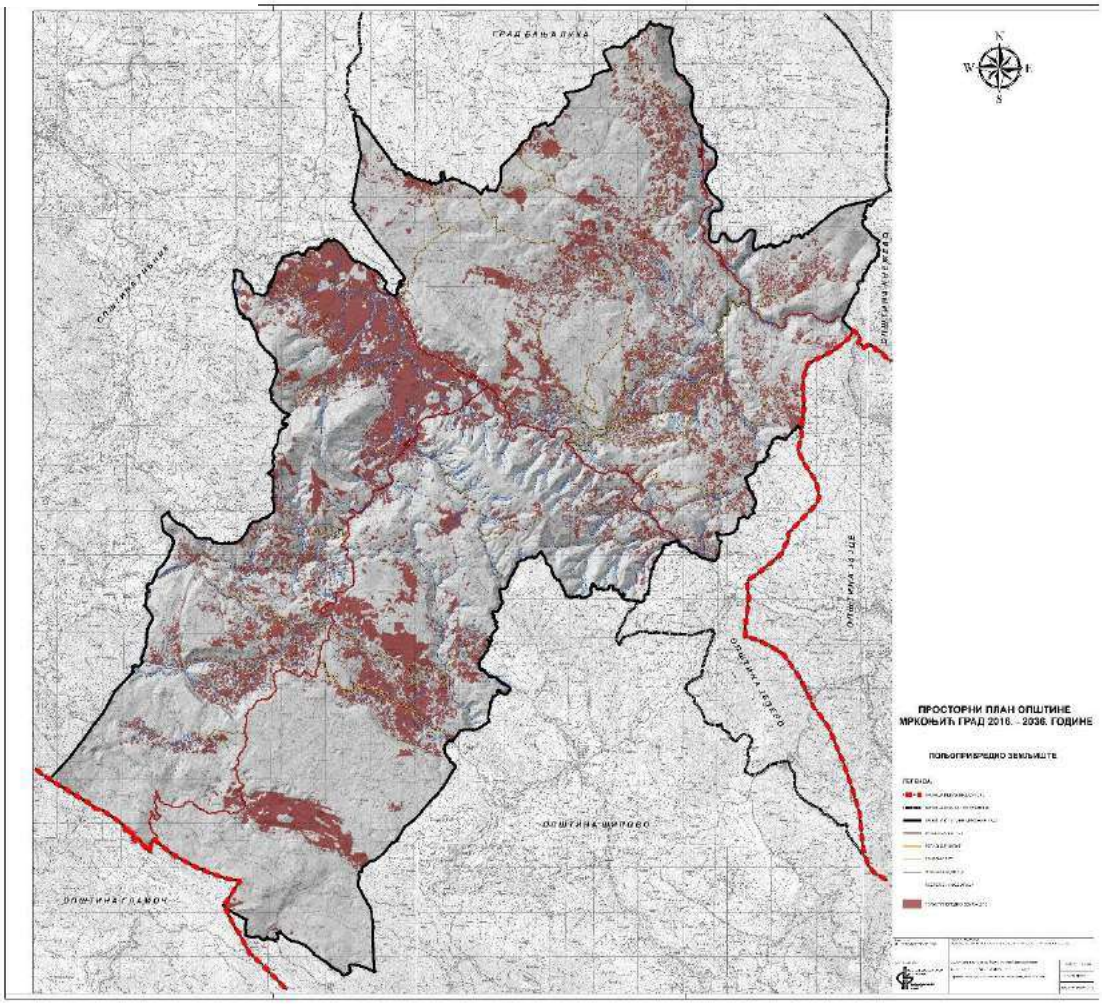


Source: Spatial Plan Sanski Most 2022-2042.

7

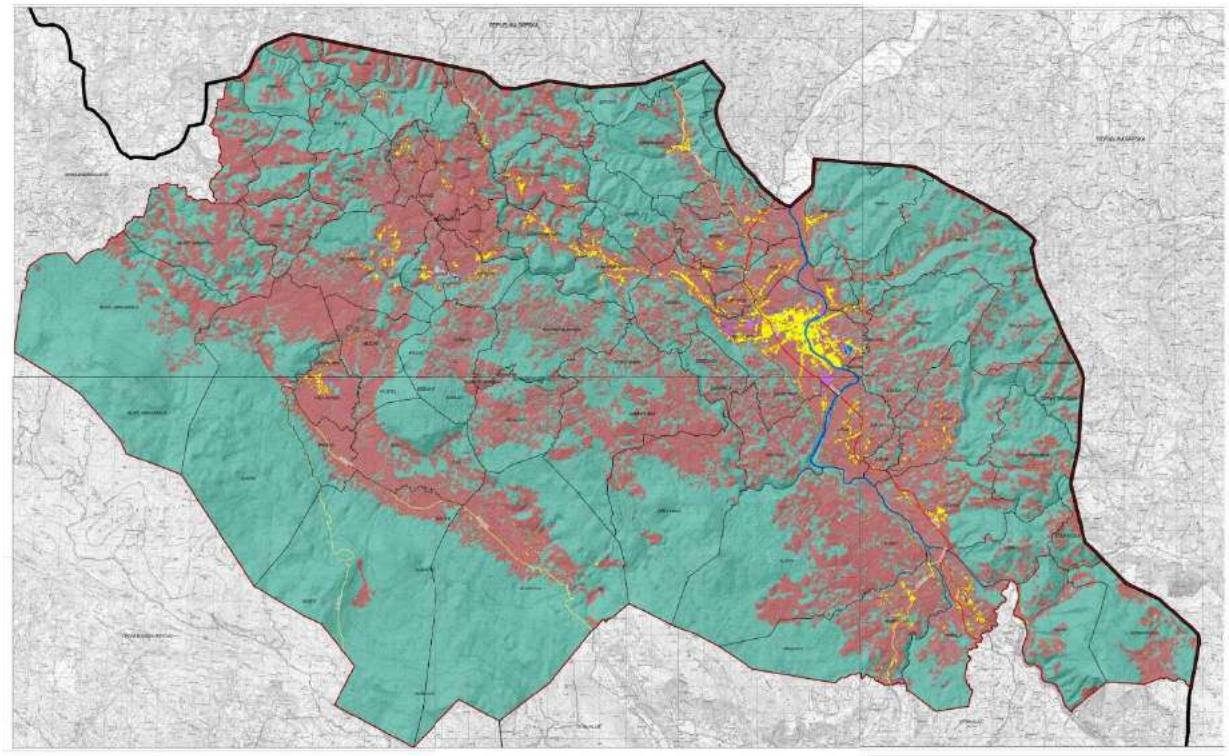
Agricultural maps

Mrkonjić Grad



Source: Spatial plan Mrkonjić Grad 2016-2036

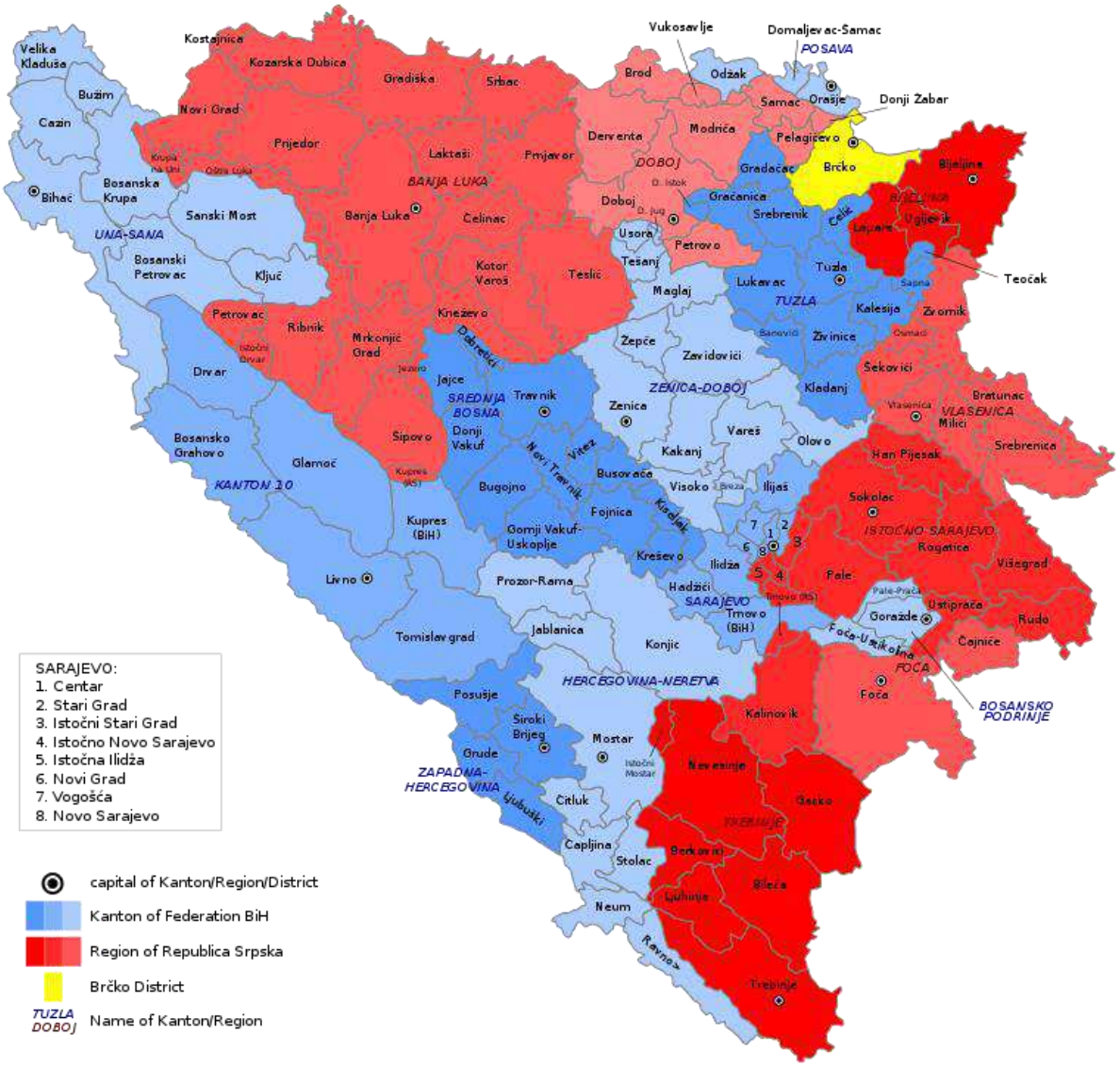
Sanski Most



Source: Spatial Plan Sanski Most 2022-2042.

ANNEXE 3: ADMINISTRATIVE ORGANIZATION

1 Municipalities of Bosnia and Herzegovina



Source: Wikipedia

2 Municipality departments

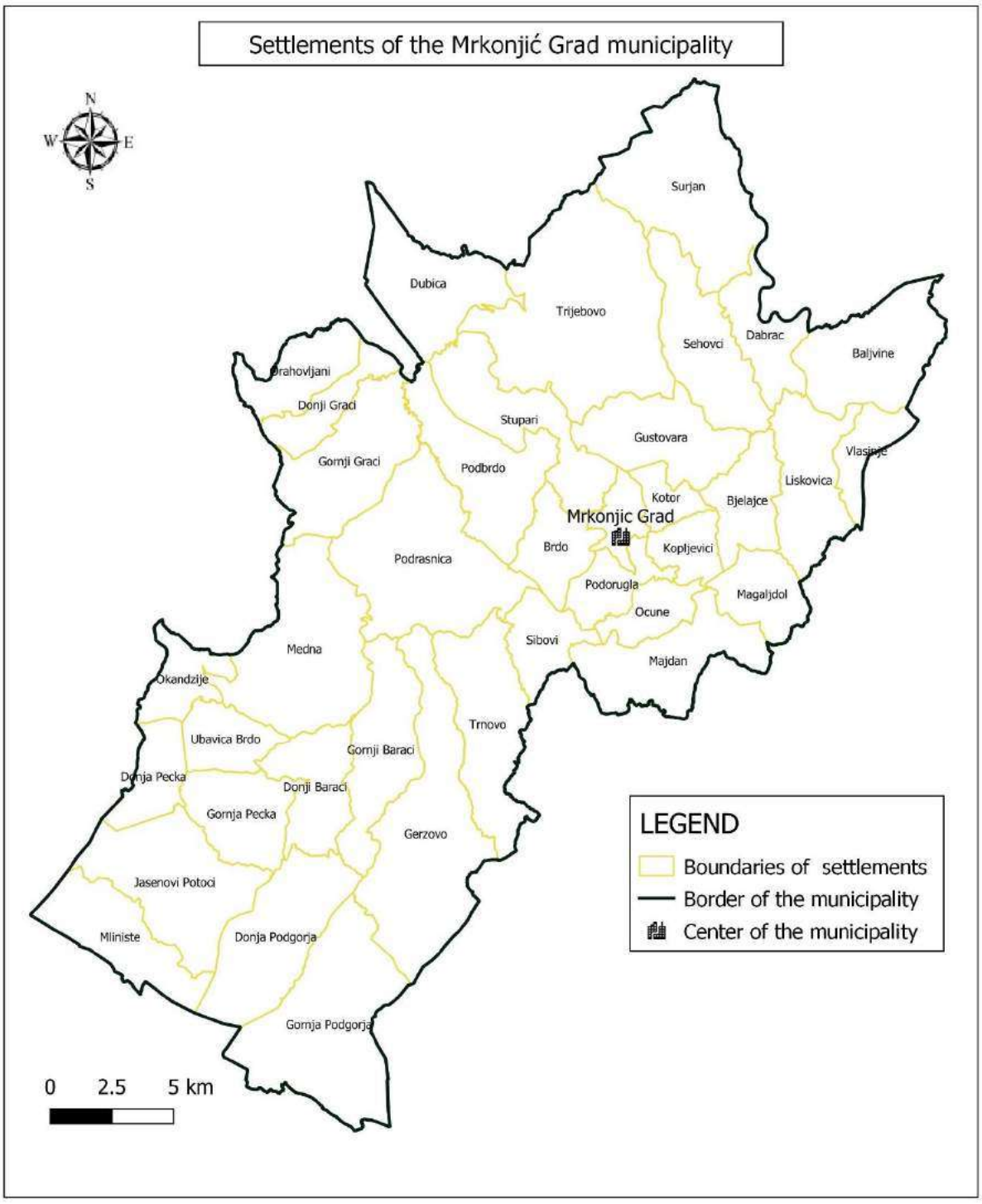
Mrkonjić Grad municipality structure:

1. Department of Economy and Finance
2. Department for General Administration and Social Activities
3. Department for Spatial Planning and Communal Affairs
4. Department for City Development and Property Management
5. Department for Inspection Affairs
6. Professional service of the Assembly and the Head of the Municipality

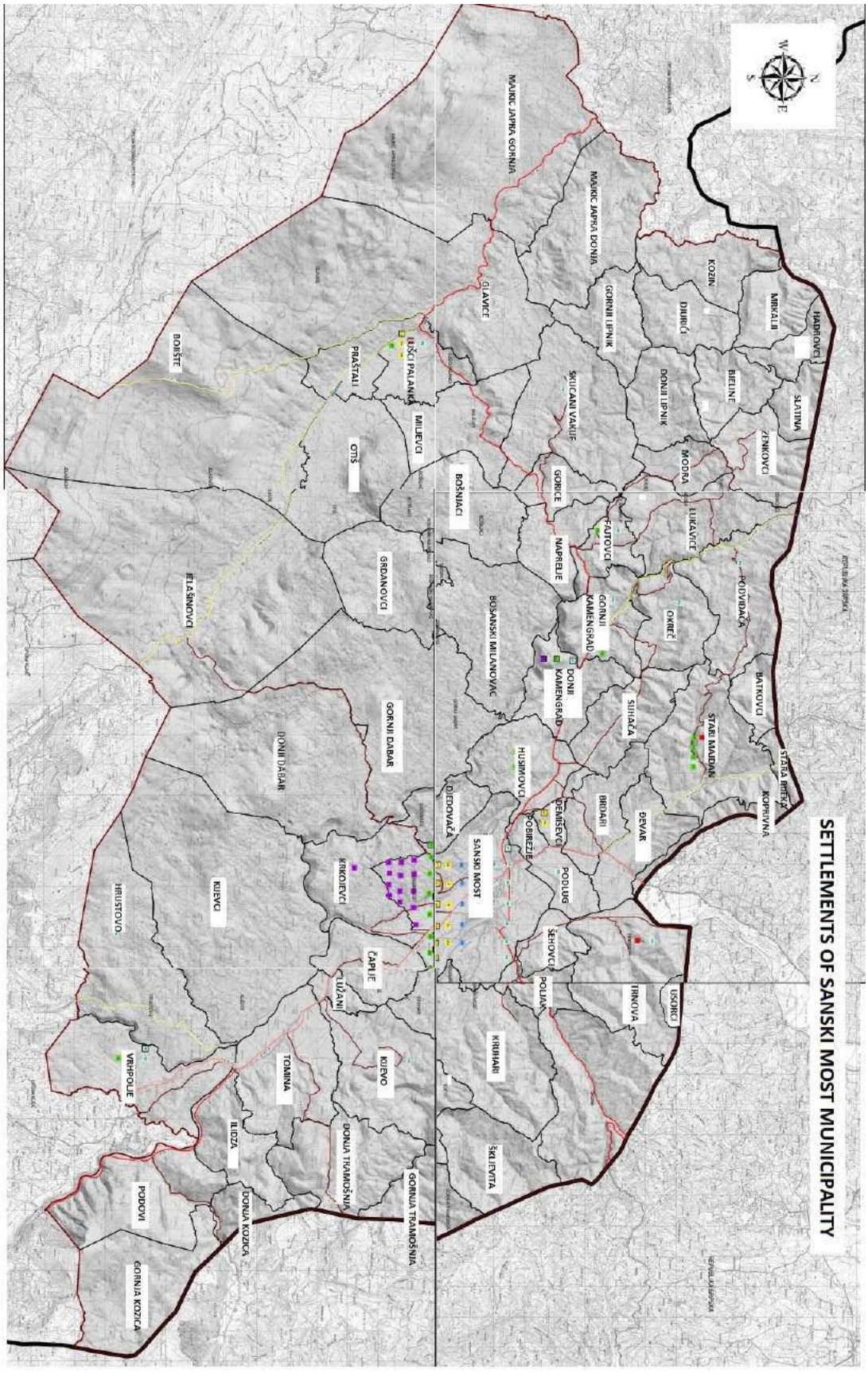
Sanski Most municipality structure :

1. Cabinet of the Municipal Mayor
2. Office for Finance, Treasury, and Joint Affairs
3. Professional Office for the Affairs of the Municipal Council
4. Civil Protection office
5. Office for Property-Legal, Geodetic Affairs, and Real Estate Cadaster
6. Office for Urban Planning, Spatial Planning, Construction, and Commercial and Residential Affairs
7. Office for Inspection Affairs
8. Office for General Administration and Social Activities
9. Office for Development, Entrepreneurship, and Resources

3 Municipality settlements



Source: Borka Malesević

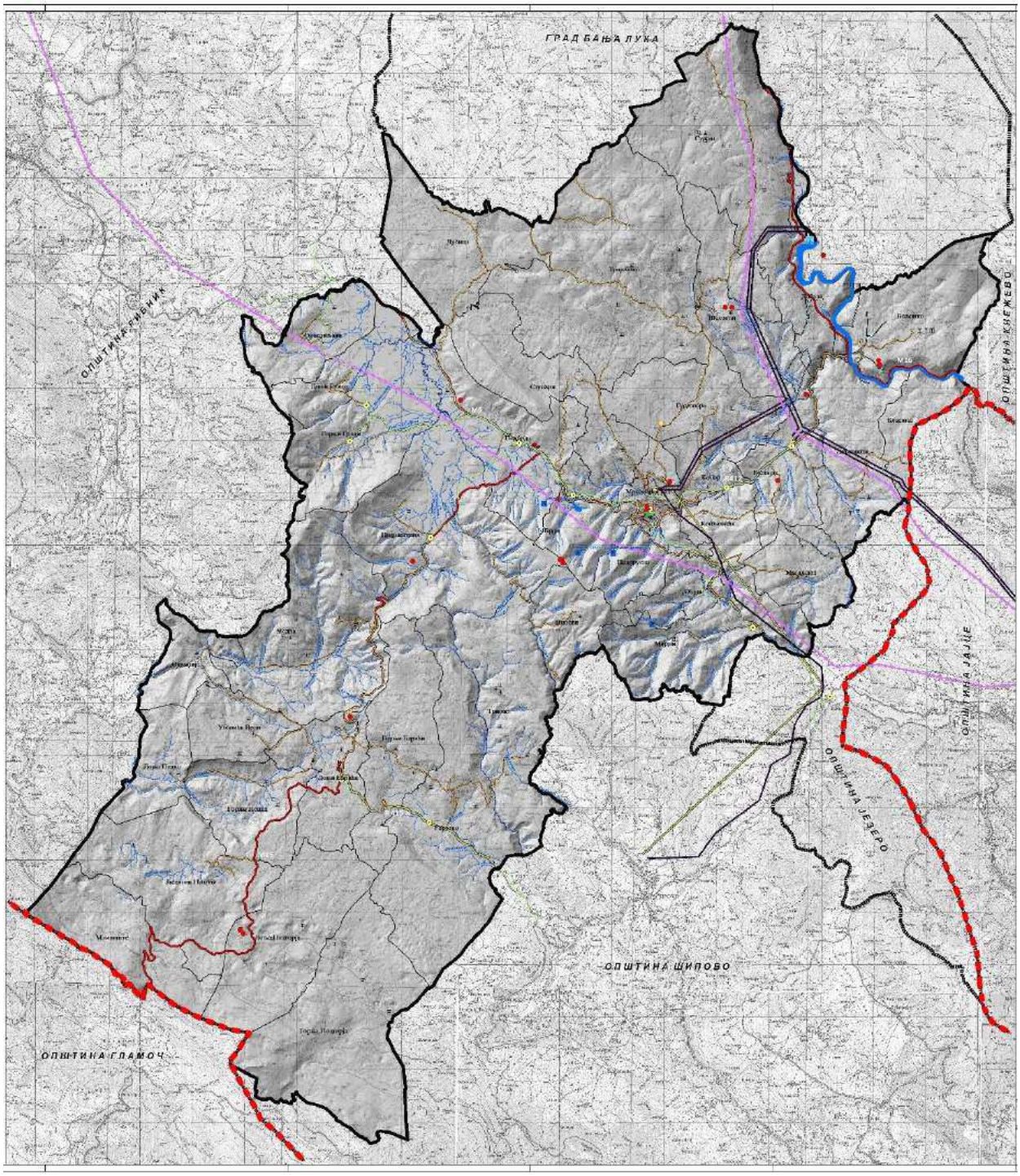


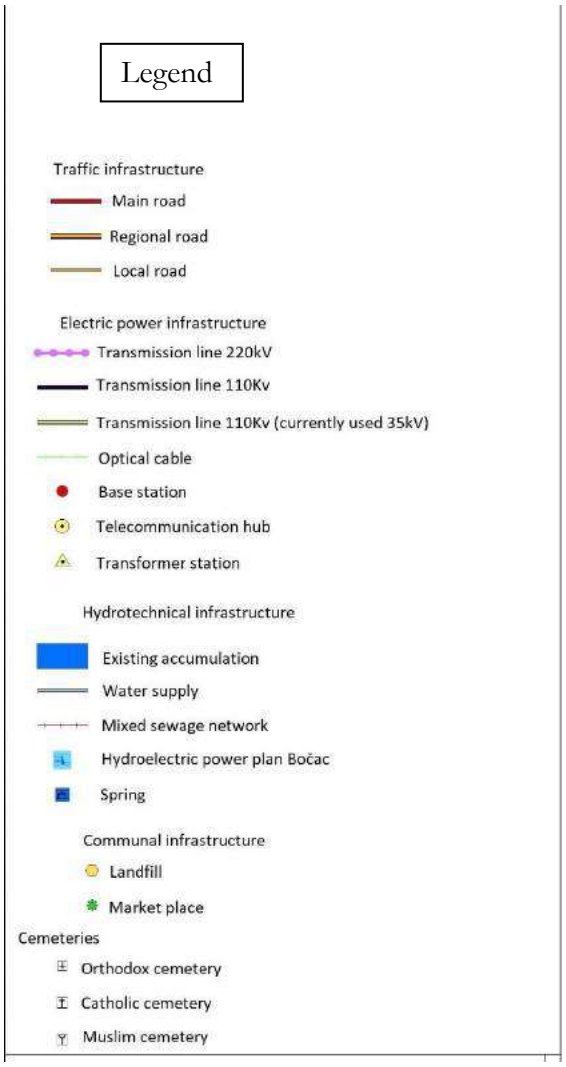
Source: Borka Malesević

ANNEXE 4: DEMOGRAPHY

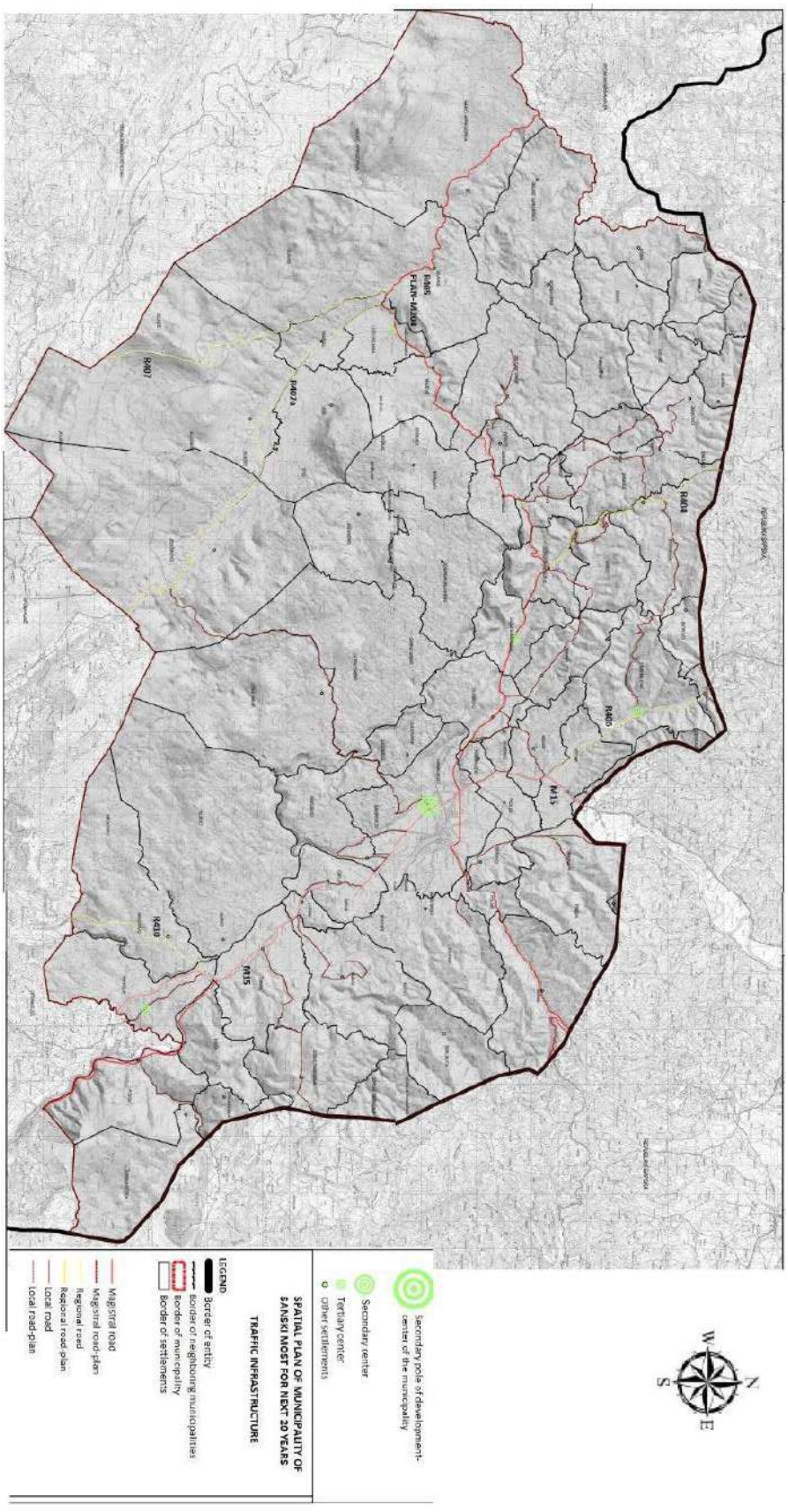
1 Infrastructure systems of the two municipalities

Mrkonjić Grad




Legend
Traffic infrastructure
Main road
Regional road
Local road
Electric power infrastructure
Transmission line 220kV
Transmission line 110Kv
Transmission line 110Kv (currently used 35kV)
Optical cable
Base station
Telecommunication hub
Transformer station
Hydrotechnical infrastructure
Existing accumulation
Water supply
Mixed sewage network
Hydroelectric power plan Bočac
Spring
Communal infrastructure
Landfill
Market place
Cemeteries
Orthodox cemetery
Catholic cemetery
Muslim cemetery

Sanski Most

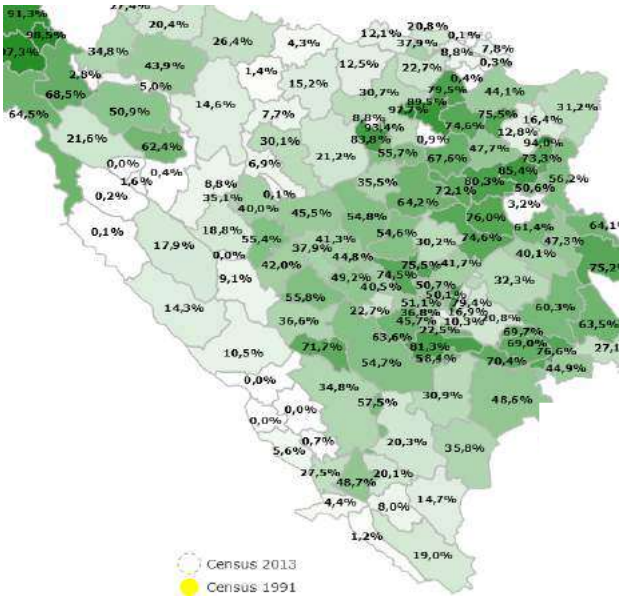


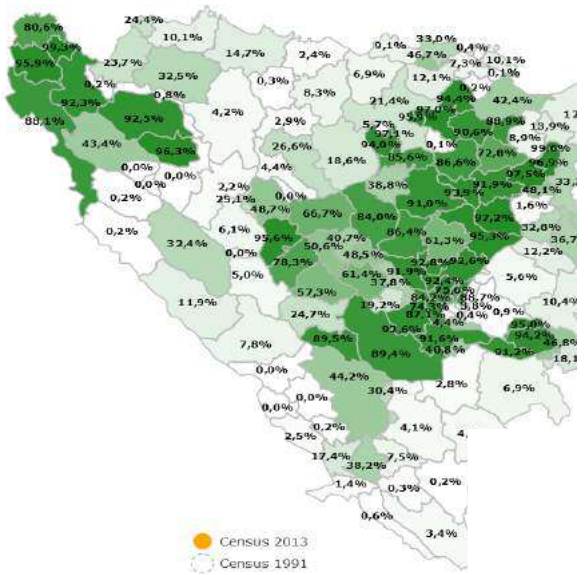
Source: Spatial plan Sanski Most 2022-2042

2

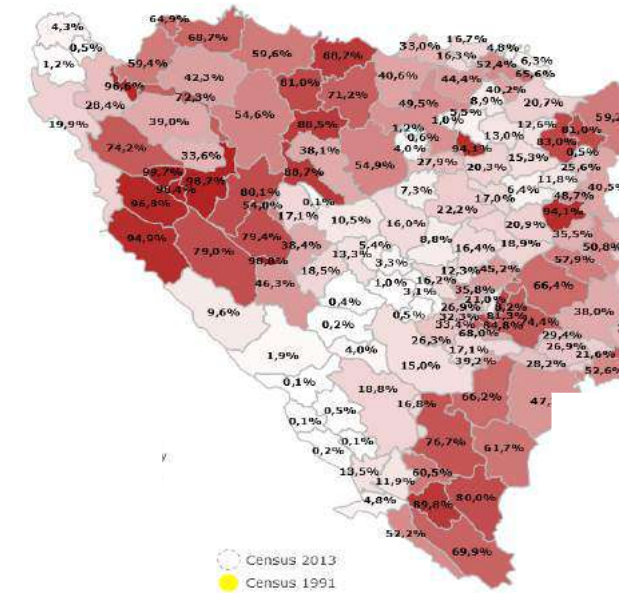
Changes in ethnic distribution after the civil war in 1992-1995 in Bosnia and Herzegovina

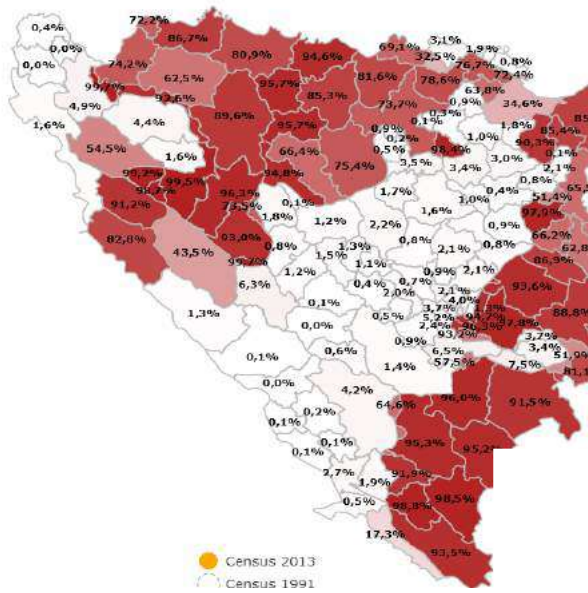
Bosniak population



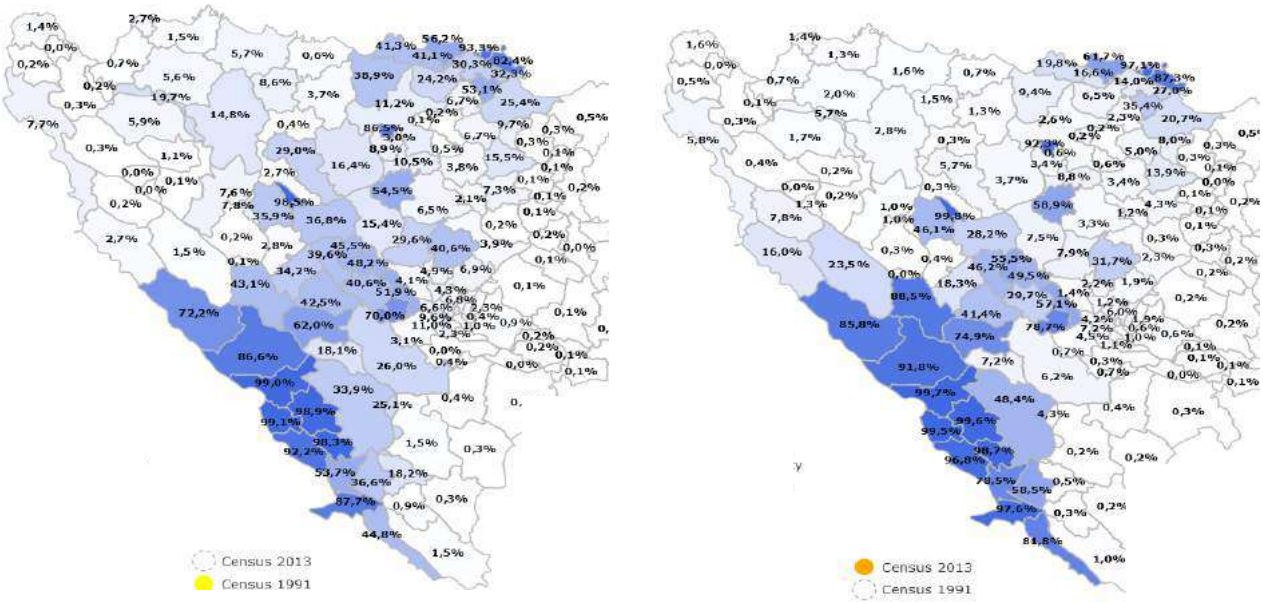


Serb population



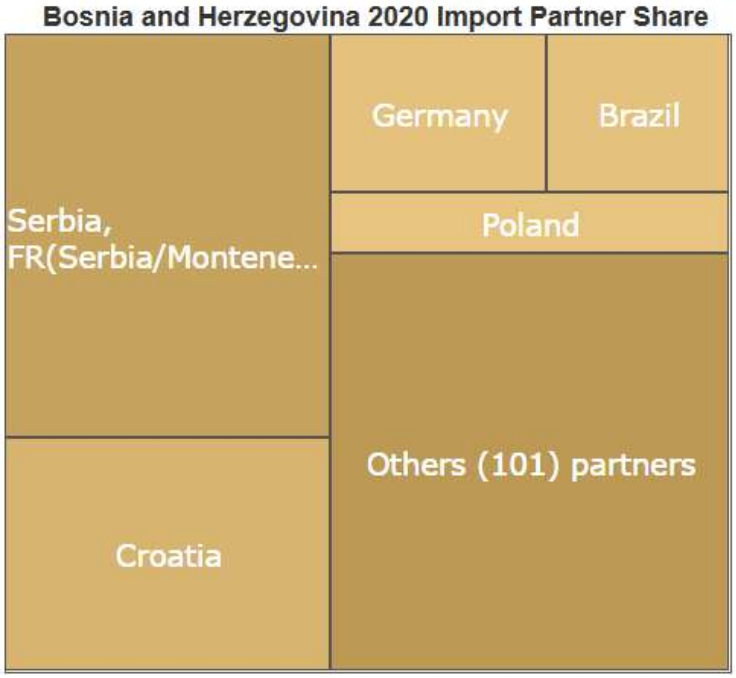


Croat population



Source : statistika.ba

3



Source: World Bank, 2022

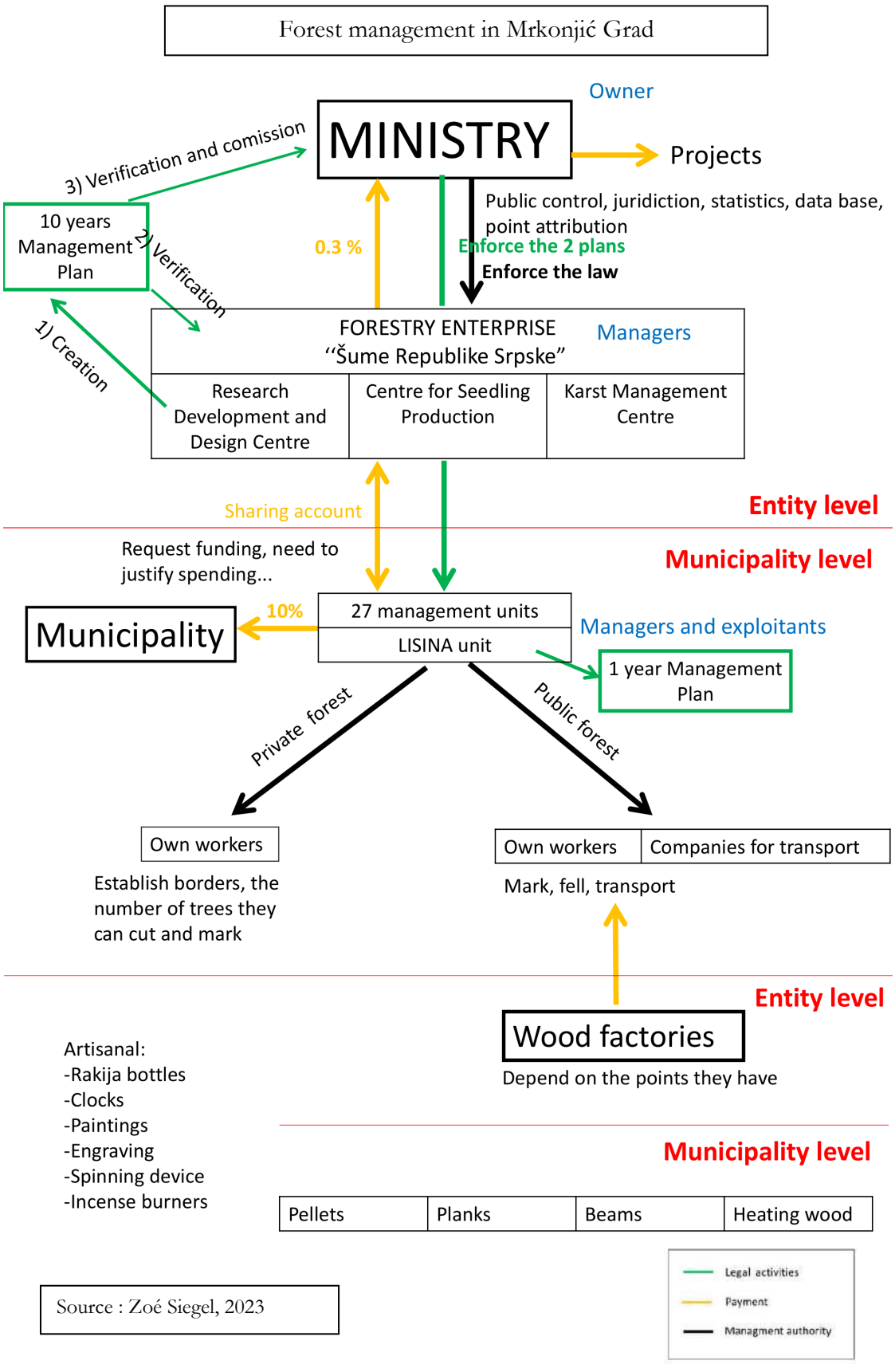
ANNEXE 5: FOREST MANAGEMENT

1

Managed area of the Sanski Most company

Source : Borka Malešević, 2023

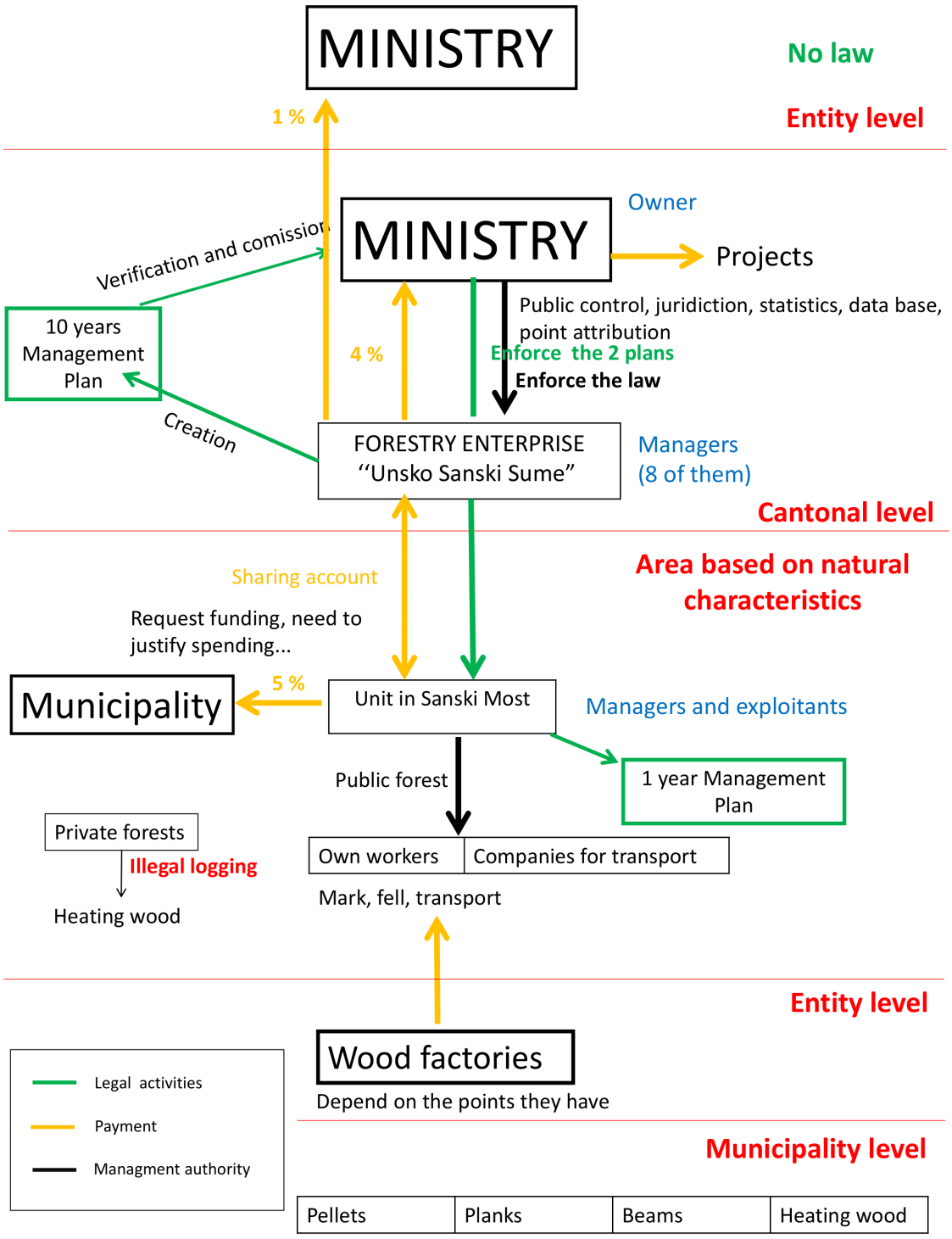
2



Source : Zoé Siegel, 2023

3

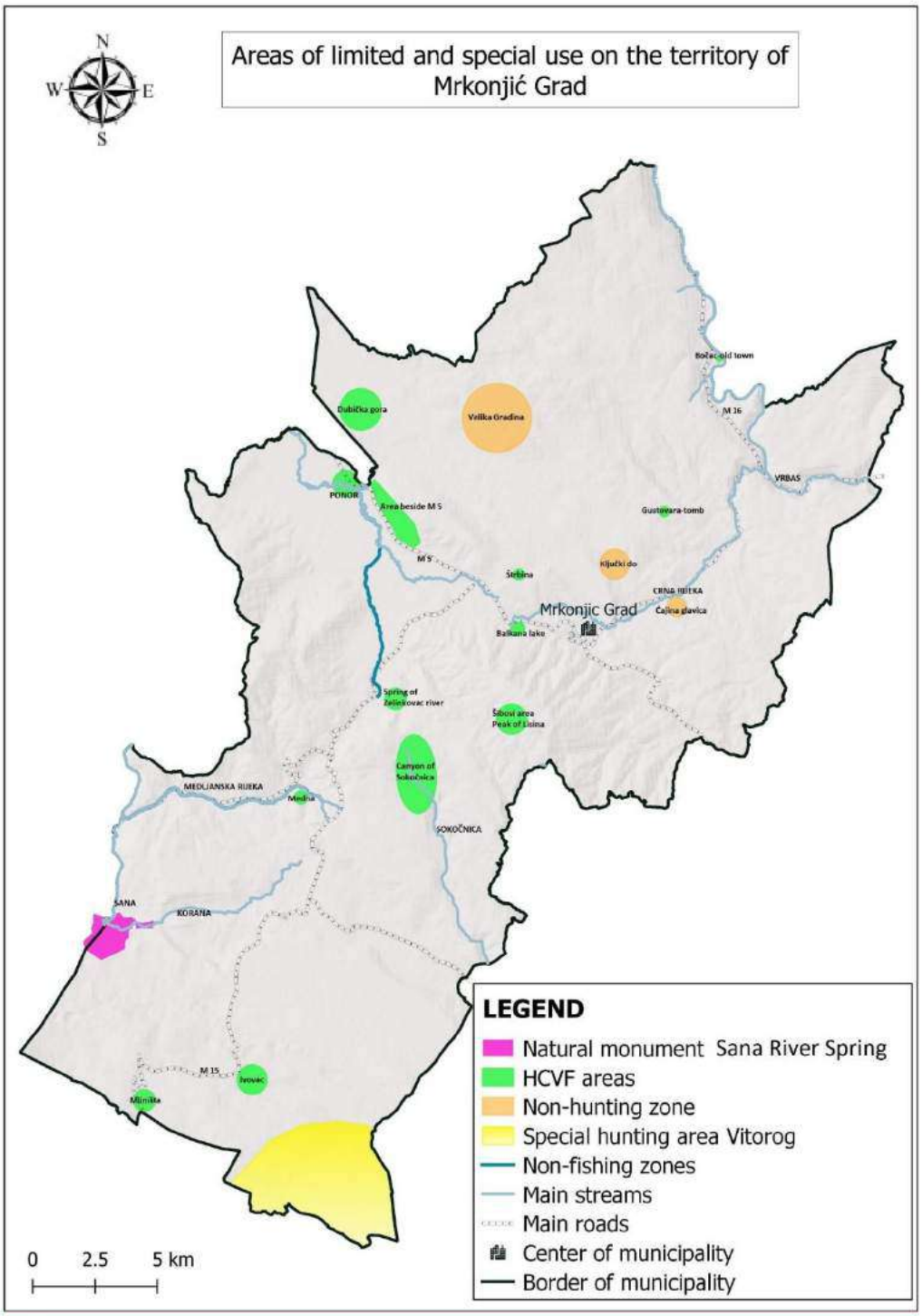
Scheme of forest management in Sanski Most



Source : Zoé Siegel, 2023

ANNEXE 6: PROTECTED AREAS AND BIODIVERSITY

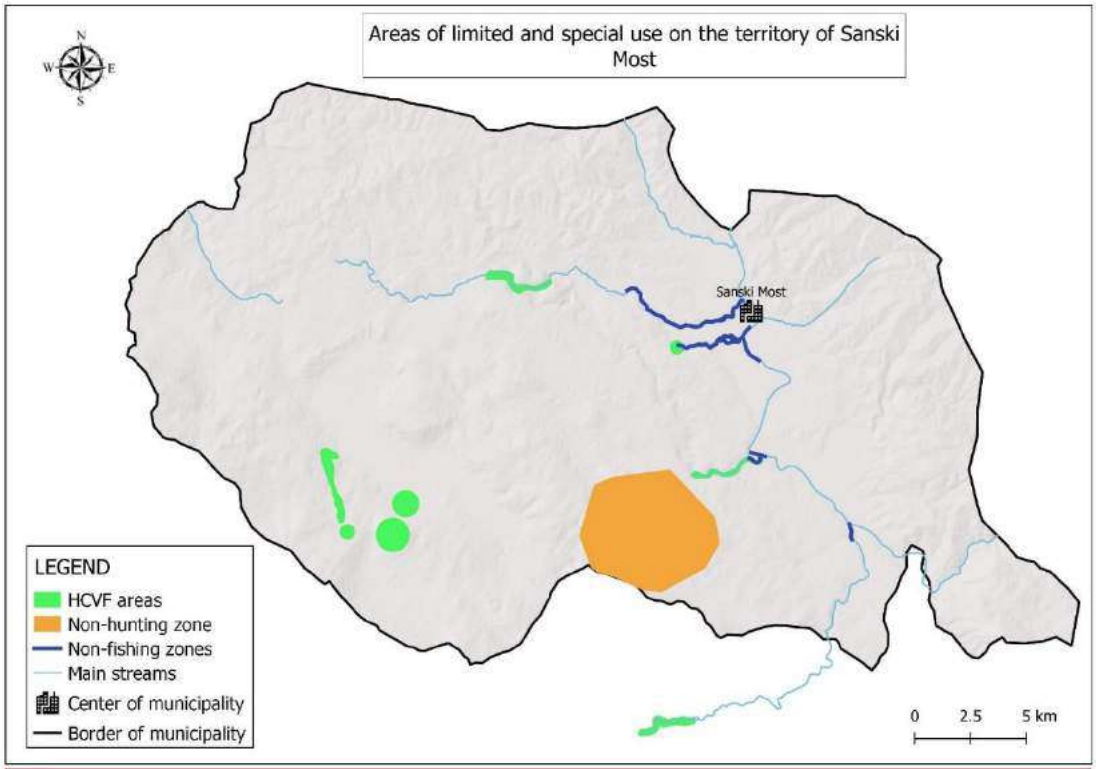
1



Note:
The shown elements are not true to the exact sizes and shapes due to lack of more detailed data, documents, etc. However we chose to present the observed structures visually to facilitate comprehension.

Source : Borka Malesević, 2023

2

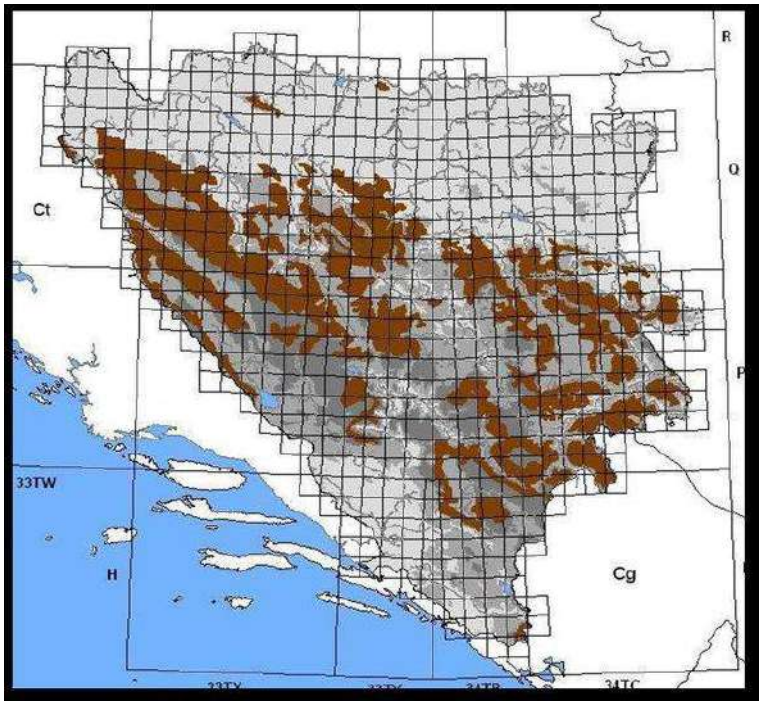


Note:
The shown elements are not true to the exact sizes and shapes due to lack of detailed data, documents, etc. However we chose to present the observed structures visually to facilitate comprehension

Source : Borka Malesević, 2023

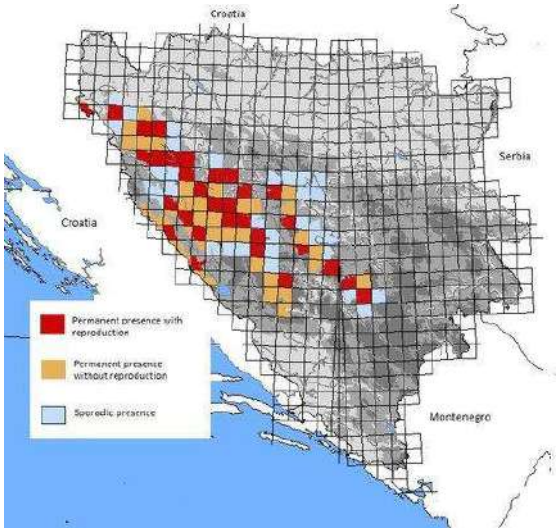
3	Distribution of large mammals in B&H

Brown bears



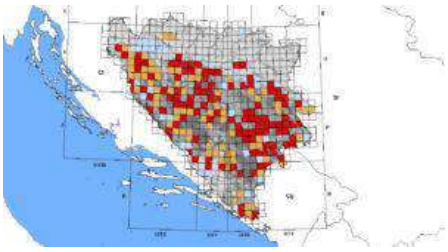
Source: Trbojevic, 2017

Lynxes



Source: Trbojevic, 2019

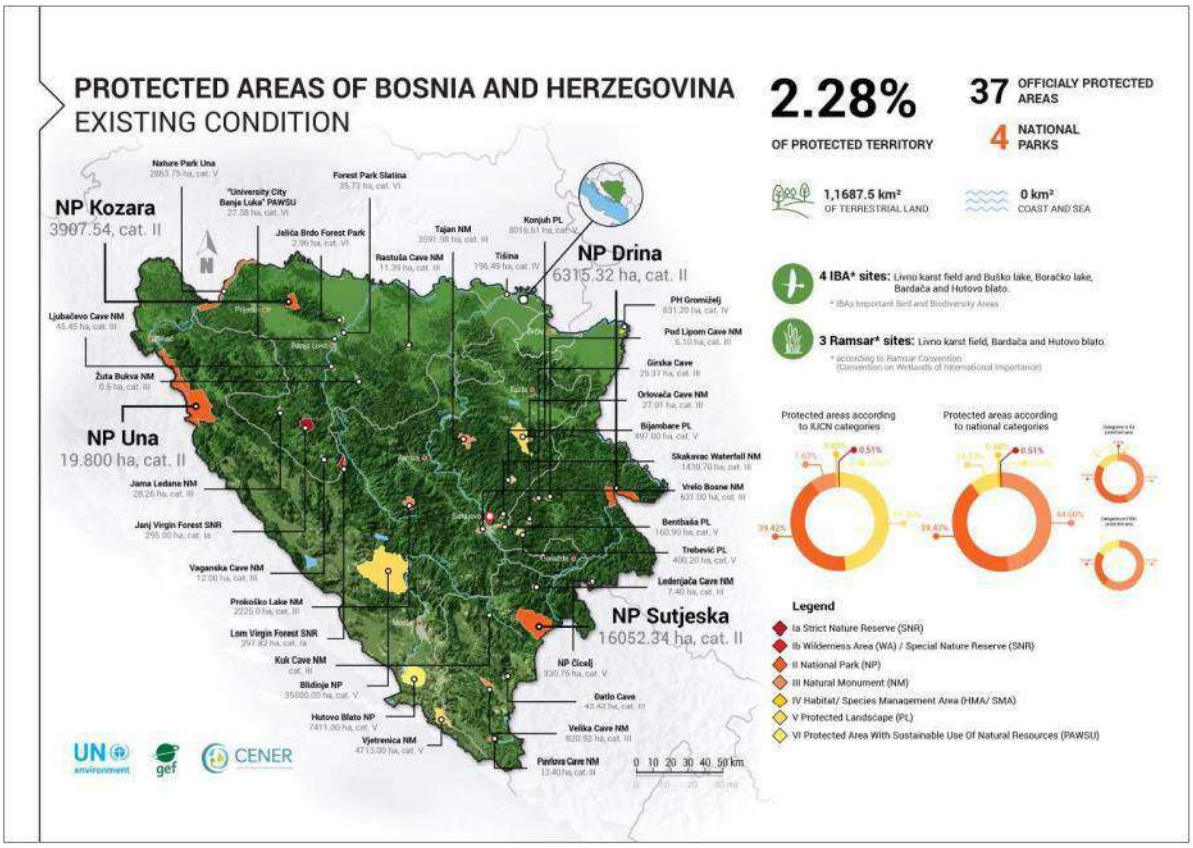
Wolves



Source: Trbojevic, 2017

PS: Better quality picture was not obtained

4	Protected areas in B&H



Source: USAID[16], 2020

This map was computed in 2020. It needs to be updated. More detailed and updated data are available in the following websites:

-In RS: http://e-priroda.rs.ba/en/protectedsites/

-In Federation of B&H: http://e-prirodafbih.ba/protectedsites/

[16] USAID: United States Agency - International Development

ANNEXE 7: LIST OF GRANTED CONCESSIONS FOR MINI-HYDROELECTRIC POWER PLANTS IN BOTH MUNICIPALITIES

MRKONJIĆ GRAD

- **On river Sana:**

Medna mini hydroelectric plant -built

Installed power 4.90MW

INVESTOR: Austrian group *Kelag* and Slovenian company Interenergo

Sana-Prizren mini hydropower plant with an installed capacity of 3,50 MW

- **On Medljanska Rijeka**

Medna-Sklop mini hydropower plant with an installed capacity of 0,89 MW

- **On Ponor river**

Ponor mini hydroelectric power plant with an installed capacity of 9,99 MW

- **On the Sokočnica river**

Sokočnica ini hydroelectric power plant with an installed capacity of 0,75 MW

Source: Report of the department for finance and economy of the Mrkonjić Grad municipality for 2016

SANSKI MOST

- **On Bliha river**

Kamengrad mini hydroelectric power plant with an installed capacity of 1,59 MW

Ljutovik mini hydroelectric power plant with an installed capacity of 1,04 MW

Skok mini hydroelectric power plant with an installed capacity of 1,36 MW

Skucani Vakuf mini hydroelectric power plant with an installed capacity of 0,05 MW

Sokočnica mini hydroelectric power plant with an installed capacity of 0,75 MW

Hatiraj mini hydroelectric power plant with an installed capacity of 1,44 MW

- **On Dabar river**

Dabar mini hydroelectric power plant with an installed capacity of 2,76 MW

- **On Kijevska rijeka**

Kijevska rijeka mini hydroelectric power plant with an installed capacity of 0,85 MW

- **On Sanica river**

Kljajići mini hydroelectric power plant with an installed capacity of 5,90 MW

Pećina mini hydroelectric power plant with an installed capacity of 0,58 MW

Saleševići mini hydroelectric power plant with an installed capacity of 3,34 MW

- **On Sana river**

Čaplje mini hydroelectric power plant with an installed capacity of 11,63 MW

Kamičak mini hydroelectric power plant with an installed capacity of 5,07 MW

Vrhpolje mini hydroelectric power plant with an installed capacity of 5,00 MW

- **On Sasina river**

Sasina 1 mini hydroelectric power plant with an installed capacity of 0,12 MW

Sasina 2 mini hydroelectric power plant with an installed capacity of 0,17MW

Sasina 3 mini hydroelectric power plant with an installed capacity of 0,45 MW

Source: https://voda.ekoakcija.org/bs/pregled