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DISSERTATION

SUSTAINABLE ARCHITECTURE OF FORTIFIED DWELLINGS IN THE BALKANS

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Sustainable architecture of fortified dwellings in the Balkans

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ABSTRACT

Kullas in the villages Western Kosovo, North Albania and South-East Montenegro represent typical examples of vernacular and traditional architecture of these countries, built on purpose of residing and protection from enemies of the time.

Because of their orientation, situation in the topographic terrain, natural building materials and techniques, natural ventilation, lighting and heating and architectural layout, these historic buildings may be considered as laboratories for sustainable vernacular architecture.

However, considering a lot of reasons, starting from political issues in the countries, improper treatments and lack of maintenance, these historic buildings tend to somehow be neglected, and the possibility to be conserved and adapted for the contemporary needs is not being considered by the owners and other relevant stakeholders.

This study will aim to explore and analyze the significance of Albanian kullas for their owners/ users, local communities and their context development. Moreover, it will analyze and prove the sustainability of these structures, built long time ago by craftsmen who at that time had in mind the concept of sustainable architecture. Finally, it will give options on preserving these structures and optimizing their thermal comfort, so that they are no longer seen as "museums frozen in time" but rather living heritage sites. The sustainable upgrade of these buildings could serve as replicated models for same building structures that lie in the cross-border territories of Kosovo, Albania and Montenegro.

Keywords: *kulla, thermal comfort, historic buildings, protection, upgrade*

KURZFASSUNG

Die Kullas in den Dörfern im Westkosovo, in Nordalbanien und im Südosten Montenegros sind typische Beispiele für die traditionelle Architektur dieser Länder, die zu Wohnzwecken und zum Schutz vor den Feinden der damaligen Zeit errichtet wurden.

Aufgrund ihrer Ausrichtung, ihrer Lage im topografischen Gelände, ihrer natürlichen Baumaterialien und -techniken, ihrer natürlichen Belüftung, Beleuchtung und Beheizung sowie ihrer architektonischen Gestaltung können diese historischen Gebäude als Laboratorien für nachhaltige volkstümliche Architektur betrachtet werden.

Allerdings, im Anbetracht vieler Gründe, angefangen bei politischen Fragen in den Ländern, unsachgemäßer Behandlung und mangelnder Instandhaltung, werden diese historischen Gebäude jedoch eher vernachlässigt, und die Möglichkeit, sie zu erhalten und an die heutigen Bedürfnisse anzupassen, wird von den Eigentümern und anderen relevanten Interessengruppen nicht in Betracht gezogen.

Ziel dieser Studie ist es, die Bedeutung der albanischen Kullas für ihre Besitzer/Nutzer, die lokalen Gemeinschaften und die Entwicklung ihres Umfelds zu untersuchen und zu analysieren. Darüber hinaus wird die Nachhaltigkeit dieser Bauwerke, die vor langer Zeit von Handwerkern errichtet wurden, die damals das Konzept der nachhaltigen Architektur im Sinn hatten, analysiert und nachgewiesen. Schließlich werden Optionen für den Erhalt dieser Strukturen und die Optimierung ihres thermischen Komforts aufgezeigt, damit sie nicht länger als "in der Zeit eingefrorene Museen", sondern als lebendiges Kulturerbe betrachtet werden. Die nachhaltige Aufwertung dieser Gebäude könnte als Modell für die gleichen Gebäudestrukturen in den grenzüberschreitenden Gebieten des Kosovo, Albaniens und Montenegros dienen.

Stichworte*: kulla, thermischer komfort, historische gebäude, schutz, modernisierung*

I dedicate this dissertation to my uncle, Dr. Bujar Bajçinovci, Professor of Architecture, who has always pushed me to pursue my doctorate studies, but unfortunately is not with us anymore to celebrate my biggest achievement.

ACKNOWLEDGEMENTS

This dissertation would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

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ABBREVIATIONS

ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers
CH	Cultural Heritage
CHwB Kosova	Cultural Heritage without Borders Kosova
CIBSE	The Chartered Institution of Building Services Engineers
E	East
EED	Energy Efficiency Directive
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Rating
IBO	Ökologisch BauenGesund Wohnen
ICOMOS	International Council on Monuments and Sites
IMEC	Interuniversity Microelectronics Centre
ISO	International Organization for Standardization
J	Joule
KEA	KEA European Affairs
KU Leuven	Katholieke Universiteit Leuven
kW	kilowatt
MCYS	Ministry of Culture, Youth and Sport
MJ	Megajoule
N	North
REHVA	Federation of European Heating, Ventilation and Air Conditioning Associations
RH	Relative Humidity
S	South
SI	International System of Units
UNESCO	The United Nations Educational, Scientific and Cultural Organization
W	West
WHS	World Heritage Site

GLOSSARY

Absolute air humidity [g/kg]- The relationship of the quantity of water vapour present to the quantity of air present. The absolute humidity of outdoor air varies depending on the climatic zone and the time of the year. Where the outdoor air is too dry or too moist, it must be humidified or dehumidified to create comfortable conditions.

Ahuri- barn, usually located in the ground floor of kulla

Baçicë- shepherd's wife, who took care of the milking of the cattle, specifically the preparation of dairy products.

Bejlerë- nobles, fiefs.

Bjeshkët e Nemuna- Cursed Mountains, is a national park in the districts of Gjakova and Peja in western Kosovo.

Çardak- porch of traditional houses.

Cerga e madhe- big side of oda.

Cerga e vogël- small side of oda.

Çiflig- çifllëk- Feudal properties.

Çifqinj- serfs.

Çikma- The protruding element, 20-100 cm in the facade of kulla and about 40 cm raised. This element is generally built into the door section (or in a position that favors the surveillance of the area as well as the protection of kulla. This element is (or isn't) placed on all sides of the wall and is constructed by carved stone tiles. In its front are placed two carved windows, whereas in various points are placed *frëngji*.

Çilima- traditional rugs.

Divanhane- In the last floor, there is a wide corridor (*divanhane*), that looks like a hall. Along the wall of *divanhane* is a platform with wide timber boards, in a height up to 1-1.5 m, which is used by family members during the summer to stay or sleep. In this height the walls are often extruded in the facade as a balcony. This part of *divanhane* is so called *dyshekllëk*, it has a dozen of small arched windows next to each other.

Dyshekllëk- Building element in the last floor, presented in various forms and materials. This element is usually found at the same level as the outer wall, either in one part of the façade or on the building's corner, or it can be extruded from the façade and placed either in one part of the façade or on the building's corner; it is usually built out of stones but also timber versions are present.

Fistar- tribe.

Frëngji- Small shooting holes in the perimetric walls of kulla in the form of turrets.

Furde or shiklla- Pine planks, used for covering the alpine roofs of kullas in North Albania and Plavë and Guci. These timber planks were mainly the "red" heart of the black rock pine cut only with an ax, 1 m long and 30-40cm wide.

Kanuni i Lekë Dukagjinit-The Code of Lekë Dukagjini is a very sophisticated and elaborate set of rules that governed parts of the northern Albanian territory as well as Western part of Kosovo. It used to be a customary code which was unwritten and subject to constant change as popular legal practice developed.

Krevet- Or shameshi as the Kelmendi area calls it, is a wooden architectural element, placed on the façade, that served as the main entrance to kulla when the ground floor was used as a barn. It was placed mainly on the front facade, but also on the side ones and had mainly a function of entering the building, but it also served as a storage place for food. Usually, krevet is encountered in one story, but seldom there are cases where it is found it two stories. The width reaches 1m-1.5m and is generally built entirely of wood, but in cases where stairs are exposed to rain, it is constructed by stones.

Kulla- Tower in English- the typical Albanian fortified stone house.

Mahalla- neighborhood.

Oda e burrave- The main room in every kulla- the gathering room of men, which is always located in the top floor. Only men of the family hang out in this room- women are never allowed- not even when men are not in the house.

Qilerë, qilarë- Two or more separate rooms, located in the same floor as the fire house. These are actually small bedrooms for married couples of these family members.

Relative air humidity [%]- The ratio of absolute humidity to saturation humidity. The saturation humidity depends on the air temperature, meaning that the relative air humidity is temperature- dependent. It is subject to fluctuations over the course of the day.

Rrafshi i Dukagjinit- Dukagjini Plain in the Western Kosovo.

Saç- traditional utensil used for making *fli* (traditional dish with dough and dairy).

Shilte- hassock, low mattress.

Shtëpia e Zjarrit- The fire house is located in the the first floor, respectively the middle floor, where all family life takes place, in the first phase was a one-area space where food was cooked, family members ate and slept.

Sofra- low- big round timber dining table.

Teliz- This architectural element circumscribes kullas (usually in its three sides) in the upper floor and is used as an outer space to connect the areas of this floor. This timber element extrudes in the façade about 90-120 cm and is supported by stiffeners embedded in the beams of the lower floor. It is used as an external covered corridor, but also as a storage for agricultural products or as a toilet.

Thermal bridge- A thermal weak point in the building skin. At the points where two components meet, at the corners of the building and where the building skin is interrupted, the insulation layer is reduced, leading to increased heat loss. Thermal bridges may be localised points, such as where a support penetrates the building skin, or extended lines, such as the building's external corners.

Ustabah- the main building master.

U-value [W/m^{2}K]- The value used to measure the passage of heat through a building component. The heat transfer coefficient or U-value quantifies the heat flow through a building component surface area of 1 m^2 where the temperature difference between inside and outside is 1 K. A component's U-value is determined by its constituent materials and their thermal conductivity, layer thicknesses and installation context. The smaller the U-value, the more effective the building component is in insulation terms.

1. INTRODUCTION

It's a common saying in the green building movement that "the greenest building is the one that isn't built". As much as this idea imparts the message of sustainable environment, people have historically constructed buildings by taking into account- sometimes seldomly- the advantages of green, respectively sustainable construction. Historic buildings teach us how they have achieved this "green mission" in an empiric road, and they still serve as living examples of this lesson. One of the main reasons is because historic buildings, specifically stone dwellings, are valued for the fact that they have resisted time and place, and are still active in terms of sheltering- accommodation, by being critical points of the modern life.

Meanwhile, millions of buildings already exist but are not being used to their full potential, despite their historic character and environmental and sustainable features. This implies that there is a tendency to abandon these resourceful assets also in terms of research and revisit; architects are oriented more in achieving energy efficiency by the use of new technologies, don't take into account the potential of historic fabrics towards architectural sustainability. By revisiting the stone architecture, not only in terms of structural, historical, cultural… meaning, but also in terms of researching the approach it takes towards reaching the thermal comfort, we will be more successful in terms of adaptive reuse of such buildings, nowadays and in the future.

The design, materials, type of construction, size, shape, site orientation, surrounding landscape and climate all play a role in how buildings perform. Historic building construction methods and materials often maximized natural sources of heating, lighting and ventilation to respond to local climatic conditions. Generally, this concept of architecture has always been valid, but as stated above, the methods for response to climatic conditions and context have changed, and it enables us to preserve and use historic buildings in a more sustainable approach.

Although quite a new topic in the field of cultural heritage, sustainability of historic buildings, specifically thermal comfort upgrade is being extensively researched throughout various integrated as well as individual projects. Moreover, developed countries have adopted directives, legislation, policies and technical guidelines and building regulations, for energy efficiency of historic building. In the name of these legislative requirements and research projects, a lot of historic buildings have been sustainably upgraded and their lifespan has been extended by complementing the actual needs of communities.

However, Western Balkans states, specifically Kosovo, Albania and Montenegro have no historic buildings legislative requirements towards sustainable upgrade or/and energy efficiency, no technical guidelines, nor there have been any extensive research projects in this field. Thus, no such project has been implemented in these regions so far. This leaves Albanian historic buildings in general, and fortified dwellings in specific, in a hostile environment for the everyday use of communities, especially for living purposes, taking into account that sustainability living needs are not being fulfilled.

1.1. THE BACKGROUND OF FORTIFIED DWELLINGS

Vernacular architecture witnessed today in Albanian rural and urban areas in the Balkans, dates back to the 18th-19th century. Although the traditional urban and rural houses of earlier centuries have been lost as a result of continuous historical unrests in the region, the surviving ones attest to the centuries-old way of life and building tradition in Albanian regions. While crafts and trade activities are commonly transposed in the urban housing typology, the rural houses reflect functions related to agriculture and farming. The rural house, on the other hand is represented through the typical Albanian fortified stone house called kulla ("tower" in English), traditionally erected in the western part of Kosovo, northern part of Albania and north-east of Montenegro.

Kullas in these three countries have suffered various types of degradations due to a dozen of socio-political and economic factors. However, a common issue that led to their negligence, is the fact that communities are less and less considering kullas as their primary space for living, as accordingly they don't fulfill their modern needs, and as such only low-income families "are stuck in kullas, in time and space". This is partially a result of institutional disregard towards this category of cultural heritage, which as a consequence has affected the community awareness about the significance of these assets. If we talk into more detail about the specifics of these three contexts, we can understand that kullas have been prey of destruction since their erection and continue to be even nowadays. Their destruction was mainly due to political situation and wars (the most recent Kosovo war of 1998-1999), uncontrolled buildings in their setting, lack of institutional protection, lack of owners' awareness, natural aging process and lack of maintenance.

Transformations, which resulted in loss of authenticity of kullas in the cross-border region, started first during the Ottoman period in the 19th century and is still one of the main reasons that contributes to their degradation even nowadays. With quite a different socio-political context, nowadays these transformations happen in the name of “the adaption of buildings to contemporary needs”, which have an adverse effect in their authenticity and integrity.

Finally, if we focus in the institutional protection and administration of this typology of cultural heritage, we can understand that regardless of their multiple values, only kullas in Kosovo (most of them) enjoy their designation status as monuments, whereas those in North Albania and the region of Plavë and Guci, are still not mapped, researched and protected by respective state institutions. Moreover, in terms of physical preservation, kullas in the cross-border region, have never been a focus for institutional investments as their tendency was always to invest in the geographic centers of the states.

All the above-mentioned reasons, some more and some less, have affected the condition of kullas, and have contributed to their current abandoned, neglected and degraded state. However, taking into consideration their regional significance and their potential to ascribe universal values, these resourceful assets are the utmost cultural heritage sites in the Western Balkan.

1.2. HYPOTHESIS, AIMS AND OBJECTIVES

Kullas in the villages of Dranoc, Valbona and Vuthaj represent main examples of vernacular architecture in Kosovo, Albania and Montenegro. These fortified dwellings have been built mainly for the same reasons and have more or less the same architectural features, with some differences due to their geographical position. Their actual condition suggests that kullas have preserved quite a lot their architectural and contextual authenticity and integrity.

This means that the Albanian kulla, as a typology in the cross-border region, has the ability to demonstrate the significance of shared regional stone dwellings, which can also be attributed the universal value. In this context, the study aims to address the sustainability component, which is the fundamental concern of these building, in order to continue to function in the future without jeopardizing the set of their multiple values, while also instilling in the awareness of communities, the desire and need to preserve them. More precisely, the thermal comfort of these buildings is specifically addressed for the objectives of this study, implying that this is the utmost component for meeting the needs for their sustainable upgrade, which would then directly impact the economic, social and cultural sustainability of these buildings.

The general objective of the thesis is to prove that these buildings are valuable not only in terms of historical and cultural significance, but they are also living examples of sustainable architecture. By proper conservation and adaption for the contemporary needs, they can serve as role models to develop their context for economic, environmental and touristic purposes. Drawing from the aforementioned statement, the hypothesis of this research is:

Fortified dwellings are significant assets for the up-growth of their wider context.

In order to verify the hypothesis, the following research questions have been formulated:

1. Can fortified dwellings in the Balkans be adapted for contemporary use, which in turn would enable the communication of their joint unique heritage value regionally and internationally?

2. Can kullas in Dranoc, Valbona and Vuthaj serve as smart role models for the region's vernacular architecture in terms of sustainable upgrade?

3. Can thermal comfort guide their future preservation and viability in terms of economic, environmental and touristic development?

Each research question is addressed with a corresponding part in this thesis. The answers to the first question are revealed in the first and second parts of the thesis, which give an overview about the history, emergence, architecture, values, current condition, transformations and initiatives towards preservations. Moreover, they point out the sustainability of historic buildings, and specifically the thermal comfort components, legislation, research and case studies implementation. The answers to the second question are revealed in the third part of the thesis, which reveals the thermal comfort results of data analysis in the Kulla of Isuf Mazrekaj in Dranoc, Kulla of Selimaj family in Valbona and Kulla of Deli Gjonbalaj in Vuthaj. The third question is answered in the last part of the thesis, which provides a technical guideline for thermal comfort upgrade of kullas in Kosovo, Albania and Montenegro.

In conclusion, the sustainable upgrade of kullas specifically, can directly and indirectly impact the up-growth of their wider context, not only architecturally but also environmentally, socially and culturally. The small kulla clustering upgrade, can be part of a wider development and promotion chain. This means that when these assets become livable and/or usable for lucrative purposes (i.e., bed and breakfast, slow food restaurants, etc.), they will retrieve the historic and cultural image of the villages they are situated to. This will be a starting point for the return of people who migrated and abandoned their birthplace, since they will have a place to live and work. Furthermore, this will be a strong foundation for cultural and natural tourism development, regionally (i.e., in Western Kosovo) but also cluster-based (in the whole cross-border region, with the main topic of Kullas). Another preservation, development and promotion strategy, which started with the Ilucidare Project (more on this, in the chapter below) is the serial world heritage nomination of kullas in Kosovo, Albania and Montenegro as either transnational or transboundary properties.

1.3. RESEARCH STRATEGY AND DATA COLLECTION METHODS

This research uses the interpretative-analytical and classification approach in order to combine an in depth understanding of the complexity of kullas in the Western Balkans. By using the primary and secondary research, the results of this thesis will attempt to verify the hypothesis. Case study comparative analysis, buildings survey and investigations and questionnaires are the meanings of primary research, whereas the secondary research is based on literature review.

I. Primary research:

- Case studies comparative analysis: Kulla of Isuf Mazrekaj in Dranoc, Kosovo, Kulla of Gjonbalaj family in the village of Vuthaj in Montenegro and Kulla of Selimaj family in Valbona valley in Albania;
- Survey of the existing condition of the buildings (measurements, building defects and pathology, history of conservation);
- Building-climate investigations (temperature and relative humidity) by putting data loggers in the three case studies kullas inside and outside, in order to get indoors and outdoors measurements. Data analysis were conducted by using excel personalized formulas.
- Sun study analysis of the wider context and the setting of case studies throughout all seasons, with google earth sun study tool, and ArchiCAD modelling by applying sun study.
- Questionnaires to owners/ users of these buildings regarding means of heating and ventilation, as well as history and interventions in their buildings.

II. Secondary research:

- Literature review of Albanian kullas, including history, architecture, legal protection, transformations, physical condition, threats, initiatives towards their preservation, intangible and natural values, etc. (Books, articles, papers, reports, archives, websites, municipal and governmental reports and plans, etc.);
- Literature review about sustainability of historic buildings in general, with a focus on thermal comfort (Books, articles, papers, reports, legislation, technical guidelines, building regulations, projects, websites, etc.);
- Analysis of three case studies in the UK- thermal comfort upgrade of historic stone houses.

III. To complement the primary and secondary research, the thesis has used the Capacity Buildings and final reports of the Ilucidare Project, developed during January- December 2021. ILUCIDARE is a European funded project which promotes heritage as a resource of innovation and international cooperation. The funding for this project derives from European Union's Horizon 2020 research and innovation programme. It is a 3-year project starting from February 2019, led by the University of Leuven, in partnership with Europa Nostra, KEA European Affairs, International Cultural Centre, World Monuments Fund Spain, Kosovo Foundation for Cultural Heritage without Borders Kosovo, University of Cuenca and IMEC. ILUCIDARE ambitions to establish an international network promoting heritage as a resource for innovation and in international cooperation through a diversity of collaborative activities. Within the scope of the program, Coaching sessions and Capacity building activities were held in Albania, Kosovo and Montenegro on the theme of the shared heritage of Kullas. From March to October 2021, some Capacity Building modules were held in Albania, Montenegro and Kosovo, touching upon 3 (three) main themes that serve one (1) end joint purpose, that is developing shared strategies for the re-use of Kullas and applying for cross national nomination for UNESCO enlisting of Kullas.

Note: The author of this thesis has been the Project Manager of CHwB Kosovo in the Ilucidare project. The activities held during 2021 has complemented the research of this thesis as much as the thesis research has complemented the Ilucidare activities. Throughout the project the author has managed all the activities and human resources, has delivered lectures, presentations, has designed the modules and agendas, and has drafted the structure of research reports by partners as well as revised the final products. The following activities have been developed during Ilucidare project, managed by the author:

1. Albania: "Tools for mapping Cultural and Natural Heritage", Online and onsite (Shkodra, Albania); "Mapping, Assessing and Valuing Kullas", onsite in the villages of Valbona and Dragobi, Albania. The goals of this capacity building were to create local capacities and joint tools for mapping of kullas in the cross-border area, Mapping of cultural heritage based on Core Data Index form and GIS and database for tangible, intangible and natural heritage. Throughout the first phase, trainers and 15 participants built a joint form for mapping the condition, tangible, intangible and natural values of kulla in Kosovo, Montenegro and Albania. The form was tested by mapping kullas in Shkodra in situ and was consequently revised. Under the supervision of the trainers (trained in the first phase) and by using the mapping form (developed in the first phase) 20 participants were trained to identify and evaluate Albanian vernacular constructions-kullas. From many kullas in this region, 70 of them located in the villages of Dragobi and Valbona, were identified and evaluated by the trainees. Their condition, background, values and much more information were collected and processed. Trainers from the partner organization in Albania have conducted an onsite and desktop research and have mapped and analyzed kullas in North Albania. An extensive report was elaborated. Trainers from the partner organization in Montenegro have conducted an onsite and desktop research and have mapped and analyzed kullas in the region of Plave and Gusi. An extensive report was elaborated.

2. Montenegro: "Consolidation and thermal comfort improvement of Kulla of Deli Sadri Gjonbalaj, Vuthaj, Montenegro" (Online and onsite). The 100 - year-old Kulla of Deli Sadri Gjonbalaj, located in the picturesque village of Vuthaj in Montenegro underwent consolidation and thermal comfort improvement works. For two weeks, 3 experienced craftsmen from Kosovo, taught the local workers from Montenegro on the restoration materials and techniques of historic buildings by practical work "in situ". The intervention project was drafted by professors and experts from the Danube University of Krems and IBO Association in Vienna, in collaboration with the author- Project Manager of CHwB Kosovo and NGO Labeatët from Montenegro. This is the first example of a restoration project implemented in this region.

3. Kosovo: Documenting intangible values of Kulla (Online) Ilucidare Conference: "Beyond walls and beliefs- Përtej murit dhe bindjeve", (Onsite- Peja, Kosovo). This training has gathered about 15 professionals of the field of cultural heritage, anthropology, ethnology and related fields, coming from Kosovo, Albania and Montenegro, who together discussed and analyzed the methods of mapping intangible values of Kulla. The training has also offered a series of practice case studies of intangible values mapping in the world. The final activity of all capacity buildings was the Ilucidare Conference: "Beyond walls and beliefs- Përtej murit dhe bindjeve", which was held in Peja, Kosovo. This two-day conference revealed the findings, in terms of mapping intangible and tangible values of kullas- as joint resourceful assets of the three countries. The conference gathered about 20 professionals and institutional representatives of the field of cultural heritage, who together drafted an action plan on how to best preserve this authentic shared heritage. Finally, the main aim of the conference was to develop shared strategies for applying for cross national nomination for UNESCO enlisting of Kullas.

Note: During the Ilucidare project, the author was invited to deliver lectures about cultural heritage, specifically kullas to the KU Leuven Master students. Moreover, she was part of evaluating their assignments. In addition to that, the author acted as a co-promoter and external evaluator to one of the KU Leuven master students- Ragini Karmarkar, on her thesis "A Feasibility Study for a Serial World Heritage Nomination of Kulla in Western Balkans (Kosovo, Albania, Montenegro)".

IV. Synthesis [results]

Data analysis: The primary and secondary research data were analyzed, using various strategies (such as sun study analysis of the context with google earth, sun study analysis of the setting with Archicad, temperature and relative humidity of the context taken online, indoor and outdoor temperature and relative humidity of the buildings by using the data loggers, building defects analysis by onsite surveying, and heating and ventilation by questionnaires conducted to owners). Data from the case studies were analyzed using same methods, in order to get comparative results.

Guidelines: The final result of the thesis is the synthesis of all data results, by providing technical guidelines on thermal comfort upgrade of kullas in Kosovo, Albania and Montenegro. Moreover, the final part will provide conclusions to the research as well as anticipate further work on the topic.

1.4. STATUS OF KNOWLEDGE ON THE TOPIC

Until after the Second World War, research about Albanian cultural heritage in general, and kulla as vernacular heritage in specific, was a seldom interest point of Albanian researchers. There were some analysis and research about kullas from foreign authors, and although they enrich this research field quite a lot, they cannot be considered as a whole, or competent, as they treat the subject only in a fragmented methodology. However, there are extensive recent research about kullas (after 2000) especially about kullas in Kosovo and Montenegro, but not about those in Montenegro, specifically in the region of Plavë and Guci. No matter the information these books, articles, reports or papers give, the mapping of the actual condition of these vernacular-built heritage site is still lacking. A recent project, so called Ilucidare, aimed at extending the research on kullas in Kosovo, Albania and Montenegro, specifically by mapping the actual condition of these building as well as documenting the intangible and natural values. The project and its results are described in the following parts of the dissertation. However, kulla, as a shared Albanian heritage needs to be further studied, in terms of field mapping and research (especially in the region of Plave and Guci, but also North Albania), and its story shall be complemented by more detailed research in its intangible values and oral history.

On the other hand, although quite a new topic in the field of cultural heritage, sustainability of historic buildings, specifically thermal comfort upgrade is being extensively researched throughout various integrated as well as individual projects. Moreover, developed countries have adopted directives, legislation, policies and technical guidelines and building regulations, for energy efficiency of historic building. In the name of these legislative requirements and research projects, a lot of historic buildings have been sustainably upgraded and their lifespan has been extended by complementing the actual needs of communities.

However, Western Balkans states, specifically Kosovo, Albania and Montenegro have no historic buildings legislative requirements towards sustainable upgrade or/and energy efficiency, no technical guidelines, nor there have been any extensive research projects in this field. Thus, no such project has been implemented in these regions so far. This leaves Albanian historic buildings in general, and fortified dwellings in specific, in a hostile environment for the everyday use of communities, especially for living purposes, taking into account that sustainability living needs are not being fulfilled.

1.5. LITERATURE REVIEW DISCUSSION

Kulla as a dwelling and as a fortification was subject of research to various travelogues, who analyzed the architecture and archeological traces of Albanian cultural heritage. Worth mentioning are the Austrian archeologists C.Praschniker and A.Schober in their book "Archäologische Forschungen in Albanien und Montenegro", 1919, Vienna. Illyrian fortifications are also analyzed by the archaeologist E. Čerškov, in his book "Rimljani na Kosovu i Metohiji", Beograd, 1969. Illyrian settlements are also discussed in the 1977 English translation of the book by the Croatian archaeologist A. Stipčević "*The Illyrians: history and culture"*. The Illyrian architecture and history was also in the focus of various authors, such as by the Albanian Humanist Marin Barleti, in the book *"Historia e Skënderbeut"* 1967, Tirana (An Albanian translation from the original Latin book by Marin Barleti *"Historia de vita et gestis Scanderbegi Epirotarvm principis"*, published in 1504 in Venice). Similar descriptions are also given by the Turkish travelogue E. Çelebi, as stated in the book *"Shqipnija para dy shekujsh"*, Tirana, 1930 (An Albanian partial translation from the original Turkish book of *Evliyā Çelebi's "Seyāhatnāmesi*") and "*Putopis, odlomci o Jugoslovenskim zemljama*", Sarajevo, 1967 (A Croatian partial translation from the original Turkish book of Evliyā Çelebi's *"Seyāhatnāmesi*"). Çelebi gives information about the urbanism-architecture of Albanian cities, and also provides details about building materials and courtyard formation.

In the 19th century the following authors and travelogues analyze and describe the cultural heritage, focusing in the geographical and historical point of view: L. Heuzey and H. Daumet in *"Mission archéologique de Macédoine"*, Paris 1876; L. Heuzey in "*Les opérations militaires de Jules César: étudiées sur les terrain par la mission de Macédoine*", Paris 1886; J.G. von Hahn in *"Albanesische Studien",* Vienna, 1853, etc.

In early 20th century, the Italian archaeologist L.M.Ugolini, the Austrian archaeologist and historian C. Patsch, etc. in their research expeditions have delt with Albanian architecture and art.

Austrian-Hungarian scholars, such as F.Nopcsa, Th.Ippen and others, have been well acquainted with the Albanian history and culture. From this group it is especially worth distinguishing J.G. von Hahn and his book *"Albanesische Studien",* which, as stated by himself in the preface of the book, "is not the result of fantasy and short journey, but is the result of studies and research of several years". We should not forget the fact that J.G. von Hahn was, for 19 uninterrupted years, consul in the east, and during 40s of the XIX century he was consul in Ioannina and Preveza, so it was possible to get to know closely the Albanian people and culture. In addition, the stories of Th. Ippen are very important for the enlightenment of the circumstances of that time, and of special importance are the stories about Shkodra. In 1884, he was assigned to the Austro-Hungarian consulate in Shkodra, where he was promoted to vice-consul in 1887. He was named consul at Shkodra in 1895.

It is important to mention the Hungarian geographer and ethnologist Adolf Strauss, who quite strongly criticizes some authors who tendentiously presented the Albanian reality. Alike is the opinion of G.B. Pellegrini, K.J. Jirecek and Ludwig von Thallóczy, who with numerous studies enrich the knowledge on our history. Everyone agrees that the cities in these provinces during the XIII-XIV centuries had reached a high level of development.

The following foreign writers wrote about Albanian vernacular dwellings. H.F. Tozer in *"Researches in the Highlands of Turkey; Including Visits to Mounts Ida, Athos, Olympus, and Pelion, to the Mirdite Albanians, and Other Remote Tribes. With notes on the ballads, tales, and classical superstitions of the modern Greeks*", London, 1869. H.F. Tozer also mentions kullas and their architectural layout. Furthermore, A. Boué in "*La Turquie d'Europe*", Paris, 1840; K.Steinmetz in "*Eine Reise durch die Hochländergaue Oberalbaniens*", 1904, Vienna, Leipzig. On the other hand, Kulla, as Albanian vernacular heritage was a focus in the following writings by the foreign authors: F.Nopcsa in "*Albanien: Bauten, Trachten und Geräte Nordalbaniens*", Berlin, Leipzig, 1925; A. Haberlandt in "*Kulturwissenschaftliche Beiträge zur Volkskunde von Montenegro, Albanien und Serbien. Ergebnisse einer Forschungsreise in den von den k. u. k. Truppen besetzten Gebieten*", Vienna, 1917; A. Degrand in "*Souvenirs de la Haute-Albanie*", Paris, 1901; Th.Ippen in "*Die Gebirge des nordwestlichen Albaniens*", Vienna, 1908, etc. F.Nopcsa and Th.Ippen, among other information, describe the rise and distribution of kullas. Going into more details, F.Nopcsa also provides information about the functioning of the areas inside kullas.

The Serbian translation of 1923 K. Jirecek's book "*Istorija Srba"*, Beograd, gives an overview about the rise of kulla. In addition, the Russian consul in Prizren, Ivan Jastrebov, wrote about the Dukagjini Plain that: *"there is no family without a two or three story kulla"* in "*Stara Srbija i Albanija"*, 1904, Beograd.

In terms of vernacular architecture in general and kulla in specific, there are a large number of studies by authors of new generations. The studies of the following authors should be especially mentioned: Z. Shkodra, A. Meksi, A. Baçe, E. Riza, P. Thomo, L. Mile, A. Muka, B. Strazimiri, B. Samimi, Sh. Prifti, then, M. Krasniqi, F. Drançolli, J. Drançolli, F.Doli, E. Riza, Z. Cana, M. Carabregu, A Beqiri, E. Dukagjini, Gj. Karaiskaj, H. Statovci, K. Halimi, J. Ivančić, A. Lainovic, M. Lutovac, S. Tomoski, J. Krunic and others.

This dissertation has mainly used the following Albanian sources about Kullas: M. Krasniqi "*Gjurmë e Gjurmime*", 1979, Prishtinë, who describes the Kullas in the Dukagjini Region, from the cultural and architectural point of view, starting from their erection, influece, distribution, architecture and function. Apart from kullas in the Dukagjini region, M.Krasniqi also mentions kullas in North Albania and Plavë and Guci. Somewhat similar writing about kulla, but in a more extent way in terms of architecture, and specifically the building typology is also given by Agush Beqiri in *"Arkitektura popullore: Enterieri dhe Eksterieri"*, Prishtina, 2022- A monography of the deceased architect, a professor at the Faculty of Art, which is in the process of being published by F.Jerliu, professor at the Faculty of Architecture, University of Prishtina. Among other information, the typology of kullas is well described in the book of F. Doli *"Arkitektura Vernakulare e Kosovës"*, 2009, Prishtinë. Moreover, the book of F. Drançolli *"Kulla shqiptare*", 2001, Prishtina, gives us another overview of the typology of kullas, briefly mentions the sustainability of these dwellings and extensively describes the transformation and degradation of these buildings. Sustainability of kullas is also mentioned by Emin Riza *"Qyteti dhe banesa shqiptare shek. XV- XIX*", 2009, Tirana.

During the literature review, it was encountered that only few sources mention kullas in the region of Plavë and Guci. Worth mentioning are the books of Halil R. Markišić, "*Kulturne vrijednosti Plav" and* "*Islamska Epigrafika u Plavu i Gusinju",* Rožaje *2016,* Rožaje, which give a brief description about kullas in these areas.
In terms of the intangible values of kullas, specifically in the social and economic way of living, Berit Becker, provides her research in *"Behind stone walls: Changing household organization among the Albanians of Kosova"*, 2003.

As per the builders of kullas, specifically the well-known craftsmen from Dibra, the following foreign authors mention them in their books: Th. Ippen in "Skutari und die Nordalbanische

Küstenebene", 1907, Sarajevo; J.G. von Hahn and his book *"Albanesische Studien*", 1853, Vienna; M. Bitschev "*Die Architektur in Bulgarien*", 1961, Sofia; A. Chatzēmichalē "*La maison grecque*", 1949, Athens; N. C. Moutsopoulos "*L 'architecture vernaculaire dans les Balkans"*, 1985, Paris.

Finally, worth mentioning is also the *"Encyclopedia of Vernacular Architecture of the World"*, edited by Paul Oliver, which even in its first edition published in 1997, gives a general overview about kullas in the Balkan region. The encyclopedia does not mention specifically Albanian mountain kullas but rather similar examples in the region.

As far as sustainability of historic buildings is concerned, the literature review shows that there is a dozen of initiatives on producing directives, regulations and guideline for energy improvement of historic buildings within the EU, UK, USA and beyond.

As first initiatives on this topic are the Energy Performance of Buildings Directive (EPBD) 2010/31/EU and the Energy Efficiency Directive (EED) 2012/27/EU revised in 2018, which have encouraged the development of energy efficiency in historic buildings in the EU. Further on, two specific standards were drafted and published one after another: the European Standard CSN EN 16883 Conservation of cultural heritage - Guidelines for improving the energy performance of historic buildings and the American standard, ASHRAE Guideline 34-2019, Energy Guideline for Historic Buildings. The following UK's Approved Documents recognise the special nature of historic buildings by providing guidance on the improvement of their energy efficiency:

- Approved Document L: Conservation of fuel and power;
- Approved Document C: Site preparation and resistance to moisture;
- Approved Document F: Ventilation;
- Approved Document J: Combustion appliances and fuel storage systems;
- Approved Document to support Regulation 7: Materials and workmanship.

Moreover, Historic England has also produced the following series of guidance documents, which provide advice on the principles, risks, materials and methods for improving the energy efficiency historic buildings:

- Insulating pitched roofs at rafter level/warm roofs;
- Insulating at ceiling level/cold roofs;

- Insulating flat roofs;
- Insulating thatched roofs;
- Open fires chimneys and flues;
- Insulating dormer windows;
- Insulating timber-framed walls;
- Insulating solid walls;
- Early cavity walls;
- Draught-proofing windows and doors;
- Secondary glazing for windows;
- Insulation of suspended ground floors;
- Insulating solid ground floors;
- Energy Efficiency and Historic Buildings - Application of Part L of the Building Regulations to historic and traditionally constructed buildings;
- Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency.

In addition to that, Historic Scotland published the following Technical Papers regarding energy efficiency in historic buildings:

- Technical Paper 1 Thermal Performance of Traditional Windows;
- Technical Paper 2 In situ U-value Measurements in Traditional Buildings;
- Technical Paper 6 Indoor Air Quality and Energy Efficiency in Traditional Buildings
- Technical Paper 9 Slim-profile double glazing;
- Technical Paper 10 U-values and Traditional Buildings;
- Technical Paper 12 Indoor Environmental Quality in Refurbishment.

In conclusion, despite the approvement of international directives and guidance on energy efficiency improvements of historic buildings, various countries in Europe but also in the world, have conducted a number of research projects on the topic, have organized a dozen of conferences and have implemented various case studies- where historic buildings have been upgraded in terms of energy efficiency. However, on the other hand, Kosovo (not an EU member state), Albania and Montenegro (both candidates for EU member states) have no requirements on energy efficiency upgrade of historic buildings in their national cultural heritage laws and regulations. Moreover, no guidance on the topic has been produced as yet by these states and only a few historic buildings have been sustainably upgraded.

1.6. ANTICIPATED CONTRIBUTION AND LIMITATIONS OF THE THESIS

1.6.1. Anticipated contribution

a) Anticipated contribution to the international discourse of cultural heritage:

Rationale: Vernacular heritage reflects the most sublime form of human production and is coming to be recognized worldwide as a constitutive part of cultural identity production. The Encyclopedia of Vernacular architecture of the World (where I was invited to contribute with a chapter for Kosovo) is an indicator that traditional architecture of the world constitutes a very important component in preserving the peoples' meaning of heritage of through history. Vernacular heritage and more precisely, its preservation and sustainable upgrade, is becoming more complex in terms of its form and use, while being a major factor in the economic growth of buildings and settlements. In this context, contemporary understanding of the vernacular heritage is extended to include notions and concepts of transnational collective memory, that goes beyond national boundaries and policies, whith which we are commonly used to deal with. This transition, however, remains understudied in both empirical and contextual terms, and the reason for this lies in the global neglect of the reality that traditional cultural understandings are still primarily linked to sovereign nation-states. One typical example is the common unique heritage of stone buildings in the cross-border area of Albania, Montenegro and Kosovo, this being subject to the study of this thesis.

Anticipated contribution: In this context, this research may contribute to the international discourse by revealing the significance of a joint Albanian vernacular cultural heritage, that lies in three different countries, as well as provide guidelines for its consolidation and sustainable upgrade, so that "kullas" will no longer be frozen in time as "stone museums", but will have the chance to be living and enjoying heritage places, for communities and tourists. In the near future, kullas can be part of UNESCO serial world heritage sites, and their multiple values can be cherished worldwide.

b) Anticipated contribution to the regional discourse of kullas:

Rationale: The political and economic situation in Kosovo, Albania and Montenegro had a very negative impact on the condition of the built heritage. Despite the multilayered significance, only few kullas are protected and preserved in these regions. Most of them are in a degraded condition or have been transformed throughout the time, preserving only some parts of their original architecture. Moreover, although they shape the pristine mountainous landscape of the regions, until now, kullas were not properly researched nor mapped by relevant institutions. Most of them are abandoned, and those that still function is usually used by poor families, who are not able to build another house in the setting of kullas. There are no sustainable upgrade cases of these stone houses, to make them once again proper source of life, and neither are guidelines to tell the owners or experts on how to properly upgrade them without diminishing their authenticity and integrity.

Anticipated contribution: In this context, this research, once published, will be a thorough research about Albanian kullas in one place, which can serve as a basis for many future research and preservation projects. Moreover, the technical guidelines provided for the thermal comfort upgrade of kullas, can initiate various regional intervention projects, either governmental or internationally funded, aiming to preserve and promote these resourceful assets.

c) Anticipated application of the results

The primary anticipated contribution of this thesis in terms of application of its results goes to the scientific and academic literature on Albanian kullas in the Balkans. It is anticipated that this thesis shall add value to the body of knowledge on the written sources about these vernacular fortified dwellings. For one, it may be used as a basis for further scientific research on this typology of cultural heritage, its preservation and contemporary use within a broader urban space. Concurrently, it may provoke awareness of the general public on the important role that these buildings have in the historical and cultural image of the Albanian people.

Given that no technical guidelines on the sustainable upgrade of historic buildings have been produced in the respective countries, and this topic is still seen as a paradigm, and as such it is not a requirement in the national cultural heritage laws, we have not even a single implemented case, on the sustainable upgrade of a historic building. Thus, the thesis provides recommendations for kullas thermal upgrade, which not only can be used by owners, experts but can also be implemented by the central and local governments. Moreover, this can serve as a replicable model, to produce a rather different cultural heritage typologies guidelines on the sustainable upgrade. On the verse on this thesis and Ilucidare project, one kulla in the village of Vuthaj- Montenegro (the case study used in this research) underwent consolidation and thermal comfort upgrade. This is the first example implemented so far in the three countries, and it could serve as a smart replicable model to be followed by communities in the future.

Finally, taking into consideration the joint values these kullas share and the potential they have for cultural and natural tourism development in the cross-border region, this thesis can serve as a starting point for the compilation of the nomination file of kullas as UNESCO serial world heritage sites.

1.6.2. Limitations

The main constraints of this thesis were the lack of research instruments such as onsite U-value measurement instrument, thermal imaging camera and so on. Moreover, the capacity of the used data loggers, didn't allow the uninterrupted data measurements for 1 year, and because of COVID-19 restrains, it was impossible to travel that often (4 times per year in each location to change the batteries or unload the data from the memory card). Thus, the data gathered per each case study is only presented for the summer-autumn season. This means that the data recorded in the winter season was lost due to the reasons mentioned above.

Another issue, was changing one of the case studies in the midway of this thesis research. Initially, the Kulla of Ramok Celaj in the village of Vuthaj was selected and as such it was analyzed and investigated. However, afterwards because of a family misfortune, the family decided to destroy the building, and as such all the data was irrelevant, and another case study was selected (the Kulla of Deli Gjonbalaj in the same village).

1.7. STRUCTURE OF DISSERTATION

The dissertation is divided into four parts, which are grouped according to the research content they present.

Part I "Kulla: An Albanian Vernacular Heritage in the Balkans" addresses the context of this typology of Albanian cultural heritage in the Balkans. This part consists of four chapters, each bringing forward a thorough research about history and emergence of kullas, focusing on those situated in Kosovo, Albania and Montenegro, their architecture, with an emphasis on building typologies in each country, building construction, materials and techniques, as well as the main craftsmen of the time. An elaborate part is given to the sustainable design of these buildings, which could definitely compare to the contemporary requirements. Quite an extensive analysis is given to the distribution of functions of kullas and the definition of multiple values, which contribute to Universal values of these building. Intangible values attributed to these buildings are also presented in this part, a topic not quite thoroughly researched in the past. This part ends by giving an extensive overview on the current condition, management and legal administration, threats and initiatives towards preserving these assets.

Part II "Thermal comfort of historic buildings", consists of five chapters that bring forward an elaborated literature review about the components to consider while improving thermal comfort of historic buildings, the legislation and technical guidelines in the world, with a focus on those of the UK, regarding energy efficiency, with an emphasis on thermal comfort of historic buildings. This part also discusses the lack of these guidelines as well as the lack of sustainable upgrade of historic building requirement in the cultural heritage laws of Kosovo, Albania and Montenegro. Moreover, an analysis of the factors that affect the thermal comfort in the built heritage and solutions on how to mitigate these factors are provided. Lastly, as there are no case studies of thermal comfort improvement in historic buildings in the region, such case studies in the UK were analyzed and presented.

Part III "Thermal Comfort Analysis of Case Studies: Kulla of Isuf Mazrekaj- Dranoc, Kulla of Selimaj Family- Valbona, Kulla of Deli Gjonbalaj-Vuthaj" is the core part of this thesis. It presents the results from the thermal comfort analysis of three case studies (Kulla of Isuf Mazrekaj- Dranoc, Kulla of Selimaj Family- Valbona, Kulla of Deli Gjonbalaj-Vuthaj) conducted throughout the research. The conducted analysis was focused on climate and sun study of the context, sun study of the setting of kullas, temperature and relative humidity, heating and ventilation and building defects and pathology. This part is the base for setting the guidelines on thermal comfort upgrade of kullas.

Part IV "Guidelines on Thermal Comfort Upgrade of Kullas" is the synthesis part of the thesis. It consists of technical specifications of kullas' elements that need to be optimized in order to achieve a full thermal comfort upgrade of these buildings. The specifications are based on comparative analysis of geography, context and architecture of case studies kullas, which can serve as models for other kullas similar to them, located in the same regions. This chapter, also elaborated the conclusions of the whole research and anticipates further work that need to be completed, which would contribute to get more accurate and longer-term results of this topic.

PART I

KULLA: AN ALBANIAN VERNACULAR HERITAGE IN THE BALKANS

PART I -

KULLA: AN ALBANIAN VERNACULAR HERITAGE IN THE BALKANS

Vernacular architecture in Albanian countries presently dates from the 18th and 19th centuries. Although traditional urban and rural houses from earlier centuries have been lost due to the region's ongoing historical instability, those that have survived provide witness to Albanians' centuries-old way of life and building history. While crafts and trade activities are frequently transferred in urban housing typologies, rural houses reflect agricultural and farming roles. The rural dwelling, on the other hand, is symbolized by kulla, a characteristic Albanian fortified stone building. Kulla is an authentic and direct derivate of socio-political circumstances in Western Kosovo, North Albania, and South-East Montenegro defined by insecurity and ongoing historical strife.

This section discusses the context of Albanian kullas in the Balkans, specifically in the Kosovo-Albania-Montenegro cross-border region, in order to get acquainted with the general knowledge about the Albanian vernacular heritage. Further on, the second chapter presents a thorough research into the history and emergence of kullas in these areas. In the third chapter, architecture is explored, with a focus on architectural typologies in each country, function, building structure, materials and techniques, as well as the important craftsman of the time. This chapter also devotes a significant attention to the sustainable design of historical structures, which could easily meet today's standards. The notion of numerous values, which could contribute to the Universal values of these buildings, receives a comprehensive review in Chapter 4. Intangible values ascribed to these structures are also discussed in this section, a topic that has received little attention in the past. The final chapter provides an in-depth look at the current condition, including management and legal administration, threats, and actions aimed at safeguarding these assets.

2. HISTORY AND EMERGENCE OF KULLA

Kulla is an authentic and direct derivate of socio-political circumstances marked by insecurity and continuous historical unrest in the cross-border region of Kosovo, Albania and Montenegro. Its location was strategically chosen to observe the surroundings. Its main function was to provide shelter and security for Albanian families living in them but it also served as a place to host the guests (Albanians were well known for hospitality). Thus, these dwellings have a compact structure, a high level of fortification built with strong and high circumscribing walls, small windows, and shooting holes (Albanian: *frëngji*). They have rectangular floor plan usually 10 x 10 meters, with very thick fortified walls made out of stones, which reach 70-80 meters in thickness, sometimes even more and 7-8 meters in height, with not or very small openings or riffle loopholes. They are mainly built in three floors but they occasionally appear in four floors versions. The ground floor has been exclusively used as barn for cattle, the first floor comprised of bedrooms while in the second floor we encounter the so-called Guest Chamber (Albanian: *Oda e Burrave*) which served as a meeting place for men, who discussed a lot of social-political issues of the time- by attributing it the role of an institution. Kullas, first started to be built at the end of the 17th century, a time which was marked by insecurity, turmoil and continuous fighting. Most of the remaining Kullas date back to the 18th an 19th century, with quite a few being built in the 20th century as well.

According to Krasniqi, the word *Kullë* (tower in English), derives from the Arab language, which was spread amongst the Balkan peoples through Byzantines[1], whereas according to Jirecek, this word was mentioned in Greek documents of the 11th century.[2] The word means fortification or a resistance place.

In the Middle Ages there were quite a lot kullas, and a dozen of them are still preserved in the Balkans and Europe. Jirecek mentions fortifications from the Illyrian times in Meduni, in the eastern part of Montenegro, as well as roman fortifications in Danub, or those from the Middle Ages in Zveçan and Magliq.[3] Various travel writers mention kullas in Greece, South Albania,

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[1] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p. 327.
[2] Konstantin Josef Jirecek (1923) *Istorija Srba.* A Serbian translation by Jovan Radonić. Beograd: Izdavačka knjižarnica G. Kona, p.24.
[3] Konstantin Josef Jirecek (1923) *Istorija Srba.* A Serbian translation by Jovan Radonić. Beograd: Izdavačka knjižarnica G. Kona, p.24.

Bulgaria and Rumania. In Greece they are found in Morea (Peloponnese Region)[4], in Rumania in Olltenia[5] and in Western Bulgaria. The famous Turkish travelogue Evlia Çelebi, wrote that in the south Albania (Gjirokastra, Delvina, Myzeqe) there are a lot of multiple story houses with strong kullas. The French travel writer Ami Bue also mentions kullas in Greece and Albania in the first half of the 19th century. Bosnia and Herzegovina used to have about 300 stone kullas the upper floor with timber, whereas Dalmatians in some villages, when in risk of attack by the Ottoman attack sheltered in fortifications. Kulla are also found in Macedonia, especially in Dibra.[6] The similarities can be found in terms of architecture, planning, construction techniques, and use of the materials, yet the socio-cultural and geographical conditions differentiate them.

There are different opinions about the genesis of kullas. Foreign ethnologists think that they were first built in the Western Europe, i.e., in Italy, Germany or Switzerland. According to Beqiri, this statement does not stand though, as these buildings have emerged as a reflection of complex internal factors that have influenced their architectural shape. Some other foreign authors say that the construction of these kullas should be related to blood feuds. However, Beqiri argues even with this statement, because allegedly these authors did not know well enough the way of life and customs of the Albanian people.[7]

Moreover, Agush Beqiri states that fortified dwellings have been built a long time ago in Kosovo, precisely in Kamenica during 14th-15th century. This then village- settlement (now a ruin) used to have a lot of fortified residential buildings in that time. During archaeological excavations, a kulla type of dwelling was found- apart from a dozen stone houses. The ruins of Kardhiç near Gjirokastra were also known for fortified dwellings. Unfortunately, this settlement was destroyed in 1811 by Ali Pashë Tepelena (Ottoman pasha of the western part of Rumelia, from Tepelenë, Albania). The ruins of Borsh can also give us a reflection of rectangular stone houses, with no decorations.[8]

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[4] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p. 330.
[5] My secret Romania (2022) *Kule. Romanian fortified houses*. Available at: http://mysecretromania.com/kule-romanian-fortified-houses/.
[6] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p. 330-333.
[7] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri*. Unpublished book, p.51.
[8] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.53-54.

Kullas were built in almost all areas where there were natural conditions, but mostly in the regions of Dukagjini, Has, Gjakova Mountains (Alb: Malësia e Gjakovës), in the areas of western Macedonia, Mat, Lume, Mirditë, even in the vicinity of Vlora. [9] Natural conditions are very favorable in building stone houses anywhere in the cross-border region of Kosovo, Albania and Montenegro, which has a lot of rocks, whereas the central part lacks this sort of material, thus in buildings we encounter more adobe and bricks.

According to Mark Krasniqi, the construction of kulla, was mainly conditioned by to the insecure socio-political situation in the lands populated by Albanians, as a result of the fall of the feudal system and the Ottoman Empire, which influenced not only the raising of national consciousness [not only Albanians] and activism of the movements related to it, but also in the *"frequent attacks of the army and the Turkish occupation, blood feuds, quarrels among themselves, gangs of Kaçaks in the Cursed Mountains, etc."* [10]

These circumstances and the structure of kulla themselves explain their classification as "fortified houses". Undoubtedly, the environmental and geographical factor is of special importance in enabling the construction of kulla, since stones and timber were easily found in the vicinity, but the economic factor was also crucial. In the XVIII and XIX century livestock in this region had flourished, there were families who owned thousands of sheep, and with the breakthrough of the monetary economy comes the enrichment of the villagers of this area through the export of livestock and livestock products.[11] As a result, with the fall of the feudal system, serfs (Alb: *çifqinj)* and shepherds had the opportunity to become owners of lands which were sold by pashas [12]

The societal factor played a significant role in the construction, shape and way of use of kullas as residential houses. The feudal system had a great impact in the emergence of these buildings in this region. The renowned Albanian family Begolli from Peja has ruled in this region since the 16th century, not only in the economic, but also in the political aspect. A lot of villages in the Dukagjini plain as well as in Drenica were feudal properties (Alb: *çiflig- çifllëk*) of this family. Blood feud, until recently was in power in some regions among Albanians, has also

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[9] Ibid. p.57.
[10] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p. 327.
[11] Ibid. p.326.
[12] Ibid. p.343.

affected that people had to be secured by building strong kullas, to be protected by attackers. Social life standards between Albanians were regulated by the Code of Lekë Dukagjini (cent. XIV), according to which the blood feud is a responsibility of the oldest member of the tribe (Alb: *fistar*). There were cases that people who were in blood feud didn't dare to get out of kullas because of the revenge. [13]

Kullas in villages are quite different from those in the cities. These differences are not very obvious in the exterior rather than in the function of rooms. According to M. Krasniqi, kullas that we encounter nowadays are influenced by older "porch"- *çardak* houses, with stone ground floor and timber upper floor. A long time ago, even the timber porch was a good protection for long riffles. However, with the advancement of riffles, sometime in the middle of the 19th century, thick beech boards couldn't resist the armory anymore, thus people started to build other floors by stones, too. [14] The Russian consul in Prizren, Ivan Jastrebov, wrote about this region: *"there is no family without a two or three story kulla".*[15] In some villages of Dukagjin, kullas were first built by the nobles (Alb: *bejlerë*) in their lands to supervise their serfs and to spend the summer holidays there. The feudal system had an impact in the type of rural houses, because the serfs were never sure if their lords will let them stay in the same property, thus by pushing them to usually built temporary houses. Moreover, serfs never dared to build a more beautiful house than their lords' without their permission. The serfs' house was always simpler and a story lower that his lord's- whose house dominated the village.[16]

Kullas were initially erected for the safety of the family, but later on it became a habit and even fashionable. Kullas were built by all rich families, because owning such building meant respect and honor. However, the construction of kullas was not only a privilege of rich families. They were also built by middle-class families, primarily because the villagers were willing to help each other with construction as well as materials. [17]
The construction of kullas were not time consuming, because all the building materials were provided by the villagers and were kept at the construction site for 8-10 months before they

[13] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.335-336
[14] Ibid. p.340.
[15] Ivan Jastrebov (1904) *Stara Srbija i Albanija*, Beograd: Spomenik Srpske kraljevske akademije, XLI, p.18.
[16] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.342.
[17] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.57.

started the construction, while the agreement with the craftsmen was made even a year ago.[18] The emergence of these buildings also had political impact, as in 1878 was established the League of Prizren, with various uprisings of Albanians against the Ottoman power.

Recently, comprehensive studies of Kulla typology have revealed some interesting facts about the evolution of these buildings, which indicate the continuous nature of the process of improving the living space according to specific contemporary needs. According to Flamur Doli, within the diachronic and synchronic context, the layout of Kullas seems to have evolved around and in accordance with the essential Neolithic dwelling unit i.e. the kitchen (which later becomes the men's meeting room); a nucleus continuously improved by adding spaces, in horizontal or vertical directions, to accommodate new requirements or sometimes even just supplement existing layouts with the necessary structures, which served other purposes (in this case bastions). The picture below shows the evolution of Kullas, whereby the kitchen or men's meeting room is a constant element persisting from the embryonic period. [19]

Typologically speaking, all kullas, wherever they are built, are similar in both volumetric appearance and layout. To the observer they resemble each other quite a lot, but, if treated scientifically, each province has its own peculiarities, especially in exterior architectural details, then in the functional scheme, in the building material, which was applied according to the what the region has offered.[20]

[18] Ibid. p.57.
[19] Flamur Doli (2009) *Arkitektura vernakulare e Kosovës*. Prishtinë: Shtypshkronja Iliri. p.408.
[20] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.57.

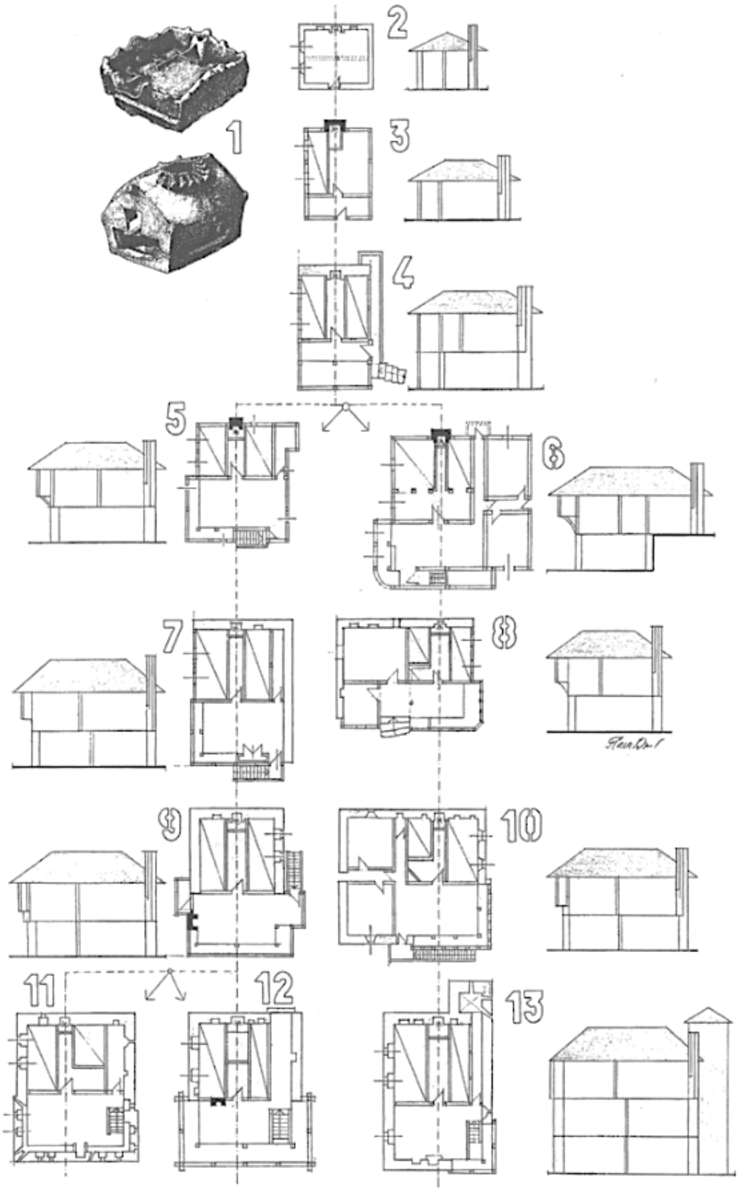

Fig. 1 The scheme of the evolution of kulla; 1- Basic living unit, 2-3- simple house, 4-10- house with gallery, 11-13 kulla. (Flamur Doli, 2009, p.408)

The importance of the kulla once lay in their protective function, but also in presenting the prestige of the social status of the family. Nowadays they serve as a reminder not only of important historical moments and figures for Albanians, but also of an antiquity and continuity in identifying the territorial cultural identity of the region.

2.1. KULLA IN THE DUKAGJINI PLAIN, KOSOVO

Buildings in the Dukagjini Plain represent a broad landscape of vernacular architecture, affected not only by physical-geographical components, but also by social-economical and ethnical components, in the architectural style of these buildings as well as in their function. Kulla, as one of the main representatives of these buildings in the Dukagjini Plain, is quite spread especially in the villages adjacent to the Cursed Mountains (Alb: *Bjeshkët e Nemuna*), in the outskirts of Peja and Gjakova.[21]

Fig. 2 Mazrekaj neighbourhood, Dranoc (CHwB Kosova, 2021)

In the Dukagjini Plain, kullas were usually built by Albanians, thus the ethnic factor also impacted the emergence of these buildings. Attacks by the Ottomans, blood feuds, *kaçak* gangs (the gangs of disobeyed, who fought against social injustices, against the exploiting classes of the foreign invader) in the mountains, and other entanglements have all contributed in the creation of insecure and anarchic atmosphere, thus these buildings start to rise fast. In these

[21] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.326

conditions, not only the richest, but also the middle class built kullas, by making it an authentic vernacular fortified house of the Dukagjini region.[22]

According to various authors, the construction of kullas in the villages started in the nineteenth century, although by the feudal lords of that time in this region, especially in cities, their construction had begun even earlier. However, the field research shows that kullas are 100 up to 300 years old. [23] However, when it comes up to the antiquity of kulla, often the owners or villages add up years, thus we have a narrative that fits the oral history and a collective memory which certainly differs from the historical one.

The emergence of kullas in the Dukagjini Plain started at a time when new social-capitalist relations emerged in these areas, thus kullas in cities were built to protect the new ruling class. Initially, kullas were built only by fiefs, (i.e., *bejlerë*) in Peja and Gjakova. During the 19th century, kullas start to emerge also in the villages of the Dukagjini Plain. This was also as a consequence of the economic increase in the villages during the ottoman feudalism. During 18th and 19th centuries, in Dukagjin Plain and other neighboring regions, livestock has bloomed and farmers had thousands of sheep in the Mountains of Sharri and in the Cursed Mountains. The 19th century is the period when monetary economy emerges quite fast in Dukagjini Plain, by increasing the incomes of farmers from the livestock export and products. The 19th century is also a period of powerful awakening of national conscience among peoples in the Balkans, a period of liberation movements for definitive destruction of Ottoman rule. This has also affected the awakening of new bourgeoisie ambitions in this region. [24] Kulla in every region has sort of the same features, a small plan in comparison to its height. They are usually three stories, but we sometimes encounter them in four stories (though quite seldom). The oldest kullas were of two stories only, with a timber gallery (Alb: *dysheklläk*).

[22] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.327.
[23] CHwB Kosovo, Institute of Albanology Kosovo and Faculty of Anthropology/ UP (2021) *Kulla as a changing heritage and as a continuation of tradition*. Ilucidare project. Unpublished research report.
[24] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.326.

2.2. KULLA IN NORTH ALBANIA

On this very mountainous side, located below the mountain massif of the Albanian Alps, i.e., in the impressive landscape of the valley formed by the rivers Valbona and Tropoja, kullas shape up almost the entire landscape. [25]

Fig. 3 Kulla in Rragam, Valbona, 2021

Today's scenery of kulla and other stone dwellings in this area is the result of a long millennial evolution of the economy, lifestyle and art of construction, because as it is well known, the first human houses were primitive. Archaeological findings of expeditions, started spontaneously in the seventeenth century, and continued with great intensity, especially in the twentieth century, have proven the permanent presence of numerous settlements in this area. [26]

[25] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.65.
[26] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

Conditioned by the rugged terrain and building materials that could be provided by the surrounding environment[27], the simple stone houses dating back to Antiquity and continuing further, coexisted with the wooden and straw dwellings[28], the remains of which have now been returned to nature. Whereas in areas where the terrain consisted of tuff stones or other unfavorable building materials, houses were erected of wood, or even straw fences, sometimes filled with mud. With stones or wood, the dwellings were one-story and had only one interior space (alcove), where all the activity of the family[29] or even the tribe took place. The fire, which served simultaneously for cooking, heating and lighting, was lit in the center of the dwelling and the smoke was distributed throughout the space until it came out of the cover, as the ceiling is a very late element. Small holes in the side walls in the form of turrets (Alb: *frëngji*) are characteristic of the dwellings of the mountainous areas of this period, even in cases when they were built of dry stones. [30] The floor was of compacted earth, while stone slabs, tiles, or wood-paneled roofs, depending on the area, began to be used after wood and straw roof cover. Since the survival of the family depended on the cattle, their shelter in the interior of the dwelling, without or with a simple separation was a reality that continued for centuries. [31]

Numerous scholars, starting with Konstantin Josef Jireček[32],, Baron Nopcsa von Felső-Szilvás[33], Arthur Haberlandt, etc., refer to the end of the ninth century as the time of the spread of kulla. The first kulla, according to some of them, were built on the model of medieval fortified tower-castles (*donzhon*) of the Catholic knights of Western Europe, originating from the German Lombards, who ruled up to Italy for several centuries. The purpose of constructing these buildings seems to have been military - that is, defense. Such kullas began to spread in the coastal and plain areas of the Balkans, while in today's Albania, they were initially built in the Western Lowlands (Durres[34]), and over the centuries, they started to be built in the depth of the county (Berat[35]) to continue towards mountainous areas. At the end of the 15th century, with

[27] Ibid.
[28] Karl Steinmetz (1904) *Eine Reise durch die Hochländergaue Oberalbaniens.* Wien; Leipzig: A. Hartleben.
[29] Theodor A. Ippen (1908) *Die Gebirge des nordwestlichen Albaniens*. Wien: Lechner.
[30] Ibid.
[31] Injac Gj. Ndojaj (1943) "Pasunija private e Shqipnís", *Hylli i Dritës.* No. 1-3.
[32] Konstantin Josef Jireček (2017) Reprint of 1877 ed. *Die Heerstraße von Belgrad nach Konstantinopel und die Balkanpässe Eine historisch-geographische Studie.* Germany: Norderstedt Hansebooks GmbH.
[33] Baron Franz Nopcsa (1925) *Albanien: Bauten, Trachten und Geräte Nordalbaniens.* Berlin; Leipzig: Verlag von Walter de Gruyter & Co.
[34] Arthur Haberlandt (1917) *Kulturwissenschaftliche Beiträge zur Volkskunde von Montenegro, Albanien und Serbien. Ergebnisse einer Forschungsreise in den von den k. u. k. Truppen besetzten Gebieten.* Sommer 1916. Wien: Verein für österreichische Volkskunde. Available at: https://www.volkskundemuseum.at/publikationen/publikation?publikation_id=1566894250301.
[35] Ibid.

the spread of the Ottoman Empire and the weakening of the military power - already of the tribes - a part of the Catholic Albanians of the north continued to move deeper and deeper into the mountains, initially settling in simple dwellings, until centuries later, some of them built real houses and stone kullas.[36]

Typologically speaking, Kullas in Gjakova Highlands are completely identical to the kullas of Has and Dukagjini, except that their courtyards are significantly poorer in terms of ancillary construction. The ground floor, as in all other kullas, serves as a barn. The first floor meets the daily needs of the family, and in addition to the fire room there is also a room (Alb: *qilerë*) for married couples, and on the top floor there is the guest room for men (Alb: *Oda e burrave*). [37] Although in this area there are two-story buildings of both variants, but also all sub-varieties, however the most typical ones are the three-story kullas with a stone gallery slightly protruding. Otherwise, even this has been preceded by the older variants, i.e., kullas with the protruding timber gallery. [38]

Relying on many studies, evidences and reports of the time, it can be said that the progress of the construction of kullas has gone through three stages. The first stage that marks the beginning of the extension of residential kullas in the depths of the mountains, as well as the consolidation of their typologies, began in the first half of the XIX century, while the second stage begins with the Independence of Albania and goes beyond the Second World War. The third stage is the shortest, as it starts around the mid-1950s and lasts for no more than 3 decades. [39]

The construction of the first kullas are evidenced by Nopcsa, according to whom, Kelmendas and Dukagjinas started to construct these buildings in the early twentieth century[40], as well as Ippen, according to whom, the complex of the kulla of Bib Doda was built in 1833[41]. From this period onwards, there are numerous sources[42] that prove the presence of the first kullas everywhere in Albania and beyond, especially in today's North-Northeast Region of Albania,

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[36] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania.* Ilucidare project. Unpublished research report.
[37] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.65.
[38] Ibid. p.65.
[39] Ibid. p.65.
[40] Baron Franz Nopcsa (1925) *Albanien: Bauten, Trachten und Geräte Nordalbaniens.* Berlin; Leipzig: Verlag von Walter de Gruyter & Co.
[41] Theodor A. Ippen (1908) *Die Gebirge des nordwestlichen Albaniens*. Wien: Lechner.
[42] Ibid.

such as Selcë i Kelmendit, Hot, Theth and Salcë of Shala, Dukagjin, in Nikaj-Mertur, in Ujmisht of Kukes, in Puka, in Mat, Lura and Dibra, in Mirdita, etc.

2.3. KULLA IN PLAVË AND GUCI, MONTENEGRO

In absence of written historic documents and research, kullas in Montenegro can be elaborated on the basis of analogy with those in Kosovo and Albania, as they belong to the same typology, and also for the fact that the socio-political conditions were the same at the time they were built, with different borders of the Balkan countries than those we encounter today. Field observation also provides information about the typical kulla of the region of Plavë and Guci in Montenegro.

Architecture in Plavë and Guci has emerged by being shaped according to the circumstantial and economic conditions of people. Therefore, based more on the economic conditions of people, the buildings are sometimes encountered in simpler structures but sometimes as more developed, appearing on the one hand in simple aesthetic shapes and on the other hand, as complex bold architectural volumes. These distinctive features constitute the typological morphology of traditional constructions, which in themselves include various residential, economic and religious buildings.[43]

Kulla is the most characteristic building typology of this region. The buildings lie in a rectangular floor plan and rise on three stories. Same as in kullas in Kosovo and Albania, the ground floor was used as a barn, while the upper floors for the family members. The most representative area of kulla is *Oda e burrave*, always located on the top floor. Kulla are mostly found in Plava but they are also found in Gucia. The later ones are distinguished with simpler features and poorer decorations. More decorative features are found in kullas in Plava - in its center and outskirts. The most distinguished architectural elements are around the openings and the long shooting holes in the top floor, precisely just below the roof canopy. *Dysheklllëk* is also present in these buildings, in various forms and materials. This element is usually found at the same level as the outer wall, either in one part of the façade or on the building's corner, or it can be extruded from the façade and placed either in one part of the façade or on the building's corner; it is usually built out of stones but also timber versions are present. The most common

[43] Labeatët (2021) *Kullas in Plavë and Guci.* Ilucidare project. Unpublished research report.

ones are built by stones only, as can be illustrated in the picture of the Kulla of Ramok Çelaj in Vuthaj.

Fig. 4 Kulla of Ramok Çelaj, Vuthaj, 2021

According to some scholars, the most special kulla[44], even the oldest one in the Albanian region, is the Rexhepagaj Kulla in Plava, which belongs to the XVII century[45]. This kulla consists of three floors, which are reached by an internal staircase. The most distinguished element of this kulla is the upper floor, which is built of timber and protrudes beyond the layout contours of the building.

Kullas in the region of Plavë (part of the historic region of Vasojevic) are also mentioned by Mark Krasniqi. He states that these buildings had the lower story built out of stones and upper stories by straws or timber planks. Rovinski states that kulla in Montenegro means a fortified

[44] Flamur Doli (2009) *Arkitektura vernakulare e Kosovës*, Prishtinë: Shtypshkronja Iliri, p. 176. See also: Halil Markišić (2016) *Kulturne vrijednosti Plava*, Rožaje: Priroda i baština. p. 19-20.
[45] Flamur Doli (2009) *Arkitektura vernakulare e Kosovës*, Prishtinë: Shtypshkronja Iliri, p. 232 and p. 233.

house with strong walls and *frëngji* similar to "Blockhaus", some of these buildings have only *frëngji* and no windows.[46]

In Guci, most of the houses were built by timber, and only some old fiefs had stone houses. In Montenegro, kullas are present also in Kraja.[47] There are 55 preserved kullas in the area of Plavë and Guci. Despite the kulla of Rexhepagiç (the only designated asset), all others were built in the late 19th early 20th century. Kulla's shape, structure and function of the interior, were designed according to the requirements of defense against attacks. Because of this role, they were also used as inns for every traveler passing by in the area. Kullas have three floors and were built by craftsmen from Dibra. In addition to the residential and defensive purpose, kullas were a symbol of prestige, wealth and power of the family. Only the wealthiest people of Plavë and Guci built kullas. Fifteen kullas in this area have inscriptions in the ottoman language.[48]

The stone kulla, characteristic of Plavë and its surroundings, differs from the common wooden house due to its exterior, structure, and spatial organization. The stone kullas, uniquely adapted to defend against attacks, act as a retreat during besiege. Essentially it is a simple, stereo metrically clean house without large openings, and made (with discretion) of protruding gallery (made of timber), a single stone cube with a steep batten roof. Later, the kulla became a symbol of wealth and power and a reminder of values (worth preserving). "Ordinary houses", of persons with any kind of status, were also called kullas. Today the kullas of Plavë are spread out, between old wooden houses tucked in the landscape and new houses misplaced in the typology of the region.[49]

46 Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.331.
47 Labeatët (2021) *Kullas in Plavë and Guci.* Ilucidare project. Unpublished research report.
48 Halil Markišić (2016) *Islamska Epigrafika u Plavu i Gusinju.* Rožaje, p.134-135.
49 GTZ (2006) *Architectural Atlas of Montenegro*, p.45.

3. ARCHITECTURE: FORM AND FUNCTION

"The most suitable geometric shape of an independent building, intended for protection, is the circle or square. Only these two forms provide conditions for equal observation and access from all four sides. However, when it comes to accommodating other functions in these two basic shapes, the circle is not appropriate, thus Albanian kullas were built in square plan (dimensions about 10 X 10 m). The spatial figure of the stone tower is the basic stereometric shape: the cube. The height of the entire tower is 3 floors by 3 meters and 1 meter for the ceiling, a total of 10 meters. So, the whole spatial shape of the tower is a cube of dimensions 10 x 10 x 10 m: the ideal stereometric stone crystal". [50]

3.1 BUILDING TYPOLOGY

There are typological similarities in the interior spaces but also in the exterior architecture of kullas in these regions. Eventual differences in composition, functional scheme, construction technique, etc., are likely to have been made due to the different way of life, the different economy, but also the circumstantial material that was found in the region. [51]

Various researchers/writers classify kullas in the Dukagjini Plain in Kosovo into typologies according to their most characteristic elements. According to Agush Beqiri, kullas of Dukagjini Plain can be classified in two typologies: kulla with timber *dysheklëk* and with less protruding stone *dysheklëk*. Both of these typologies also have their own sub-variants.

The typology with timber variant, which is also the oldest, has mainly three sub-variants:

- The timber gallery extends in the whole front facade of the highest floor, but also partially in two cross facades;
- The timber gallery extends along the entire length of the front façade;
- The timber gallery places at the corner of the building, where two perimeter walls join.

The typology of kullas with stone gallery, has the following sub-variants:

- The stone gallery extends in the whole front facade of the highest floor, but also partially in two cross facades;

[50] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.63-64.
[51] Ibid. p.67.

- The stone gallery extends in the whole front facade of the highest floor, but also partially in one cross façade;
- The stone gallery extends on the front side of the upper floor;
- Sub-variant of the kulla which has no stone gallery at all;
- The most characteristic sub-variant of the real Albanian kulla is the one with stone gallery in the corner of the two perimeter walls .[52]

Fig. 5 Left: Kulla of Osdautaj, Isniq (Peter Moore)

Fig. 6 Right: Kulla in Dukagjini Plain (CHwB Kosova)

According to Flamur Doli, depending on the position of *dysheklllëk*, kullas can be grouped into seven subtypes:

- Projecting out from the center of the perimeter wall of the longitudinal façade of the *divanhane* (wide corridor inside the walls of *dysheklllëk*);
- Projecting out along the whole length of the perimeter wall of the longitudinal façade of the *divanhane*;
- Projecting out along the whole length of the perimeter wall of the longitudinal façade of the *divanhane* and partly stretches out of the both side walls;
- Projecting out along the whole length of the perimeter wall of the longitudinal façade of the *divanhane* and partly stretches out of the left side wall;
- Projecting out along the whole length of the perimeter wall of the longitudinal façade of the *divanhane* and partly stretches out of the right-side wall;
- Projecting out of the left corner;

[52] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.62-63.

- Projecting out of the right corner.[53]

Subtypes of kulla based on staircase position certainly indicate the relative safety of the region of the time when the kulla was built. According to Drançolli, based on the architectural design of the stairs, kullas can be classified as follow:

- Kullas with indoor and outdoor timber staircases - second half of the 18th and the beginning of the 19th century;
- Kullas with one indoor timber staircase - second half of the 19th century;
- Kullas with two indoor staircases- a unique case in the Dukagjin. Plain.[54]

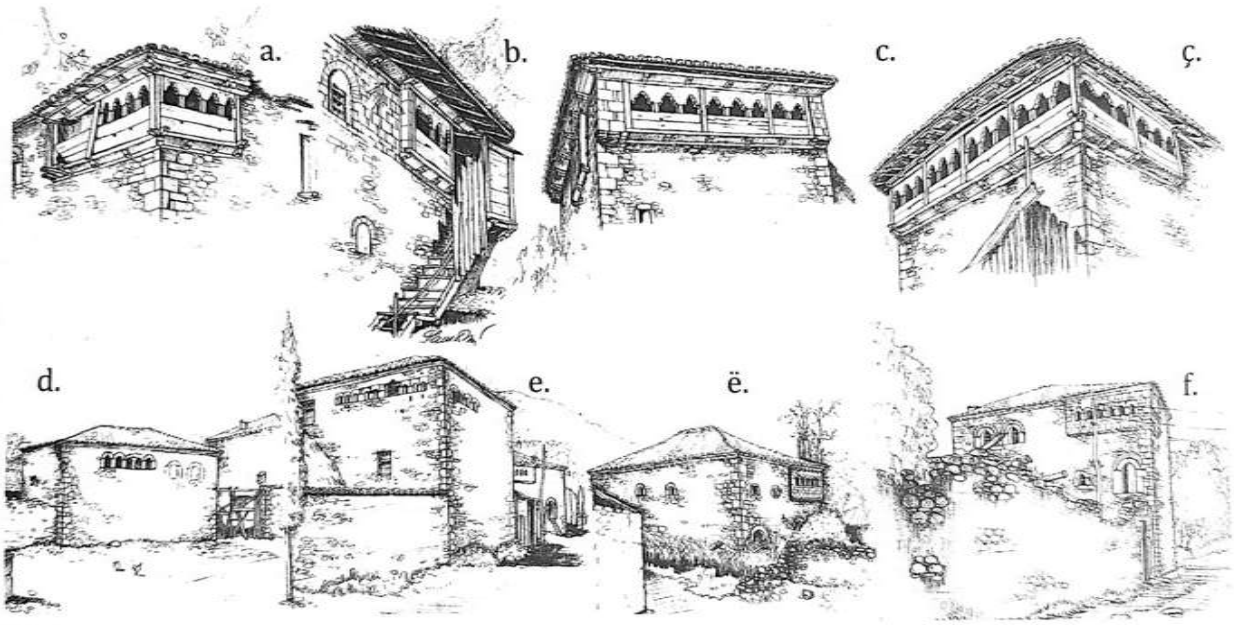

Fig. 7 Typologies of kullas in the Dukagjini Plain (Flamur Doli, 2009, p.193)

[53] Flamur Doli (2009) *Arkitektura Vernakulare e Kos*ovës. Prishtinë: Shtypshkronja Iliri. p. 107-108.
[54] Fejaz Drançolli (2001) *Kulla Shqiptare*. Prishtinë: Grafika Rezniqi, p.188-189.

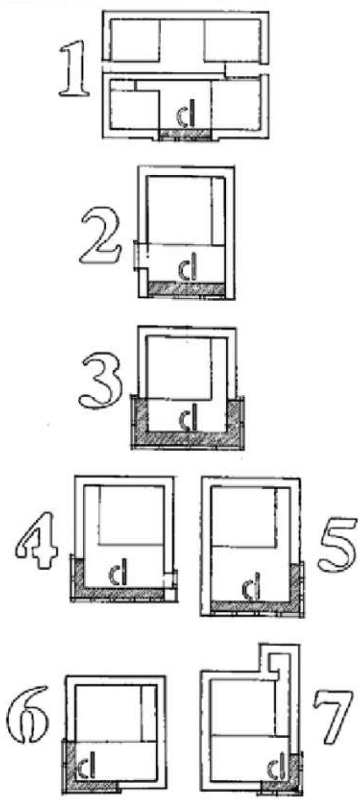

Fig. 8 Typologies of kullas in the Dukagjini Plain (Flamur Doli, 2009, p.192)

According to Agush Beqiri, kullas in the region of Plavë and Guci are almost identical in volume and layout to the ones in Dukagjini Plain. The only difference between them is the roof's shape and cover, since in this region they were adapted to other climatic conditions.[55]

Regarding the typology of construction in the province of Plavë and Gucia, several different typologies can be observed, which were given different solutions. These construction typologies differ in the way of construction, the materials used, the circumstantial conditions in which they were built, as well as, these construction typologies differ in the decorative elements that are encountered as decorative parts of their constructions. As were the economic conditions of the family, so is construction. For this reason, in the popular construction of the province of Plava and Gucia, the same construction typologies can be found, but which differ either in shape, size or other decorative elements, which makes the building more special, more

[55] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri*. Unpublished book, p.63.

important and, what is most prominent, it adds attributive historical, cultural and aesthetic value to the building. If in Plavë are more concentrated the characteristic kullas, then in Guci we encounter mountain kullas and stone houses. In this area, four typologies of vernacular buildings can be identified: simple houses, with stone ground floor and timber first floor; stone houses, which lie horizontally and have as an integral part the functional and aesthetic element *krevet (Krevet or shameshi* as the Kelmendi area calls it, is a wooden architectural element, placed on the façade, that served as the main entrance to kulla when the ground floor was used as a barn); mountain kullas, which are a further development of stone houses, but with an additional story, they have three floors in total and also have *krevet* as a specific architectural element; and, characteristic kullas with *dysheklëk*.[56]

Houses with stone ground floor and timber upper floor- These houses are mainly located in the urban center of Gucia. They are characterized as low, simple buildings with square layout. The first floor is constructed by timber and horizontal timber boards in the facades, whereas the ground floor is constructed by hewn stones, which serve as a strong and durable foundation. There are cases when the upper floor protrudes beyond the planimetric contours of the ground floor, which creates a small porch below it. In some cases, we encounter some houses with timber construction, connected with straws and mortar. In this typology of houses, the timber staircase is placed outside. These constructions are covered by a hipped roof. [57]

Fig. 9 Left and right: Houses with stone ground floor and timber upper floor (Labeatët, 2021)

[56] Labeatët (2021) *Kullas in Plavë and Guci*. Ilucidare project. Unpublished research report.

[57] Ibid.

Stone houses- These houses are found more in rural areas than in urban ones. The houses have a rectangular floor plan and are built of stone, which is the main constructive material of the whole building They are covered with a hipped roof. Stairs extend from the side of the longitudinal façade and cover almost the entire façade. There are many such constructions, that differ in shape and size. They can be found in Plava and Guci, but especially in the village of Vuthaj. Some of these buildings have "krevet", windows and shutters painted in blue. [58]

Fig. 10 Left and right: Stone houses in Vuthaj (Labeatët, 2021)

Mountain kullas- As defined by the name these constructions are built in mountainous areas. They are special constructions that stand out in terms of shape, volume, and especially in terms of their characteristic roof. The roof of these kulla is well adapted to the atmospheric conditions of mountainous areas, which is shaped in such a way as to remove snow efficiently. The hipped roof consists of two longitudinal slopes with large surfaces, while, above the cross facades the roof consists of two smaller sloping surfaces. Mostly, these kullas consist of three floors. The ground floor, as always, was used as a barn, whereas the upper floors were used by family members. [59] These buildings are usually used by two families, and are usually characterized by two separate entrances: either on opposite sides of the facades, or on two facades next to each other. These constructions are characterized by "krevet" which stands out as an integral and defining part of the main facade. This typology of kullas is usually found in the suburbs of Plava, Gucia, the suburbs of Valbona and Theth. [60]

[58] Ibid.
[59] Labeatët (2021) *Kulla of Plavë and Guci*. Ilucidare project. Unpublished research report.
[60] Ibid.

Fig. 11 Left and right: Mountain Kulla in Dol, Guci (Labeatët, 2021)

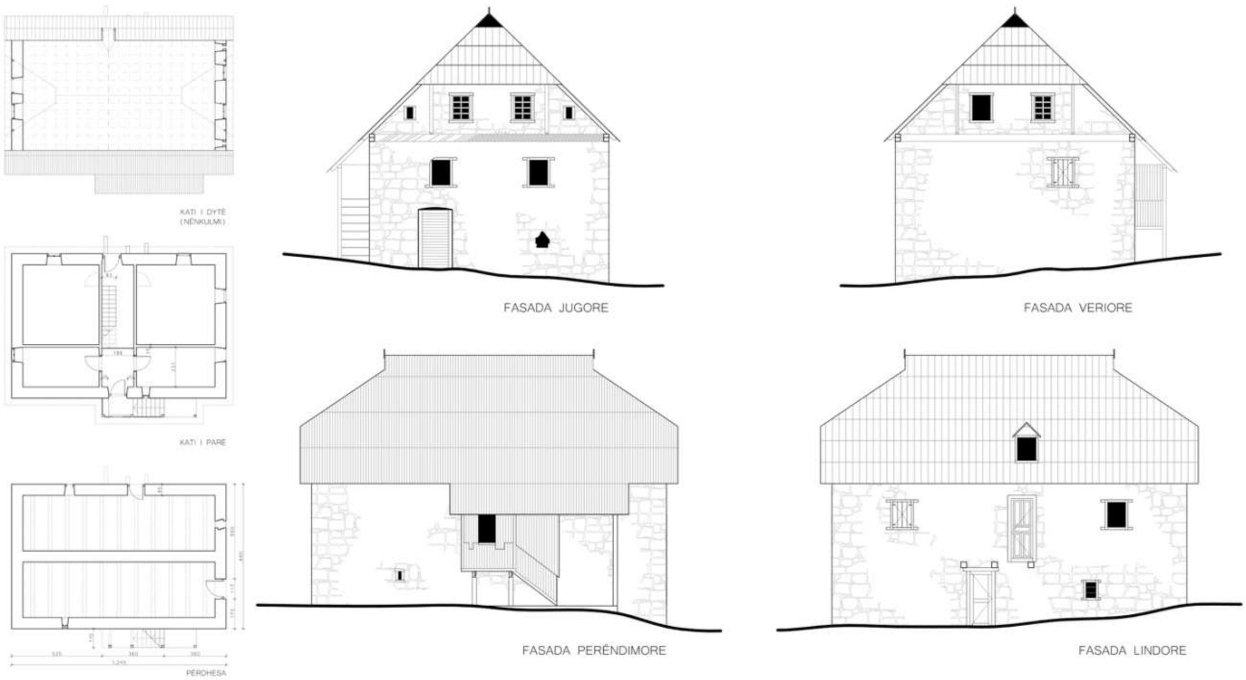

Fig. 12 Drawings of a mountain kulla in Dol, Guci (Labeatët, 2021)

Kulla- The most special vernacular construction of this province is undoubtedly Kulla with distinctive, characteristic features of grandeur and fortification. These kullas are similar to those throughout Kosovo and northern Albania. The layout of these kullas is square, distinguished by their verticality, which rise mainly on three floors. Even in this typology of construction, the ground floor has served as a barn for livestock, while the two upper floors were used by family members. The most representative floor of this building is always the upper floor, consisting of "Oda e burrave". Kullas with highly decorative elements are found in Plavë, whereas the simplest ones are usually found in Guci. The most distinguished decorative elements are around the openings of kullas, as well as the longitudinal shooting holes in the highest part of the floor, respectively under the roof canopy. The gallery, is also an inseparable part of the structure, which appears in timber rather than in stone. The gallery is placed in various locations of kullas (always on the top floor), flat on one façade, flat on the corner of the building, protruding in one of the facades, and protruding on the corner of the building. [61]

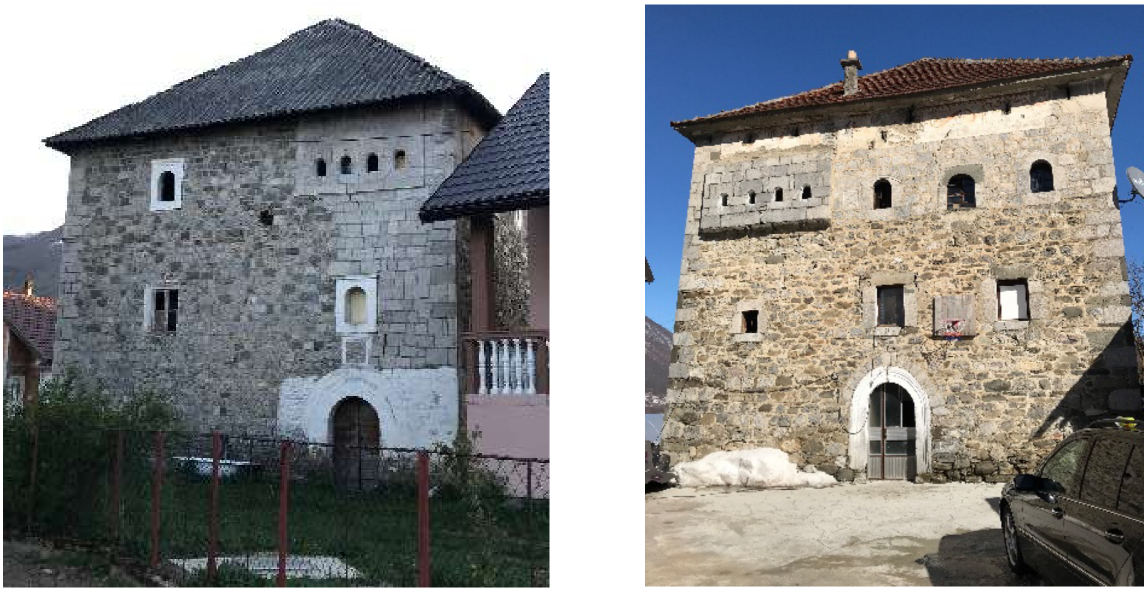

Fig. 13 Left: Kulla with stone gallery in Guci, right: Kulla with stone gallery in Vishnjeve, Guci (Labeatet, 2021)

On the other hand, the main typologies of kulla and houses in the North Albania in terms of regional distribution are as follow:

- Malësia e Gjakovës: *kulla-house type with divanhane, çikma, krevet;*
- Malësi e Madhe / Dukagjin: *kulla-house type with krevet* and seldom with *çikma;*
- Puka: *house with çardak/ kulla-house with karollhane;*
- Has: *kulla- house type with divanhane*/ one story house;
- Luma: *house with krevet in two stories (çardak)/ house with çikma*;
- Mirdita: *kulla house type with çikma*;
- Mat: *kulla- house type with çikma*, house *with qoshk (corner);*
- Dibër: kulla- *house* type with çikma/ house with qoshk / seldom house with teliz. [62]

[61] Labeatët (2021) *Kulla of Plavë and Guci*. Ilucidare project. Unpublished research report.
[62] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

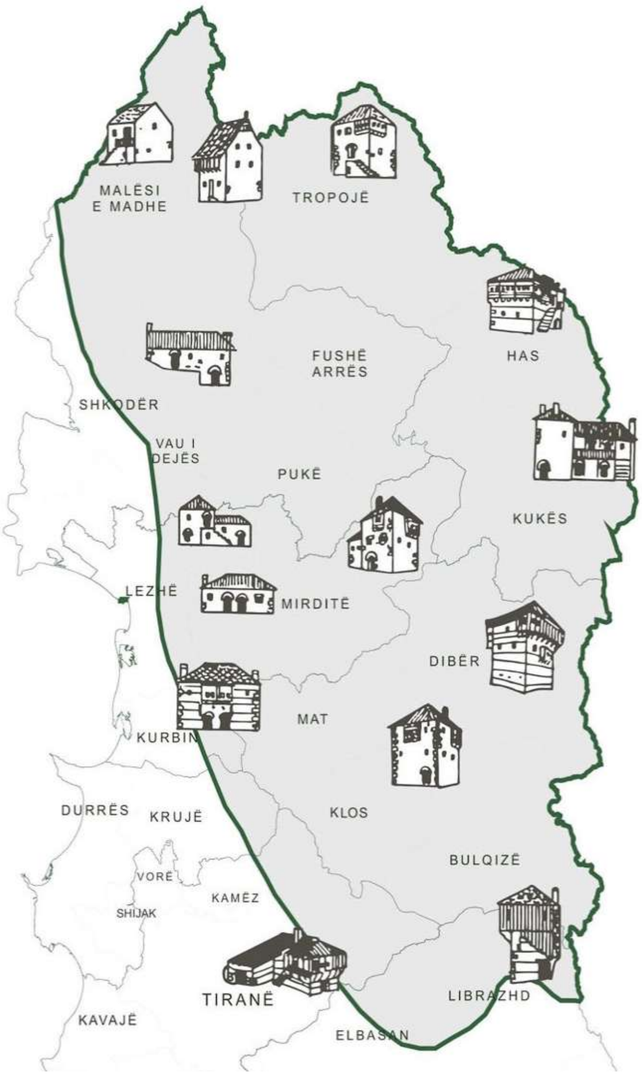

Fig. 14 The distribution of the typology of kullas in the region of North Albania (GO2 Albania, 2021)

From the research conducted in Valbona, followed up by the research of Go2 Albania, in 2021, as part of Ilucidare Project, based on the shape of the layout, kulla can be divided in the following categories:

Square shaped dwelling- These types of kulla are the earliest and can be found in every province. They belonged mainly to the first of the area because they were limited at the floor plan but were high in verticality. The square shape in most cases is 2 to 3 stories high with a hipped or pitched roof covered by pine boards, called *"furde"*. Floor height does not reach more than 2.2m-2.6 m. Generally, when it was 3 story or more, it belonged to a wealthy family.

Rectangular shaped dwelling- The most widely spread typology, consisting of two to three floors.

L-shaped dwelling- These buildings are rarer, and are mainly additions made with the expansion of families. Such typologies are found more in Dukagjini and Malësi e Madhe, but such buildings are also encountered in Has.

T-shaped dwelling- This typology is quite seldom, usually found in Dukagjini and Malësi e Madhe.

Attached dwelling- Consisting of 2-3-4-5 kullas connected in a row mainly for the whole tribe. This typology is found more in Dibër and Mat.[63]


Fig. 15 Left: Rectangular dwelling, Valbona, right: Square kulla, Valbona, 2021


Fig. 16 Left: Semi-detached kulla in Valbona (By author, 2021), right: T-shaped kulla in Has (Go2 Albania, 2020)

The other categorization of kulla into sub typologies is according to the facade elements.

[63] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

Fig. 17 Façade elements of kulla-banesa in Albania (Maksim Mitrojorgji and Joli Mitrojorgji, 2013, Forma, Permbajtja dhe Arkitektura: Udhetim ne banesen popullore Shqiptare)

During the Ilucidare Capacity Building in the villages of Valbona, and the research of GO2 Albania, the following typology of kullas were identified in North Albania:

Kulla with krevet- *Krevet or shameshi* as the Kelmendi area calls it, is a wooden architectural element, placed on the façade, that served as the main entrance to kulla when the ground floor was used as a barn. It was placed mainly on the front facade, but also on the side ones and had mainly a function of entering the building, but it also served as a storage place for food. Usually, krevet is encountered in one story, but seldom there are cases where it is found it two stories. The width reaches 1m-1.5m and is generally built entirely of wood, but in cases where stairs are exposed to rain, it is constructed by stones.[64]

Kulla with çikma- *Çikma* is the protruding element, 20-100 cm in the facade of kulla and about 40 cm raised. This element is generally built into the door section (or in a position that favors the surveillance of the area as well as the protection of kulla. This element is (or isn't) placed

[64] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

on all sides of the wall and is constructed by carved stone tiles. In its front are placed two carved windows, whereas in various points are placed *frëngji*.[65]

Fig. 18 Left: Kulla with krevet in Valbona, right: Kulla with çikma in Valbona, 2021

Kulla with *divanhan*e (closed dysheklllëk)- divanhane is a wide corridor in the upper floor of kulla, which serves as an entering hall to the oda e burrave. This element is placed in three facades of kulla, is made out of timber and is extruded about 20-25 cm from the structure. It has a dozen of windows, closed with timber covers. There are also cased where this element is built out of stones.[66]

Kulla with qoshk (corner)- The stall or balcony is a timber architectural element that extrudes from the facade in the upper floor- precisely from Oda e Burrave. This element is encountered in the middle or corner of the facade. This element is extensively built by timber, not only in the exterior but also in the interior. It has a dozen of windows, carved skillfully. There are kullas with more than one corner- qoshk. [67]

Kulla with teliz- *Teliz* circumscribes kullas (usually in its three sides) in the upper floor and is used as an outer space to connect the areas of this floor. This timber element extrudes in the façade about 90-120 cm and is supported by stiffeners embedded in the beams of the lower floor. It is used as an external covered corridor, but also as a storage for agricultural products or as a toilet. [68]

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[65] Ibid.
[66] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.
[67] Ibid.
[68] Ibid.


Fig. 19 Left: Kulla with dyshekllëk (Ilir Seci, 2018), right: Kulla with teliz in Dibra (Go2 Albania, 2021)

3.2 RURAL MICRO- COMPOSITION: THE SETTING OF KULLA

The architectural ensemble is an important unit of rural landscape composition, which varies depending on its location: in plains or mountains, the family economy: agriculture or livestock, as well as the number of family members or families within the tribe. This ensemble is a circumscribed land area, with kulla located in its center, and auxiliary facilities around it, such as: toilets, agricultural lands, and areas for processing agricultural and livestock products. The shape of the architectural ensemble is determined by the terrain and the boundary of property. In Dukagjini, Malësi e Madhe, Puka and Mirditë, the kulla ensembles are circumscribed by fences with timber sticks or tree branches, while in Dibër, Mat and in the areas of Malësia e Gjakovës, this ensemble can be also circumscribed with high stone walls over 2m and thick up to 1m. [69] The same case is also in the ensembles of kullas in the Dukagjini Plain. The strong surrounding walls were built for protection against various attacks. On the other hand, kullas ensemble in Plavë and Guci are usually circumscribed with light timber fences.

It should be mentioned that kullas in these cross-border villages are grouped into neighborhoods, where the inhabitants of the same tribe live, respectively almost all the families of a neighborhood are descended from one ancestor. In Junik, for example, there are seven neighborhoods, where members of eleven tribes live. There are as many tribes in the village of

[69] Zabit Lleshi (2020) *Kulla e Salë Markës në Zogjej, dëshmi të historisë sonë të lavdishme dhe të mjeshtrisë së ndërtimit të banesave të tipit fortifikatë*, Accessed on 21 October 2021, at: https://bit.ly/3EnCBRk.

Nivokaz as there are neighborhoods.[70] The same case is in the villages of North Albania and Plavë and Guci. During the field research in Valbona, it was found out that kullas were also clustered according to family neighborhoods.

Fig. 20 The setting of kulla in Valbona, 2021

The layouts of these clusters (Alb. *mahalla*) have evolved around the first built Kulla, which is always dominant. Within a cluster, kullas are customarily placed along the main street – sharing one sidewall with the main surrounding wall of the cluster, which stretches out the entire street axis. In this context, the interaction and coordination of the overall defensive system of the cluster is achieved in terms of orientation of the two sides of Kulla with most loopholes, towards the center of the settlement.[71] Thus, indicating that within such macro-defensive system of one cluster, Kullas as singular defensive units having been structurally interlinked together, create a strong fortifying wall, which protects the most vulnerable parts of the neighborhood.

However, as families started to grow beyond the capacities of these buildings, kullas grew correspondingly. In substantial terms the growth has been conceived as shallow prismatic volume additions on either side of the kulla, which provided additional private space for the family members. Moreover, nowadays families started to build new houses in the setting of their kullas to accommodate their actual needs. This example is also encountered in the case studies of this dissertation, which will be elaborated in the further chapters. Often, these

[70] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.62.
[71] Flamur Doli (2009) *Arkitektura vernakulare e Kosovës*. Prishtinë: Shtypshkronja Iliri. p.120.

ensembles have still preserved the auxiliary buildings, such as corncrib, granary, chicken's space called *pojata*, well, barn- when it was separate, and agricultural lands.

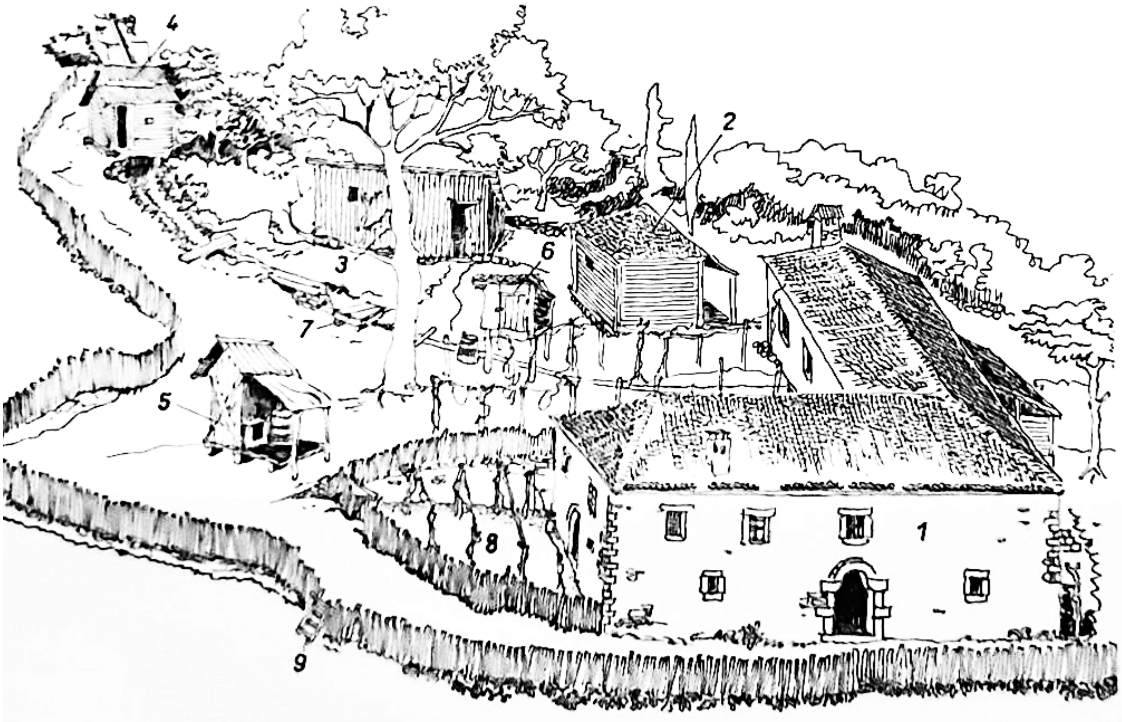

Fig. 21 Architectural ensemble in village Qelëz, Pukë. 1. Main banesa of the family, 2. Temporary building for a couple, 3. Cabin, 4. Small mill, 5. Corn crib, 6. Dairy storage, 7. A place for washing the clothes, 8. Garden for vegetables, 9. Entrance from fence; (Drawing by Faruk Zarshati and Gjergji Martini at "Banesa fshatare e Shqipërisë veriore", Pirro Thomo, 1979)

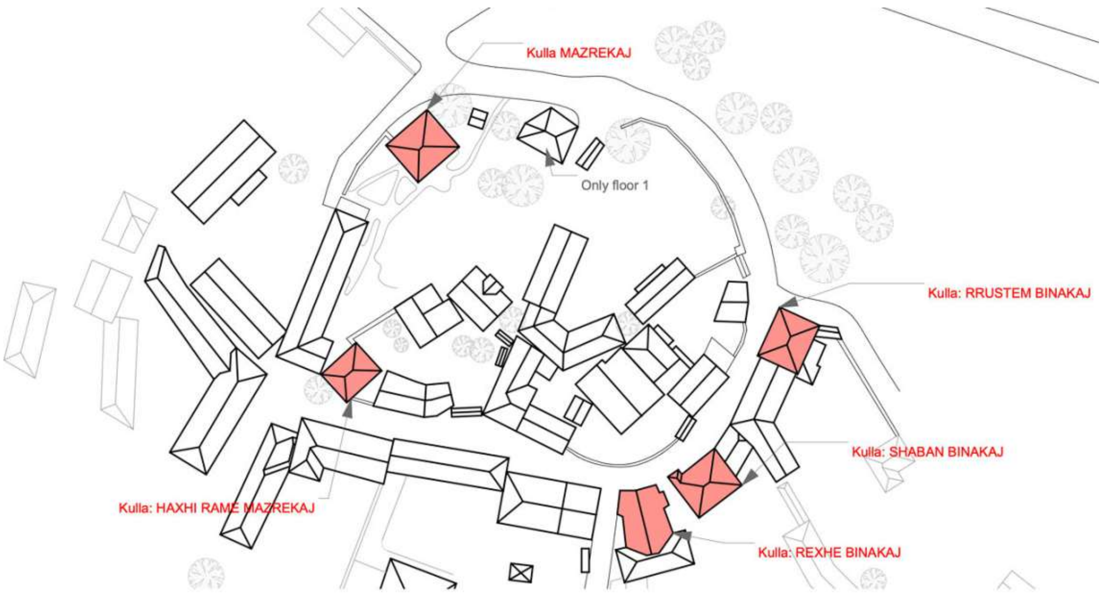

Fig. 22 Architectural ensemble of Kullas in Mazrekaj neighborhood, Dranoc

3.3 ARCHITECTURAL LAYOUT OF KULLA

Although each kulla's layout is unique, these buildings show a remarkable unity of plan, demonstrating that traditional craftsmen envisioned the kulla as a series of core parts whereby the resolution of the design is a product of the function which stems directly from safety and essential living requirements of the occupants. However, in comparison to town kullas where the ground floor has been used as a storage space, in those built-in rural environments the ground floor has been exclusively used as barn for cattle.

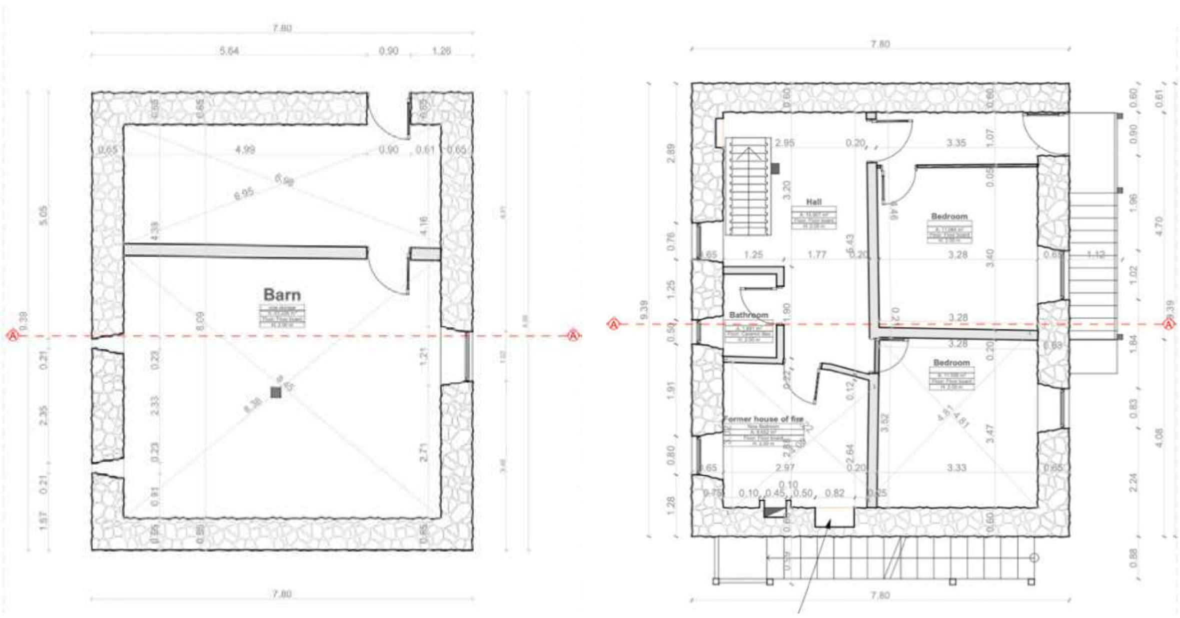

Fig. 23 Left: Ground floor of the Kulla of Isuf Mazrekaj, right: First floor of the Kulla of Isuf Mazrekaj

Ahuri (Barn)

The ground floor of all kullas is one-area and a rather dimly lit space, with almost no opening. It serves as a barn for cattle, but it is also the space in which the internal stairs for the family floor are placed. [72] Ahuri's space is organized depending on the animal breed held; whereas, if the ground on which kulla stands on was humid the floor was paved with stones otherwise it was compressed earth. Lighting and ventilation of this space is achieved with shooting holes only- sometimes we encounter a thin and long window above the door- used for natural lightning and ventilation. In the middle of the barn, there is a strong timber column put above a large stone, which serves as a foundation. In the upper part, the column has a small timber beam (jastek) above which is a large timber beam connecting two opposite walls of the kulla.

[72] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.60.

Above this beam, lay other beams in opposite direction. In some cases, the barn is separated with a fence or timber boards in smaller areas for various animals. In the barn, parallel to all walls is the manger with straws. The entrance to the barn is always provided by a single door, arched on the top, made out of beech or timber oak, it has a strong lock and cannot be opened from outside. In some kullas, the barn is separated with a wall, and accommodates a kitchen or a storage and in this case the staircase to upper floor is located outside. On the other hand, when the barn is not separated in other units, the staircase is located inside.[73]

In terms of function, placing the cattle in the ground floor had two reasons: first, the cattle was a great resource for families, thus they had to be kept and treated well, and second the heat of their bodies, especially during cold winters, was accumulated and transmitted to the people living in the first floor. Considering that some families had up to 400 cattle[74], this heat seems quite considerable.

Shtëpia e Zjarrit **(Fire house)**

The first floor, respectively the middle floor, where all family life takes place, in the first phase was a one-area space where food was cooked, family members ate and slept. However, later this space has gone through a new composition, respectively in it are located two or three small rooms - *qilerë* for married couples, which are separated by light wooden walls, whereas from the kitchen, these rooms have been separated only by a narrow corridor.

The fire house also called sometimes the women's room (oda e grave), women's stove (soba e grave) magjëria, ashef (indicating the function of the kitchen)- are the names of the space or environment where food is cooked and eaten. The most common name, however, is the women's room, because it is in this space that women spend the whole day. Within this space a lively family life takes place. In addition to preparing food and eating, this area also sometimes serves also for sleeping. The plan of this space is not defined in the same way in all places, as was the case with the guest room, but it is set without any defined rules, which would directly affect its internal disposition. For this reason, it has free organization, depending on the taste

[73] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.344-345.

[74] Frang Bardhi (1637) *Relacion i Imzot Frang Bardhit mbi Pukën.* Available at: https://pdfcoffee.com/relacion-i-frang-bardhit-mbi-puken-pdf-free html

and need of family members. The size of this space depends on the number of family members and sometimes on the type of house. [75]

Although this room is larger than the guest room, it is nevertheless poorer in terms of aesthetic design of the interior, because apart from some shelves and cupboards for storing dishes and other kitchen tools, inside there are no other additional elements. The general feature of the women's room is that it has a floor made of pressed clay: above the floor made of thick timber board is placed a thin layer of clay which is well pressed (6 - 8 cm), which has very practical reasons because it not only performs the role of thermal insulation but also protects the wood floor from any fire, as well as stops the penetration of smells from the barn under it. All the walls are plastered with lime mortar and limewashed. In the Albanian kulla this space is semi-dark because there are only some small windows. It is common to find a fireplace where food is cooked or bread is baked. In some cases, the clay floor is superficially baked and looks like it is all made of unglazed ceramics.[76]

In this area the whole family tends to gather at certain times in the day. This is the more relaxed heart of the house with children roaming around and all kinds of activities going on while people talk. The men look in now and then, and may sit down for an occasional meal, or to have a chat. It is rarely decorated and often there is only a mud floor. When there are guests, the women must wait until these have left. Something from the kitchen might always be needed. It may get very late, and the last woman may be found sleeping on a stool with her head in her arms.[77]

Qilerë, qilarë **(Bedrooms)**

On the floor where the women's room is located, we usually encounter two or more separate rooms, so called "*qilarë*". These are actually small bedrooms for married couples of these family members. The height of these separate rooms is relatively small (200 - 220 cm) and they are built with great simplicity. The floor, as in all other spaces of the house, is made of well-pressed clay, while the ceiling is made of wood boards. The walls are plastered with lime mortar and then limewashed. In these walls there is also a wooden shelf, where daily tools are left. At the top of the walls and at a height of about 1.70 cm are wooden shelves built into the walls,

[75] Agush Beqiri (2021) *Arkitektura popullore: Enterieri dhe Eksterieri*. Unpublished book, p.71.
[76] Ibid., p.72.
[77] Berit Becker (2003) *Behind stone walls: Changing household organization among the Albanians of Kosova*. Peja: Dukagjini Balkan Books, p.45.

used for placing small items used by married couples, including quince or other fruit. In these separate rooms, there is no furniture other than a kind of wide wooden bed (120- 160 cm) as well as two or three decorated wooden crates, which the bride has brought as part of her *qeiz*. Each of these small rooms has also a designated place for bathing, so called *hamamxhik*. This is actually a small plateau made of solid material, built into the edge of the room and with a small hole at the edge of the wall so that water spills outside the walls of the building, and in most cases, it is separated from the room by a wooden paravane. During the winter, these rooms are heated by sparks taken from the fireplace and placed in the *"tangarin"* of soil. *Qilarë*, like many other spaces in the Albanian kulla, are semi-dark, because they have only few very small windows. [78] These spaces communicate by the small lobby- *divanhanja e vogël,* which marks the boundary between the private quarters and "institutional" space.

***Oda e burrave* (Gathering room of men)**

The main room in every kulla is *Oda e burrave*- the gathering room of men, which is always located in the top floor. Only men of the family hang out in this room- women are never allowed- not even when men are not in the house. Single men and guests sleep in this room during nights. Thus, this room has a separate entrance from outside. Oda e burrave is quite big but not high; it usually has two windows next to each-other, with dimensions 60:80 cm, looking through the yard, and rarely through the road. The windows have double casements of strong timber. In front of the door, there is the fireplace, which apart from practical function, plays a big role in esthetic visuals. The fireplace ends with an arch[79] and a narrow cabinet above. In some cases, this part of the fireplace is made out of a big stone piece, carved skillfully.

The fireplace, as the most functional element in the whole interior, is given special importance, especially its shape, for the construction of which it is spent the most. It is usually built from skillfully carved stone. These stone blocks are often decorated by carving ornaments of various shapes. A good craftsman was hired for its construction, if the family itself did not have a talented craftsman. This functional decorative element in the guest room is lit every time the guest is in the room, whether day or night, summer or winter. At the edge of the fireplace there is also a small opening for spilling the water where the coffee cups are washed. [80]

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[78] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri*. Unpublished book, p.72.

[79] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.346.

[80] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.70.

Some kullas had only one fireplace, while others had one per each floor. The greatest kullas though, initially had their fireplaces in the middle of the room, and later in a type of a chimney, placed in each room. [81] In the period between two world wars, the iron stoves substituted the fireplaces. [82] Even today, a lot of kullas use the iron stoves for heating.

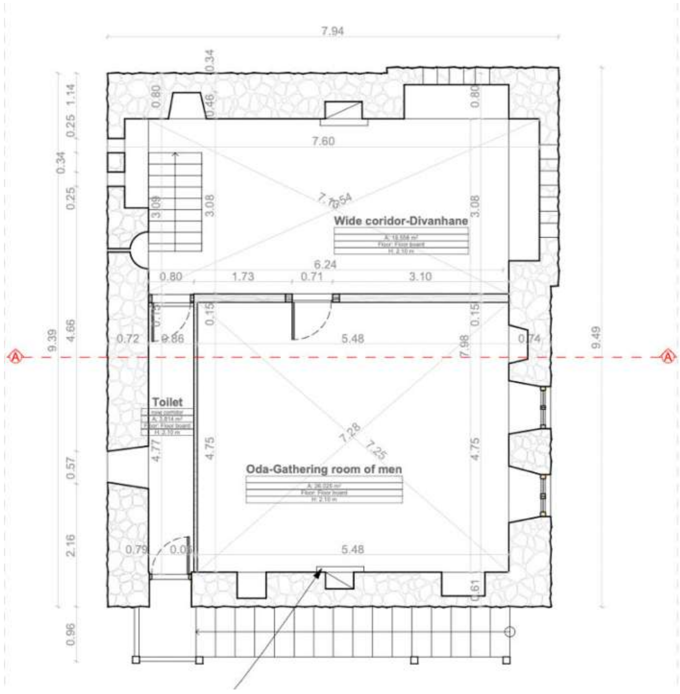

Fig. 24 The top floor of the Kulla of Isuf Mazrekaj

From the door up to the fireplace, there is an area 1 m wide, paved by compressed soil or timber boards. This part is called "*arallak*" or "between timbers". In two sides of *arrallak* are laid the "*cerga*", "*shilte*"- hassock- low mattress or rugs "*çilima*", which have straw of hay underneath. Usually, one cerga is bigger and more beautiful (laid adjacent to the windows- because there is lighter) than the other. At the more beautiful part sit the more honored and distant guests. At the bottom part of the wall, above *cerga*, are placed woolen cushions, embroidered with folk details and various colors. The big *cerga*, close to the fireplace also so called the "front of the fireplace" is reserved for the most honored guest, first of all for *bajraktar* or the eldest of a tribe. Guests sit crossed-leg next to each other. On the other side of the fireplace, sits the owner of the house. In this wall there is a small cabinet for teapot or coffeepot. In the end of the room there is a bigger wall cabinet, which serves for keeping the bed sheets. Cabinet doors and the

[81] Henry F. Tozer (1869) *Researches in the highlands of Turkey; including visits to Mounts Ida, Athos, Olympus, and Pelion, to the Mirdite Albanians, and other remote tribes*. Vol 1. University of Michigan.
[82] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.348.

room door are often skillfully carved with various motifs or painted in different colors. There are also other cabinets in this room, for keeping the dishes when there are guests, sometimes even partially open through the *divanhane*, so that women can leave the food without entering inside. [83]

When there is no such cabinet, women knock on the door and leave the food outside. This is directly linked to the patriarchal system of the time, where women were not supposed to be seen by strangers. Below the ceiling, around the walls we sometimes encounter timber shelves, where glasses, small bottles, copper or porcelain plates are held, but often apples and quinces are also found. In the end of the room there is the wall hanger which was used for hanging the weapons. In the walls are also hanged the petroleum lamp and folk musical instruments, such as lute- *lahuta* or *çiftelia me dy tela*. Oda e burrave in general represents harmony, cleanliness, and order, and is usually the same in all kullas- this is because Albanians have more or less the same lifestyle and traditions. [84]

Based on the functions, this area is separated into three special spaces: the guest room- *mysafirhanja*, the entrance hall or so called "*divanhane*", "*dysheklllëk*", "*çikma*" and the toilet. The guest room is quite big, about 50-60 m2, and has a rectangular plan. The height of this room is quite low, about 220-235 cm, since the guests always sit on the floor cross legged. The floor is usually built by thick timber boards, and very often beneath them is lied a layer of pressed clay, which serves for thermal insulation properties. The ceiling of this room is completely made of timber boards. Above these boards a layer of pressed clay is placed, which served as a thermal insulation layer, and it keeps the interior warm during the winters. There are no other details in this ceiling. [85] All the walls are plastered in lime mortar, and then lime washed.

In addition to welcoming family friends or deliberate travelers, family ceremonies are also held, and in *Oda e burrave*, at night the guests sleep together with the important leaders of that family. [86] Most common events are dinner parties just for the pleasure of having a guest. The guest rooms are the social centers of the village, and a certain amount of competition takes place over

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[83] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.348.
[84] Ibid. p.340.
[85] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.68-69.
[86] Ibid. p.70.

which is the most generous and popular. To have an open guest room is highly esteemed. A family investing in this hospitality can expect respect from the village. [87]

Divanhane **(Wide corridor)**

In the first floor, there is a wide corridor (*divanhane*), that looks like a hall. Along the wall of *divanhane* is a platform with wide timber boards, in a height up to 1-1.5 m, which is used by family members during the summer to stay or sleep. In this height the walls are often extruded in the facade as a balcony. This part of *divanhane* is so called *dysheklläk*, it has a dozen of small arched windows next to each other. [88] These windows not only create a happy feeling in the interior of the *divanhane*, but together with the protruding wall outside the gallery are the only elements that softens the cold and rough ambient that stones might create. From the inside, these windows look like lighthouses that want to bring as much light into this space that is otherwise in semi-darkness. [89] In some kullas the *dysheklläk* is constructed by thick chestnut timber boards[90] or Turkish oak, often carved with geometrical shapes or lines- contributing as such in the esthetic values of this sort of buildings. In some cases, *dysheklläk* is a hybrid of baked bricks and stones or only stones (The most typical construction of *dysheklläk*- also in Plavë[91]). Kullas with timber *dysheklläk* are the oldest ones. In a wall of divanhane (not the main facade of the building) we encounter a shallow cabinet half a meter high, where dishes are kept. In the end of this cabinet there is a hole for water flow- made out of pipe or stone slate and it gets a bit out of the exterior wall, so that the wall doesn't get wet. This place is so called *abdeshane*, i.e., a sink where family members wash their faces and hands. In some *divanhane* we encounter a small fireplace used to make coffee during the summer. In a part of this area the low- big round shaped timber dining table (Alb: *Sofra*) is hung. In a lot of kullas, *divanhane* has no ceiling. In cases of feasts, people leave their shoes in *divanhane*. From *divanhane*, one can access a narrow but long corridor, which is between the *Oda e burrave* and exterior wall- to access the toilet, whose walls are extruded in the facade. Sometimes these toilets are extruded

[87] Berit Becker (2003) *Behind stone walls: Changing household organization among the Albanians of Kosova.* Peja: Dukagjini Balkan Books, p.45.
[88] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.345.
[89] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.71.
[90] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.345.
[91] Halil R. Markišić (2016) *Kulturne vrijednosti Plav.* Rožaje: Priroda i baština, p.65-67.

as a console and in other times they are built from the foundations of the kulla.[92] The toilet had no pipes, but only a hole in a floor. [93]

This room is also the first contact of the guest with the guest room, because in this environment it is reached by timber staircase coming from outside, the entrance of which is sometimes closed with a wooden lid. This is not only a connecting room, but it is also a space where sometimes various household works are performed, while during the summer, it is a very desirable place for rest and sleep, because it is full of small openings, and because there is no ceiling but only the canopy, which creates a natural ventilation and a pleasant breeze. The space is poorer in terms of decorations if compared to the guest room, although as a whole, it represents an arranged and very beautiful space. *Dysheklläk*, not only serves as a place to sit and relax, but also the bed sheets are kept there. [94] It should be mentioned that *divanhane* has the most shooting holes in the walls because this part of the building is the most suitable one for passive protection, and in some cases, there are special channels for throwing boiled water in case of danger from the external enemy. [95]

Stairs

Two pairs of stairs in a relatively small building were built simply for practical reasons, not for religious customs, especially if we consider that the villagers of these areas belonged to all three religions. Then, we should not forget the fact that Albanian women of any religious denomination, have never hidden from men, that is, i.e., they never wore a headscarf. The external stairs (or as the villagers call them "guests' stairs", were built simply out of respect for the guests, because, the Albanian guest is sacred, and the doors of the guest room, according to unwritten customary law, must be always open to guests - day and night. [96]

3.4 BUILDING MATERIALS AND TECHNIQUES

Kullas were built by vernacular materials. Considering that the mountainous areas in the cross-border region of Kosovo, Albania and Montenegro were rich in stones, the structure of these

[92] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.346.
[93] Baron Franz Nopcsa (1925) *Albanien: Bauten, Trachten und Geräte Nordalbaniens.* Berlin; Leipzig: Verlag von Walter de Gruyter & Co.
[94] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.70.
[95] Ibid. p.71.
[96] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.59.

buildings were always built by locally provided stones. The main part of the wall consists of round shaped stones, presumably collected from nearby local riverbeds.

Other locally provided materials for these buildings were timber, mud and bricks. In some cases, Kullas are also built of bricks or the combination of stone-brick where the ground floor is built of stone and the other floors in brick with various patterns. The bricks used are usually handmade- Khorasan bricks baked in kilns made of sand, chalk, water, and a little cement or sometimes mud bricks. The material used for the interior walls or partitions is mud bricks, with the mud also used as a binding material or wood.[97] Lime mortar was also used as a binding material of the stones, but also a plaster in interior walls.

Building a kulla was a job that could take up to 2-3 years. [98] Extremely thick stone walls- the main load-bearing structure- which gradually decrease by reaching 60-70 cm in the upper floor stand on even thicker stone foundations (about 100 cm)[99]. The stones were all carved, with straight and smooth angles - especially the stones of the doorposts, some stones of the corners of the walls, etc., were also carved with pagan ornaments and symbols, but also religious - Catholic and rarely Islamic- as well as door arches. The corners of the walls are constructed by hewn stones, as are the frames of the windows and doors, as well as the extruded gallery. In some villages (Nivokaz, Junik etc.) for these architectural details was used a sort of a "pink" stone. This combination, i.e., the mixture of white and colored stones gives these kullas a special charm, and when the gallery with a series of small windows of an extraordinary effect is added, the whole aesthetics of the external volume of these masterpieces of folk architecture shows up. The plan of kullas can be 8x8 or 9x10 meters, which corresponds extremely well to the overall height of the tower, and ranges mainly from 8 to 10 meters.[100] In different areas, such as Dukagjini plain, Dukagjini region, Kelmendi, Tropoja, Puka, etc., the layouts of kullas were mostly rectangular, and less often in L or T shape - in the case of attached kullas or additions - when the family expanded. The thickness of the walls depends on the number of floors they will support, so there are usually no walls below 70-85 cm in such kullas, and in

[97] Sahar Rassam (n.d.) *Kulla: A Traditional Albanian House Type in Kosovo*. p.3, Available at: http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=03285B6CA27E665B3EE00C8FF61F382F?doi=10.1.1.558.4302&rep=rep1&type=pdf.
[98] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.
[99] Mark Krasniqi (1979) “Kulla në Rrafshin e Dukagjinit”, *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.344.
[100] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri*. Unpublished book, p.62.

some cases even 1 m. The stones were bound with mortar made of lime and sand, but they were also filled with pebbles.[101]

Timber was also used to increase stability and elasticity by laying horizontal layers of oak or chestnut wood every 80cm to 120cm that are connected with shorter binders through the thick walls. This helps the structure in case of emergency and helps to distribute the load.[102] Usually the stairs are made out of wood- sometimes with mason structure, and in some cases are covered by a canopy, to protect them from rainfalls. [103] The reason behind the use of timber was again defense from an enemy, where, in case of attack or emergency, the timber staircases can be burned before the enemy would try to reach upper floors.

The vertical division is done by constructing the grid of wooden beams finished with wooden planks or decorative elements. Also, in some cases, floors were constructed from tree trunks.[104] These floors and columns help transmit the loads to bearing stone or brick walls followed by the foundations. Wood is also used as a wall or a partition to divide interior spaces into rooms, door and window frames, decorative elements in the interior, cupboards, and staircases. Chestnut, pine,

and beech are most used.[105] The roof construction is built by timber, which gives the hipped roof profiles.

In different areas of Kelmendi, Dukagjini, Tropoja, Puka, Mirdita, etc., the initial roofs were small in angle and covered with stone slabs. Even nowadays, in some areas of Mirdita, Mat, Dibra and Kukës have a lower angle and are covered with stone slabs or roof tiles.[106] Kulla in

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[101] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

[102] Jaeger-Klein C., Kryeziu A., Mamani E., Thaçi K. (2019) *Traditional Residential Architecture in Albania and Kosovo – Mason-Carpenter Structures and Their Future Restoration*. In: Aguilar R., Torrealva D., Moreira S., Pando M.A., Ramos L.F. (eds) Structural Analysis of Historical Constructions. RILEM Bookseries, vol 18. Springer, Cham. https://doi.org/10.1007/978-3-319-99441-3_219

[103] Mark Krasniqi (1979) "Kulla në Rrafshin e Dukagjinit", *Gjurmë e Gjurmime,* Prishtinë: Instituti Albanologjik i Prishtinës, p.344.

[104] Sahar Rassam (n.d.) *Kulla: A Traditional Albanian House Type in Kosovo*. p.3, Available at: http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=03285B6CA27E665B3EE00C8FF61F382F?doi=10.1.1.558.4302&rep=rep1&type=pdf.

[105] Jeta Limani (n.d.) *Kulla of Mazrekaj family in Dranoc: A Management Plan for a Sustainable Cultural Tourism Development*. p.6, Available at: https://www.hdm.lth.se/fileadmin/hdm/alumni/papers/CMHB_2007/Kosova___Jeta_Limani_-_Kulla_of_Mazrekaj_Family.pdf.

[106] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

Dukagjini plain are also constructed by a low hipped roof less than 30 degrees, usually covered by hollow roof tiles.

However, in North Albania and in the region of Plavë and Guci[107] because of other atmospheric conditions- the higher sea level altitude then in Kosovo, higher angle of roof was used to cover the structure of kullas- as an easier method to remove the snow naturally.

Increasing the angle of the roof made it more difficult to cover it with stone slabs, but easier to maneuver with timber planks- so called *shiklla* or *furde* in Albania and Montenegro- mainly the "red" heart of the black rock pine. Residents of Dukagjini, for example, recall that until recently, for the preparation of some key elements of kulla, such as beams, etc., only the heart of the tree was used, which has more resin and has a longer lifespan, because the other layers of the trunk were used for less important items, such as household furniture, etc. Cut only with an ax, *furde* were thick timber planks, 1 m long and 30-40cm wide. [108] Roofs in the area of Plave and Guci- depending on climate conditions- demands a minimum 45˚. [109]

3.5 CRAFTSMEN AND BUILDERS

Along with many other factors, which have influenced the development of folk architecture in general, the folk architect has played a special role in this important activity. In particular, the traditional building schools of some areas have significantly contributed, which have long been known not only in this region of Balkans, but also beyond. Talented craftsmen from Dibra and Lunxhëria in Albania and other countries have constructed buildings beyond the Balkans, from the simplest to the most complex. Apart from other constructions, they also left their traces in the vernacular heritage of Albanians- kulla.[110]

Austrian Consul, Th. Ipen, wrote: *"As in most of the Balkan Peninsula, as well as in Albania, houses were built mainly by craftsmen and workers from the vicinity of Dibra of the Black Drin, who since the ancient times were engaged in masonry, stone carving, wood carving or carpentry."* The craftsmen from Dibra- he continues - although empirical and build according

[107] Halil R. Markišić (2016), *Kulturne vrijednosti Plav*. Rožaje: Priroda i baština. p.65-67.
[108] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania.* Ilucidare project. Unpublished research report.
[109] Halil R. Markišić (2016) *Kulturne vrijednosti Plav*. Rožaje: Priroda i baština. p.65-67.
[110] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri.* Unpublished book, p.111.

to the ancient style, however, the more experienced ones *"can easily build European projects"*.[111]

According to another author, the inhabitants of the suburbs of Dibra, Struga and Ohrid were mainly engaged in these crafts, and in particular the inhabitants of the villages of Tërnova, Okshtuni, Zebishti, Borova, Zabzuni and the Golobërdo site. This also applies to the village of Çermenikë in the northwest of the district of Elbasan. [112]

The Bulgarian author M. Bičev, speaking about the teachers of the famous Bulgarian craftsman N. Tuçev, mentions Albanians as stonemasons [113] , while the Greek author A. Handzimichalis also mentions the craftsmen from the district of Korça. [114] The well-known Greek researcher, N. C. Moutsopoulos, wrote that the main centers of craftsmen were in the regions of Dibra (Debreli moistar), Pinde, Evrosa, etc. [115]

The craftsmen worked in groups, usually with 15-20 members, led by the main master *(ustabah)*. In this group they also hired other workers, who usually were the cousins or sons of the craftsmen. After 2-3 years of helping, they started to professionally work on constructions. Every craftsman was obliged to have his horse or mule, or otherwise the main master would pay him less. *Ustabah, on the other hand* had a dozen of mules.[116] *Ustabah* was the main figure in the whole process of buildings. He was in charge for leading the group of craftsmen, dealing with the investor, paying the craftsmen, but also working in the hardest architectural details of the building. In one word, he was the main architect of the whole construction.[117] In the past, investors provided only the timber, while every other material had to be provided by the craftsmen. Precisely for this reason each craftsman in the group was obliged to have his own mule, so that they could carry the right material for the construction of the building. In addition to that, mules also served as a mean of transport for the craftsmen. [118]

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[111] Theodor Ippen (1907) *Skutari und die Nordalbanische Küstenebene*. Sarajevo: D.A. Kajon.
[112] Johann Georg van Hahn (1853) *Albanesische Studien*. Jena: Verlag von Friedrich Mauke: Druck der kaiserlich-königlichen Hof- und Staatsdruckerei in Wien, p. 43.
[113] Milko Bitschev (1961) *Die Architektur in Bulgarien*. Sofia, p.75.

[114] Angelikē Chatze¯michalē (1949) *La maison grecque*, Athens.

[115] N. C. Moutsopoulos, *et.al*. (1985) *L 'architecture vernaculaire dans les Balkans*. Paris: UNESCO, p.5.
[116] Agush Beqiri (2022) *Arkitektura popullore: Enterieri dhe Eksterieri*. Unpublished book, p.112.
[117] Ibid. p.112.
[118] Ibid. p.113.

Although they built a lot of settlements, these craftsmen never left any written record, thus it is very difficult to know who built what and where. Very few information is known about the names of the craftsmen and their building signature. Kullas in Strellc (a village between Peja and Deçan) were built by Ahmet Dibra, while the master Adem Dibra, built the famous kulla in Lower Istog

(Kulla of Bajra family). Kullas in Junik and Nivokaz were also built by craftsmen from Dibra, for example, in Nivokaz a group of craftsmen worked under the leadership of Ibrahim Dibra. Master Jakup Dibra and Sadik Dibra built in the vicinity of Deçan. However, the kullas of Dukagjini were built by craftsmen from other areas, for example: Goga, Sirinіç and Srezska (from the vicinity of Prizren), but also local craftsmen (Nimon Bajram Golubovci, etc.). Otherwise, craftsmen from Goga have worked in Shkodra since the 16th century. Craftsmen from Dukagjini were known more for wood carving and musical instruments. As far as the interior decorations are concerned, especially wood carving in ceiling and cabinets, craftsmen from Shkodra or so called "The school of Shkodra" were mostly known. [119]

3.6 SUSTAINABILITY OF KULLA AS PERCEIVED BY BUILDERS

Regarding sustainability of historic buildings, the prevalent idea among communities is that old buildings are less energy-efficient and costlier- both financially and environmentally- to maintain. Destroying old buildings and constructing new ones therefore, seem more practical than repairing and maintaining old buildings.[120] However, historic buildings have shown to be sustainable in terms of their construction and footprint in the environment. Research conducted so far about the kulla type of dwelling shows that these buildings were constructed by taking into account sustainability, in terms of the use of local materials, the adaption to the terrain, the orientation towards sun, the use of thermal mass, the use of minimal spaces, as well as natural heating and ventilation. Moreover, the family household has always used locally grown food, by cultivating agriculture and livestock, thus the concept of "slow food" was introduced in these buildings a long time ago.

[119] Ibid. p.115-117.

[120] Wills, C. (2013) *Historic Buildings and Environmental Sustainability*. ADEC Innovations ESG Solutions. Available at: http://info.esg.adec-innovations.com/blog/bid/320036/historic-buildings-and-environmental-sustainability.

A lot of factors have impacted the emergence and development of the traditional architecture in the ethnic Albanian territory, precisely in the construction of architectural buildings of the 18th and 19th century. These factors depend on the location of these buildings and can be divided in two groups: physical-geographical factors and social-economic factors.[121] The main factor that effected the construction of these buildings, is the terrain configuration, which impacted not only the orientation of the buildings themselves but also of the ensembles. The social factor is emphasized especially in *kulla*s as fortified Albanian existential buildings. However, nature is conceived as one of the main factors that directly impacts the methods of construction, specifically building materials and adaption to climatic conditions.[122] This being said, is the reason that kullas in the North Albania and Plavë and Guci have a higher pitched roof in comparison to those located in the Dukagjini Plain, because of the higher altitude location, i.e., colder weather and snowy winters.

Traditional masonry and stone buildings have a high thermal mass. In summer months, the high thermal mass building slows the transfer of outdoor heat to the inner cooler surfaces of the building, allowing a comfortable internal temperature. In winter, the high thermal mass building stores the daytime heat from both the sun and any heating system and re-radiates it at night. Heritage buildings of masonry construction or buildings with timber floors were designed to allow natural ventilation to reduce dampness. Many heritage places have been passively designed whereby the combination of building materials, orientation, sunlight and shade, and ventilation assist to maintain thermal comfort without the need for mechanical heating or cooling. [123]

Kullas in these villages were mainly built by natural local materials, stones and timber. Structurally, they have simple cubic or parallelepiped shapes with small openings and in many cases an extensive footprint. Their durability derives from the simple shapes that can withstand dynamic loads (earthquakes) and the quality of the craftsmanship of the masons and carpenters. Timber is used for structures bearing the floors, for the flooring, and roof structure. Furthermore, timber used in interiors and mainly roofs has proven to cause considerably lower

[121] Fejaz Drançolli (2001) *Kulla Shqiptare*. Prishtinë: Grafika Rezniqi, p.25-26.
[122] Emin Riza (2009) *Qyteti dhe banesa shqiptare shek. XV- XIX.* Tirana: Ministria e Turizmit, Kultures, Rinise dhe Sporteve. Instituti i Monumenteve te Kultures. Botimet “Dita 2000”, p.156.
[123] Heritage Council of Victoria (2009) *Heritage buildings and sustainability.* Technical leaflet. Available from: www heritage.vic.gov.au.

climate impact than other materials such as steel and concrete. Unlike the later materials, which emit CO2 when produced, trees used to make timber products naturally absorb and store CO2 as they grow. In addition, the thermal performance of timber minimizes heat island effects and increases the thermal comfort of buildings, by also notably lowering the need for mechanical cooling systems.

Kullas walls, on the other hand, are usually 70 up to 100 cm thick and they tend to narrow in upper floors. These walls are stable and provide thermal insulation, meaning they keep the rooms cold during summer and hot during winter. The rooms are quite small, the height ranges from 2.10- 2.20 meters.

This height of rooms is quite economic, a typical example of building rooms reminiscent to medieval dwelling rooms.[124] In addition to that, the cabinets are inserted in the walls leaving the rooms quite spacious with the intention to looking bigger. Windows widen in the interior by enabling a better distribution of daylight.[125] The orientation of Kulla is also decided based on the region's climatic conditions. During the Ilucidare Capacity Building in Valbona, Albania, most of 70 kullas mapped, had their entrance oriented towards the south-east. This helps in getting more sunlight as the overall structure of Kulla has a homogeneous facade with significantly fewer openings.

Drawing from the rationale on sustainability aspects of kullas, the research conducted in this dissertation, focused on case studies of kullas in the three countries, analyzes in depth the most vital aspect of their sustainability, being the thermal comfort, by direct calculations methods.

[124] Dušan Grabrijan (1978) *Razvojni put naše savremene kuće*. Beograd: Građevinska knjiga.
[125] Fejaz Drançolli (2001) *Kulla Shqiptare.* Prishtinë: Grafika Rezniqi, p.138.

4. VALUING KULLAS

4.1 SOCIO- CULTURAL LIFE

The construction similarities of kullas rises due to the similar way of life of Albanian people in these territories, not only in terms of socio- cultural but also of economic features. The structure of the Albanian family represents a large patriarchal family, which means the coexistence of at least three generations in the same house, that are blood related, namely a family consisting of parents, their married sons and their nephews. The family is also distinguished by a structured organization with a highlighted rule and hierarchy, typical for a patriarchal society, which in the case of Albanians is based on customary law known as *"Kanun (Code) of Lekë Dukagjini"*. This structuring and organization of families is also reflected in the structure of Kulla as a residential building. The Code of Lekë Dukagjini is a very sophisticated and elaborate set of rules that governed parts of the northern Albanian territory as well as Western part of Kosovo. It used to be a customary code which was unwritten and subject to constant change as popular legal practice developed. The reflection of socio-cultural life of Albanian people in the emergence and existence of kulla is described in the following chapters.

The social and cultural life of Albanians has been regulated according to a customary right, which has diverted into a patriarchal order. This sequence is revealed almost in all spheres of life, and especially in Oda e burrave, which was the main family identification area. This chamber, in some ways, has represented the identity of the kulla itself. The design of this room was structured in a way that it determined the social status, age, prestige, namely the family and social hierarchy. Although only one area, *oda* was divided into two sides, the big side (*cerga e madhe)* for the guests and the small side (*cerga e vogël*) for close relatives and family. The big side, located on the right, was reserved only for guests, and the lord of the house who always sat next to them. Halimi, a resident of Isniq village says: *"The oldest ones were always asked to sit on the large side (cerga e madhe). The small side was for acquaintances from the village."* The area between two sides, is known as a neutral place. According to Halil from Drenoc: "*If you happen to sit sit there, and you make any mistake while talking, it is not such a big deal, since it is precepted as a neutral place"*. However, it is not the same if you sit on *cerga e madhe*. According to him, *"If you by any chance speak of something not accepted by oda, and you happen to be seated in the front of the fireplace, you are immediately concepted as either smart* *or dumb. If you are wrong, oda will tell you that".*[126] Moreover, the sitting order in oda has also reflected the order of speaking, this order, among other things, is respected and guests were very careful to remain silent while someone was speaking. According to Halil, it was a rule of oda that: *"when someone was given the word, there other had to listen, it was forbidden that people talk altogether..."*[127]

This aspect of protocol, formally placed in the code of conduct, which is closely related to the method of positioning in an architectural space, sublimes the most important spiritual value embodied in architecture.

Oda has also served for various festive and mortar events and ceremonies. Often, mortal ceremonies are still organized in kullas, whereas weddings quite seldom, because nowadays they are being organized in restaurants.

"We gather when we have mortal or wedding ceremonies, although recently quite a few weddings are being organized in kullas. The elder people still try to preserve those traditions, because we grew up in kullas and we can't live differently than by respecting the rules of oda." Halili, Dranoc.[128]

Oda had multiple functions, by playing an important educational, social and political role. Even in important historical moments, this room has been the place where important assemblies have been held and major decisions have been made. Important meetings were held there, which preceded important historical events- political and social. The meetings of the country's leaders in the preparations for the popular uprisings that lead to the Independence of Albania are well known. Even in the 1990s, when the Serbian occupier forcibly removed Albanians from public schools, many kullas were turned into parallel schools (*shtëpi- shkolla*). Also, in the absence of public institutions, during this time, important meetings and gatherings were held in odas, both political and organizational, as well as judicial ones. [129]

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[126] CHwB Kosovo, Institute of Albanology Kosovo and Faculty of Anthropology/ UP (2021) *Kulla as a changing heritage and as a continuation of tradition*. Ilucidare project field research report.
[127] Ibid.
[128] Ibid.
[129] CHwB Kosovo, Institute of Albanology Kosovo and Faculty of Anthropology/ UP (2021) *Kulla as a changing heritage and as a continuation of tradition*. Ilucidare project field research report.

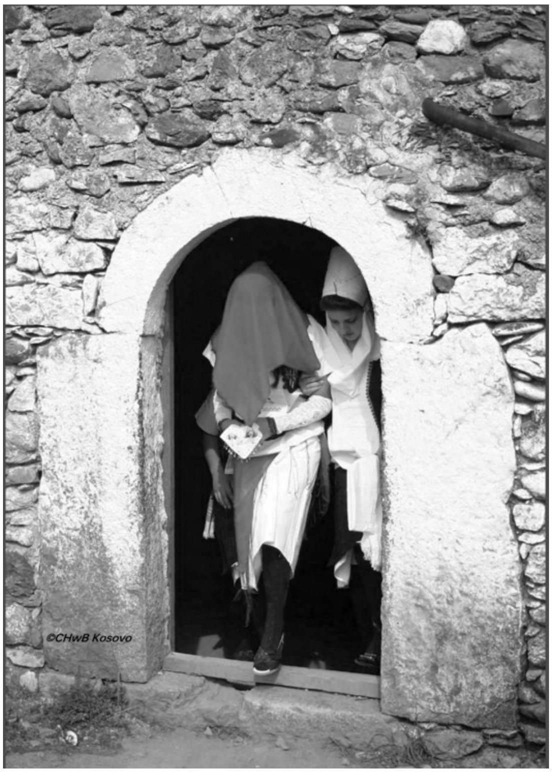

Fig. 25 Wedding in a kulla in the Dukagjini region (CHwB Kosova, 2005)

Historically, in the social and political structure and organization of Albanians, the village has been led by a leader, the head of the village, the main elder (*kryeplak*) and elders.[130] The eldership consisted of the elders of the various neighborhoods, who represented the village as a whole in the village assembly. And this body, according to Berit Backer, was *"a group of men with experience, knowledge and time to deal with community issues and discuss laws, rules and issues of social conflict."*[131] Many reconciliations of troubles and bloodshed have been made in *oda* and *kulla.* Oda has also vastly contributed to important historical, political and social events. Important historical figures, such as: Isa Boletini, Hasan Prishtina, Bajram Curri, Richard Holbrooke, and important figures of the UÇK (Kosovo Liberation Army) stood in these premises.

Regarding the spatial importance inside kulla, immediately after the men's room comes the house of fire. We often hear it called *"shpia e robve"*, a name which is connoted with the women

[130] Kahraman Ulqini (2003) *Struktura e shoqërisë tradicionale shqiptare*, Shkodër: Idremeno.
[131] Berit Backer (2003) 2nd ed. *Behind the stone walls. Changing household organization among the Albanians in Yugoslavia*, Pejë: Dukagjini.

and children of the family. But, as Mark Krasniqi points out, *"in the practice of everyday life, the fire house is of paramount importance,"* since food is prepared there. [132]

During the interviews in 14 kullas in Isniq, both men and women narrated about the house of fire, mostly based on their living experience, and some based on a memory of oral narratives from the elder relatives. Worth mentioning here, is the extremely difficult position of the woman, conditioned by the way of a very difficult life, in conditions when the fire, bread, dishes, and clothes, were taken care of by hand and mechanically, when food had to be prepared for many family members, so preparations started as early as 3 or 5 o'clock in the morning, depending on the size of the family. However, some of the elders (men and women) remembered this time with nostalgia and appreciated it for the order and discipline that prevailed and the harmony, solidarity and mutual respect they enjoyed. As a value from that time was emphasized the quality of bio food. [133]

In general, it can be said that the "house of fire", in its traditional form no longer exists, even in those few restored kullas, but the practices developed in it and the traditional cooked food continue to be practiced. Saç (for making *fli*) is one of few traditional utensils that is still used.

In the house of fire, the role of the woman is not limited to food preparation only. Being at the same time a living room for them and children, women also used loom for weaving textile. However, only few women still practice this handicraft in the villages. In the past, women wove clothes for their families, and even when they sold the products, the money was always used for the family needs.[134]

4.2 KULLA AS ECONOMIC RESOURCE

Speaking of economy on the other hand, in the Albanian society, agriculture and livestock continue to be the most important sectors in economic life and as the main source of well-being.

In the Dukagjini Plain, the pastoral economy along with agriculture, has been an important resource for the household economy. During spring and summer, the shepherds kept the cattle in the mountains, for grazing and, only in the early spring, they grazed them in the pastures of

[132] Mark Krasniqi (1979) “Kulla në Rrafshin e Dukagjinit”, *Gjurmë e Gjurmime*, Prishtinë: Instituti Albanologjik i Prishtinës, p. 330.
[133] CHwB Kosovo, Institute of Albanology Kosovo and Faculty of Anthropology/ UP (2021) *Kulla as a changing heritage and as a continuation of tradition*. Ilucidare project field research report.
[134] Ibid.

the village. Along with the shepherd went his wife, known as *baçicë*, who took care of the milking of the cattle, specifically the preparation of dairy products. Dairy was usually stored in wood keg, throughout the pastoral phase. Considering that traditional foods have dairy as their main ingredient, the process of its production and preservation was also of great importance. All the milk collected in the mountains was used for the rest of the year.[135] During the field research, it was understood that the pastoral economy is also widely used in the North Albania and Plavë and Guci.

Living in large commune, families had the opportunity to deal with both, agriculture and livestock. Most of the family members were engaged in agricultural work, while the shepherd and his wife (when the family was larger in number and had more cattle, especially sheep, more members were engaged), and children went to the mountains. Beans and wheat were among the most important agricultural crops. Also, considering that these villages have traditionally dealt with both agriculture and livestock, using each other as a complement, the meadows are also of great importance.

Fig. 26 Sheep shearing in Zllonopoja Mountain, Isniq (Tahir Latifi, 2011)

The traditional economic life, still preserved even nowadays, is reflected in pristine and mainly untouched rural landscape of kullas. Albanian villagers still cultivate agriculture and livestock, although, kullas are not the main socio-cultural and economic base. However, these relicts shape the rural fabric and are still the main living artefacts.

[135] CHwB Kosovo, Institute of Albanology Kosovo and Faculty of Anthropology/ UP (2021) *Kulla as a changing heritage and as a continuation of tradition*. Ilucidare project field research report.

4.3 STATEMENT OF SIGNIFICANCE

Kullas in the cross-border region of Kosovo, North Albania and Montenegro represent multilayered heritage assets that represent the identity, traditions and historical-social image of Albanian people. Starting from their emergence, kullas have not only served as fortified residential buildings, but they were institutions that hosted various meetings and assemblies aiming to solve social and historic issues that arose in the time of their existence. Kullas were areas of sporadic celebrations and mourning. They crystalize the everyday life of people living in them, who inserted the spirit of place, which is still quite visible, not only by the remaining artefacts and structures but also throughout collective memories and narratives. Kullas still remain one of the main nostalgic stories that keep being narrated and their stories keep being transmitted to the youth.

History, being the main point in the social life of Albanians, is directly linked to kulla. Being over 200-years old, these relicts were a testimony of historical events of the Albanian territories. Their emergence is directly linked to the political situation, which continued throughout their existence. Socially speaking, kullas took their shape based on the system of life deriving from the Code of Conduct (Kanun of Lekë Dukagjini). This means that these buildings are not regular residential houses, since their function was designed by taking into account patriarchalism, hospitality, political state of Albanians, family structure, local availability of materials and adaption to the context.

In terms of architecture, kullas represent fortifying structures, not as singular buildings but also as complexes, which has impacted the use of strong materials, thick structures and a very few openings. The mastership of craftsmen from Dibra, the use of locally available materials and the interaction with the rural context, also contribute to the sustainability of these structures. Finally, the spatial figure of the stone tower is the basic stereometric shape: the cube. The height of the entire tower is 3 floors by 3 meters and 1 meter for the ceiling, a total of 10 meters. So, the whole spatial shape of the tower is a cube of dimensions 10 x 10 x 10 m: the ideal stereometric stone crystal.

4.4. KULLAS POTENTIAL FOR ASCRIBING UNIVERSAL VALUES

However, the values of kullas are not only locally and regionally celebrated but they are also universally justified in terms of authenticity and integrity. In the Master Thesis of Ragini

Karmakar “A Feasibility Study for a Serial World Heritage Nomination of Kulla in Western Balkans”, as part of her studies at KU Leuven, where I acted as a co-promoter, the universal values of kullas type of dwelling in the Albanian living territories, based on UNESCO Outstanding Universal Value criteria, have been analyzed and proposed, as described below.

Criteria (iii) Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared:

The property bears exceptional testimony to the existence of Kosovar and Military culture that developed in the Western Balkans as a result of unrest during the decline of the Ottoman period in the 17th Century. The site gives a detailed image of the living conditions of the populations, providing unique knowledge of their hierarchical social development, code of conduct that guided the functioning of civilization, and interaction with nature to increase the degree of protection. Kullas are the symbol of the significant identity of the people of Kosovo, Albania, and Montenegro. The code of conduct and strategic location has contributed to a cultural specificity, expressed in its characteristic community structure, traditions, and fortress-like protection.[136]

Criteria (v) Be an outstanding example of a traditional human settlement, land-use, or sea-use, which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change:

Kulla is an Outstanding example of vernacular military architecture and its interaction with nature in the mountainous area on the border of Kosovo, Albania, and Montenegro. The main characteristic of this culture is the utilization of available land by masses for multifunctioning, dwelling and military purposes. The settlement provides excellent evidence of well-preserved remains of the stone structure that has survived multiple battles. The region is rich in biodiversity, rare species of flora and is surrounded by mountainous landscapes, a forest park, and four mineral water sources. When considered a whole, it provides an overall sense of architectural, historical, and environmental continuity that makes Kulla and its surrounding area the most impressive vernacular- multifunctional typology of Western Balkans. The relationship between Kulla and its environment have survived till today but is also vulnerable

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[136] Ragini Karmakar (2021) *A Feasibility Study for a Serial World Heritage Nomination of Kulla in Western Balkans*. Master of Science in Conservation of Monuments and Sites, KU Leuven. Unpublished Master Thesis.

to an irreversible change under the impact of the modern globalizing world and changing climatic conditions.[137]

Criteria (vi) Be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria):

Kulla, the vernacular typology itself, is the direct product of the historical unrest faced in the 19th Century, the decline period of the Ottoman empire in Western Balkans. They are the significant symbol of the insecure period. Kullas have survived multiple battles a recent as the war in 1998-99, which was more of ethnic cleansing where thousands of people were killed and millions were driven from their homes. The architecture of Kulla is a direct representation of the adapted way of living due to unavoidable circumstances. The region known as a rebel region, unchecked by the Ottoman authorities, gave birth to the traditions and beliefs – a self-administering social structure through a code of conduct, known as 'Kanuni i Lekë Dukagjinit'. [138]

<u>Statements of authenticity and integrity</u>

Authenticity:

The Kullas that are found in the region stays true to their original form and geographical location. No modern additions to the structures have been made to change the design that testimonies the Outstanding Universal Value. Instead, the exact layout and position have been maintained where the Kullas retain its initial architectural and aesthetical values. The use of local materials has helped in the intactness of the Kulla. However, changes have been performed, especially on the inside, only as a part of the conservation that does not harm the original state. The characteristics of the Kulla demonstrate excellent skills used by local builders that have determined the exceptional duration of the Kullas. The function of Kulla is no more extended as a defence; with the past and ongoing conservation efforts, some of them have been through the process of adaptive reuse, and others are partially used or still under the preservation process.[139]

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[137] Ragini Karmakar (2021) *A Feasibility Study for a Serial World Heritage Nomination of Kulla in Western Balkans*. Master of Science in Conservation of Monuments and Sites, KU Leuven. Unpublished Master Thesis.
[138] Ibid.
[139] Ibid.

Integrity:

During the 17th Century, the typology of Kulla emerged with the primary aim of defence. The overall structure is made out of locally available materials, with stone being used for the exterior walls that have never changed. Surviving against multiple battles, Kullas are still intact, retaining their architectural and aesthetical values. The fabric of Kullas and their surroundings are in good condition, well-maintained, and is not encroached upon by any other permanent structures. On the interior side, minor changes have been performed as part of the conservation efforts. However, they do not damage the integrity of the proposed site.[140]

Drawing from this, it can be stated that kullas have much more potential than they have been valued so far. Their universal significance could be authenticated by inscribing them as UNESCO transnational or transboundary properties under the cultural landscape category. This is at least the aim of the Ilucidare Project, and such issues were discussed in the Conference held in October 2021, in the city of Peja, Kosovo. During the presentations and workshops of the conference, it was agreed to start the work on preparing a nomination file for Kullas in Kosovo, Albania and Montenegro as serial world heritage sites.

This dissertation makes a contribution in this manner by establishing the main parameters for the preservation, protection, and management of kullas, which should eventually be incorporated in their Management Plan, as mandated by UNESCO. The potential for sustainable usage that will be enabled by the establishment of Kullas contextual standards, a goal pursued in this research, multiplies the chances that kullas in Kosovo, Albania and Montenegro will be nominated as serial world heritage sites.

[140] Ibid.

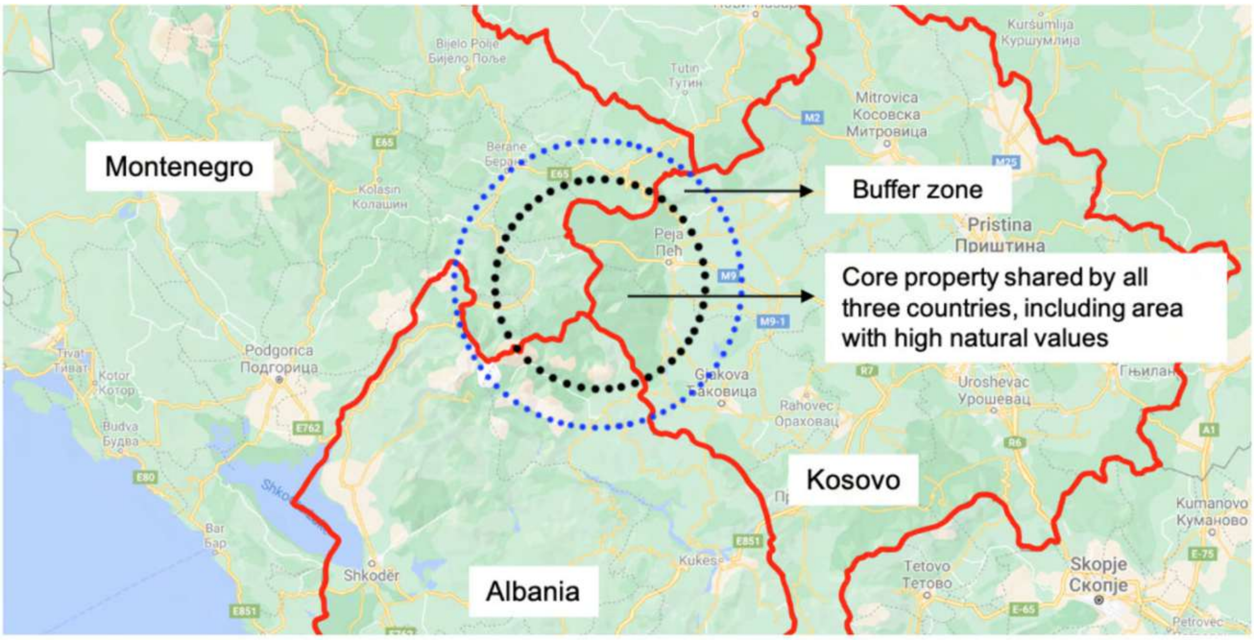

Fig. 27 Potential nomination of Kulla as a Transboundary Property under the Cultural Landscape category (Ragini Karmakar, 2021)

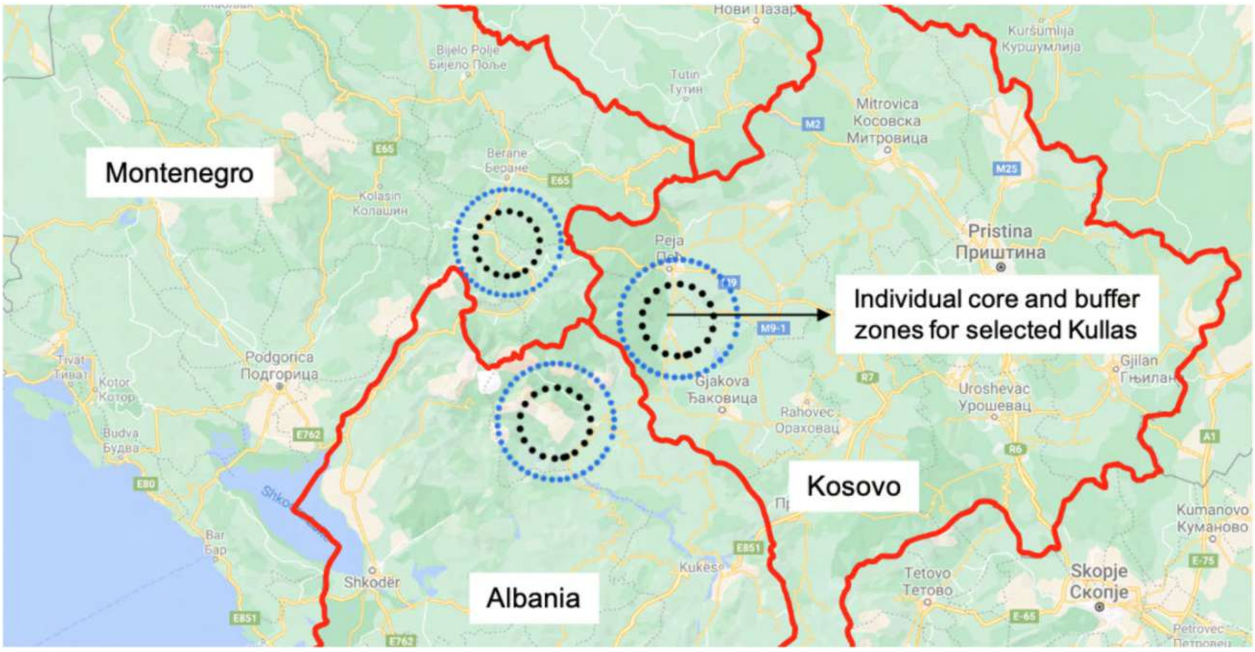

Fig. 28 Potential nomination of Kulla as a Transnational Property under the Cultural category (Ragini Karmakar, 2021)

5. CURRENT STATE

5.1. LEGAL PROTECTION

The protection of Kullas is of utmost importance for Albanians' cultural heritage and identity. Despite their values, only few of these buildings are designated as monuments and are under the protection of the states of Kosovo, Albania and Montenegro.

Around 160 Kullas in Kosovo are designated monuments in the List of Cultural Heritage under Temporary Protection of the MCYS- Ministry of Culture, Youth and Sport[141], and around 69% of them are located in the Dukagjini plain.

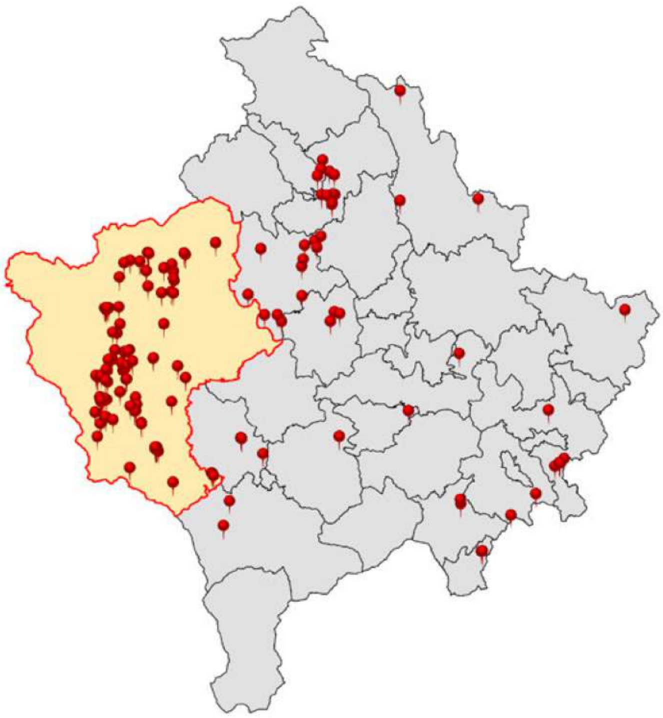

Fig. 29 The distribution of 160 listed kullas in Kosovo as architectural monuments (CHwB Kosovo, 2021)

On the other hand, there are 55 preserved kullas in the area of Plavë and Guci in Montenegro. However, only one of them- the Kulla of Rexhepagiq family in Guci is designated as a monument.[142]

[141] Ministry of Culture, Youth and Sport (2021) *List of Cultural Heritage under Temporary Protection.* Available at:
https://www.mkrs-ks.org/repository/docs/Regjistri_i_Trashëgimisë_Kulturore_-_Shqip.pdf
[142] Halil Markišić (2016) *Islamska Epigrafika u Plavu i Gusinju*. Rožaje, p.134-135.

According to the official website of the National Institute of Cultural Heritage[143], in Albania there are about 2212 cultural monuments of different categories, of which about 300 are in the 4 regions that make up the heart of the North-Northeast Region: Shkodra, Kukës, Lezha and Dibra. Among these monuments there are castles, bridges, archeological sites, museums, etc. Comparing this list with the sources from Regional Department of Cultural Heritage in Shkodra, we understand that the number of kullas or rural dwellings/ banesa in this region, which enjoy the status of Cultural Monuments are only 75. Despite their multilayered significance, most of the remaining Kullas in these regions have been left in the mercy of time, without treatment and institutional protection.

5.2. PHYSICAL CONDITION AND TRANSFORMATIONS

Until recently, kullas were part of everyday life of communities living in them. By all means, their peculiarity had been noticed by passers-by and foreign and domestic scholars. However, their destruction because of wars (the most recent Kosovo war of 1998-1999), uncontrolled buildings in their setting, lack of institutional protection, lack of owners' awareness, natural aging process and lack of maintenance are some of the reasons behind their current degraded state. Few of them are still in use, whereas most of them are abandoned or in a bad condition. Although some authentic elements were changed, still a dozen of artifacts are still being preserved, such as: tables, cradles, crates, basins and *ibrikë*, as well as *saç, tinarë, t'pina, maxhe*, and many other elements that show the stories of practices of a way of life in the past. Some kullas even expose these artefacts as museums. Such is the case of Kulla of Ramok Çelaj, in Vuthaj, Montenegro, where the owner collected all possible artefacts from villagers and exposed them in his kulla. He even named his building as an Ethnographic Museum and a lot of international and national tourists visit his "*Kulla museum*". (See Fig. 30)

[143] National Institute of Cultural Heritage in Albania (2021) *Cultural assets*. Available at: http://iktk.gov.al/site/pasuri-kulturore/

Fig. 30 Kulla of Ramok Celaj adapted as an Ethnographic Museum by the owner, 2021

Transformations, which resulted in loss of authenticity of Kullas in Kosovo, started first during the Ottoman period in the 19th century. Kulla of Isa Boletini (1864-1916, an Albanian nationalist figure) was burnt three times, 1830-32, 1892 and 1895. The same happened to a number of Kullas in Lugu i Baranit, since the inhabitants of the region were members of Prizren League 1878-1881.[144] The degradation continued during the period of Young Turks (1889-1918), where the aim was to weaken the defensive capacity of Kullas by imposed bigger openings and prohibited the use of loopholes and many other defensive features. Arguably the most substantial harm was the loss of a whole architectural volume namely that of the watchtower- Karollane- which was the vertical and defensive climax of some Kullas of Dukagjini and Drenica regions.[145] Moreover, during the Kingdom of Serbia, Croatia and Slovenia (1918) to continue throughout the Kingdom of Yugoslavia (1941), as a part of ethnic cleansing many Kullas were burned, while at the same time many that had historical values were handed to Montenegrin colonists. Consequently, many became ruins and some were heavily altered to adjust to the needs of other ways of living. The period after the Second World War (1945-1999) was a period of transformation, which came as a result of the modernization or adaption to new uses such as offices and other administrative orientated uses. To satisfy the legal requirement of the general sanitary law and to comply with other administrative measures

[144] Zana Llonçari (2011) *Conservation of Vernacular Architecture in Kosova: With reference to Kulla as a special typology*. Oxford Brookes University Department of Planning and University of Oxford Department for Continuing Education. Unpublished Master Dissertation, p. 53.
[145] Fejaz Drançolli (2001) *Kulla Shqiptare*. Prishtinë: Grafika Rezniqi, p. 38-40.

many alterations resulted in loss of authenticity and disfiguration of kullas' functional scheme. [146]

Kosovo became a victim of the war with Serbia during 1998- 1999. More than the war, it was an ethnic cleansing where thousands of people were killed, and millions were driven from home. Along with the people, Kosovo's cultural heritage was heavily damaged. Despite historical monuments and urban centres, traditional residential architecture that existed in the urban and rural areas was also targeted. [147] The aftermath of the Kosovo War, in 1999, presented a scenario of extensive destruction to its built cultural heritage, resulting in a vulnerable condition of Kullas. During the Mapping of Cultural Heritage in Kosovo project, conducted by CHwB Kosovo during 2016-2017, the field research indicated that out of 160 designated kullas, 10 of them are in a very bad condition, 19 are partially ruined and 9 are completely ruined. Nowadays, kullas are also affected by various transformations from owners, resulting in the loss of authenticity and integrity.

Fig. 31 Left: Kulla of Haxhi Zeka in Peja, burnt during the war (Department of Culture, JIAS-UNMIK Kosovo, 2000), Right: New developments in Mazrekaj neighborhood, Dranoc, (By author, 2021)

Kullas in Plavë and Guci have also been prey of destruction throughout years. In the past, all these buildings were covered by traditional timber planks, so called *shiklla* or *furde,* by locals. Recently, this element is being replaced with cheaper materials for production and faster for installation. The roofs are mostly covered with corrugated metal sheets, or metal tiles imitating the traditional roof clay tiles. Moreover, other improper interventions are affecting the

[146] Zana Llonçari (2011) *Conservation of Vernacular Architecture in Kosova: With reference to Kulla as a special typology*. Oxford Brookes University Department of Planning and University of Oxford Department for Continuing Education. Unpublished Master Dissertation, p. 53.
[147] Andrew Herscher and Andras Riedlmayer (n.d.) *Architectural Heritage in Kosovo: A Post-War Report*. US/ICOMOS Newsletter 4.

authenticity and integrity of kullas, such as the insertion of concrete columns and beams, new balconies, canopies, entrances, new constructions, often with new (not compatible) materials, and in other cases with same materials (which changes the authenticity of the building). The worst risk for kullas is their physical condition, presented by deformations, constructive cracks, wall deterioration, presence of moisture- usually by the lack of maintenance and conservation. In some cases, kullas are also destroyed by their owners, when their condition poses risk for the family members.

Fig. 32 Left: Inadequate interventions in kulla, right: Damaged kulla, Guci (Labeatët, 2021)

The Second World War caused a lot of damages in Albania, with a lot of people being killed and about 18 000 houses destroyed[148], a part of which were located in the North-Northeast region. Yet, another war started in the region- the repression, which obliged the highlanders, amongst others, to abandon their kullas in order to be used for other purposes by the communist state.

This adaptation also brought their modification on the exterior and interior. In general, kullas were stripped of their protective elements (*frëngji*), closing them altogether, or enlarging them to the size of windows. Other elements affected by this change in the façade were *kreveti, qoshku* or *divanhanja*, which were removed, turned into balconies, or closed to take advantage of more interior space. Therefore, in this context, the construction of new dwellings, sometimes in the form of kullas, or even one-story stone houses, were necessary to meet the growing need for housing, especially in conditions when the free movement of people to urban centers was

[148] Raymond Zickel, et al. (1992) *Albania: a country study*. Washington, D.C.: Federal Research Division, Library of Congress.

forbidden. With the nationalization and collectivization of every property and space, including forests and pastures, it was more difficult for the highlanders to cut the giant pines and process them into *furde*– timber boards the roofs. To address this shortage of raw materials for roofs, other industrial materials were used.

In Albania, another action, so called sanitization[149], aimed to remove the cattle from the ground floor of kullas and build new small stables instead. This change of function, had also contributed to the transformation of the architecture of kullas. With the change of political system in 1992, the North-Northeast Region of Albania was completely forgotten. The new state began to slowly abandon its citizens even in urban centers, which led to the acceleration of the degradation of health care, education, electricity, water, transport, etc. [150] Forced by these conditions, a part of the inhabitants emigrated abroad, while the rest migrated towards the cities, leaving carelessly the properties and especially their dwellings in the mountains. The degradation of kullas is an ongoing process. Those that were not destroyed, are prey to lack of maintenance, institutional protection and improper interventions, especially in the roofs, by removing the original timber layer and putting aluminum sheets instead.

Fig. 33 Left: Inadequate interventions in kulla, right: Damaged kulla, Valbona, 2021

5.3. INITIATIVES TOWARDS PRESERVATION

There have been efforts in restoring and adapting these historic buildings to various uses. In Albania, the initial interventions carried out before 1990[151] were in-depth and included

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[149] Eltjana Shkreli (2018) *Udhëzues mbi trashëgiminë ndërtimore në Theth.*

[150] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

[151] Zabit Lleshi (2020) *Kulla e Salë Markës në Zogjej, dëshmi të historisë sonë të lavdishme dhe të mjeshtrisë së ndërtimit të banesave të tipit fortifikatë*, available at: https://bit.ly/3EnCBRk.

reconstructions of retaining wall fragments, replacement of roofs and other secondary functional elements. Subsequent interventions, carried out until a decade ago, involved minor repairs, mainly for maintenance purposes, as some buildings were uninhabited. As for recent interventions, they are even rarer and are performed only in cases where kullas are at high risk of destruction. [152] Some kullas in Theth and Valbona Valley have been adapted nowadays as bed and breakfasts, such is the case of the Kulla of Selimaj family in Valbona. On the other hand, in Plave and Guci, there are only a dozen of interventions cases in kullas. Worth mentioning again is the Kulla of Ramok Çelaj in Vuthaj, which has been adapted as an Ethnographic Museum by the initiative of the owner. Moreover, during September- October 2021, the 100-hundred-year-old Kulla of Deli Sadri Gjonbalaj, located in the picturesque village of Vuthaj in Montenegro underwent consolidation and thermal comfort improvement works. For two weeks, the experienced craftsmen from Kosovo, taught the local workers on the restoration materials and techniques of historic buildings by practical work "in situ". The intervention project was drafted by professors and experts from the Danube University of Krems and IBO Association in Vienna, and the author as part of Ilucidare project.

Fig. 34 Kulla of Deli Gjonbalaj in Vuthaj, Left: Insulation of loft with hay and mud, right: repointing of stones, 2021

There have been some efforts in restoring Kullas in Kosovo, since after the war. There was a dozen of restoration projects implemented by the Ministry of Culture, especially focusing in the emergency interventions of historic buildings and kullas. Moreover, other international organizations, implemented or funded various projects regarding the preservation of vernacular heritage, such as INTERSOS, Council of Europe, Suisse Heimatshutz, European Commission, etc.

[152] GO2 Albania (2021) *Kullas in Gegnia Highland: North-Northeast Region of Albania*. Ilucidare project. Unpublished research report.

Since 2001, CHwB Kosova enforces the conservation and adaptive reuse of several *kulla*s in the Dukagjini Plain. The latest such project was the *kulla* of Isuf Mazrekaj in autumn 2017, which focused on analyzing the challenges of adaptive reuse in the local context. Professionals and students of different fields along with the community gathered, analyzed and proposed interventions. The resourceful group worked for twelve days at site and adapted the *kulla* into the guesthouse. The intervention focus lay on the improvement of the environmental performance of the *kulla* including the adaptation of its interior and yard, and the introduction of the concept of slow food and storytelling. Despite these preservation initiatives, there is a lot of work among owners of these sites and other relevant stakeholders to understand the values of kullas and use the possibilities for income generation with further preservation and development of these historic buildings.

Fig. 35 Reconstruction and adaptive reuse of the Kulla Oda e Junikut during 2001-2002 as a library; Left: before intervention (CHwB Kosova, 2001), right: after intervention (CHwB Kosova, 2019)

Fig. 36 Reconstruction and adaptive reuse of the Kulla Rruste Zeqiri, Junik as a Regional Tourism Center, during 2001-2002, Left: Kulla before (CHwB Kosova, 2001), right: Kulla after intervention (CHwB Kosova, 2016)

Fig. 37 Adaptive reuse of Kulla of Isuf Mazrekaj as Bed and Breakfast during 2017, part of CHwB Kosovo's Restoration Camp, 2020

In terms of mapping and researching kullas, the latest such project is Ilucidare, as mentioned several times above, where the aim was to map tangible, intangible and natural values of kullas, as well as their general condition, in the cross-border area of Kosovo, Albania and Montenegro. The map below shows the mapped kullas in North Albania and Plavë and Guci in Montenegro, as well as kullas mapped in Kosovo by CHwB Kosovo. 70 kullas were mapped in North Albania, 28 kullas and 11 stone houses were mapped in Plavë and Guci, and 197 kullas were mapped in Kosovo from the organization CHwB Kosovo.

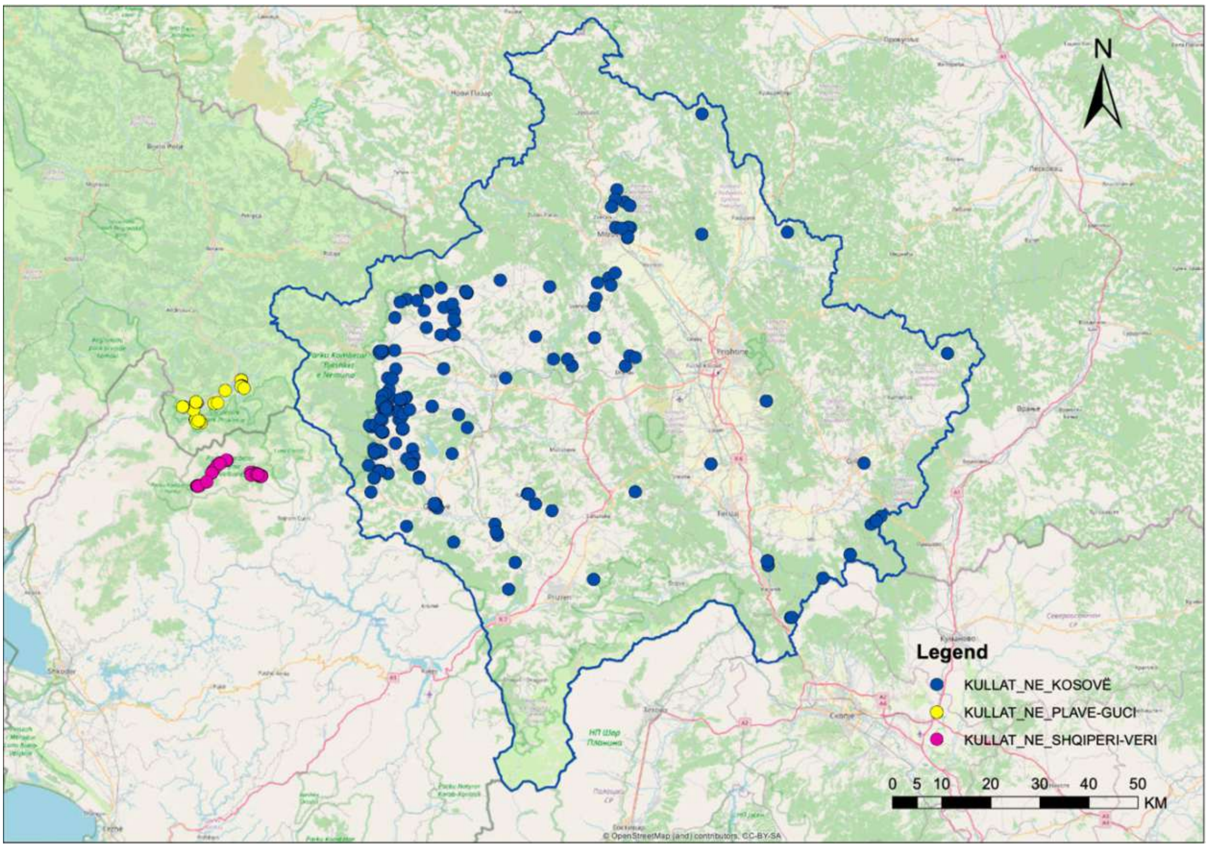

Fig. 38 Designated Kullas in Kosovo, and kullas in Albania and Montenegro mapped during Ilucidare project

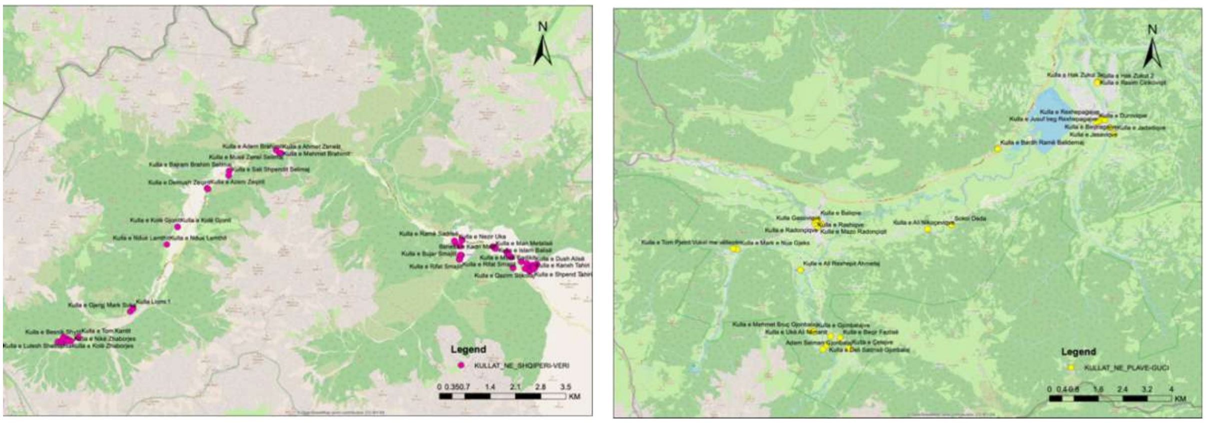

Fig. 39 Left: Mapped kullas in Albania within Ilucidare, right: Mapped kullas in Montenegro within Ilucidare

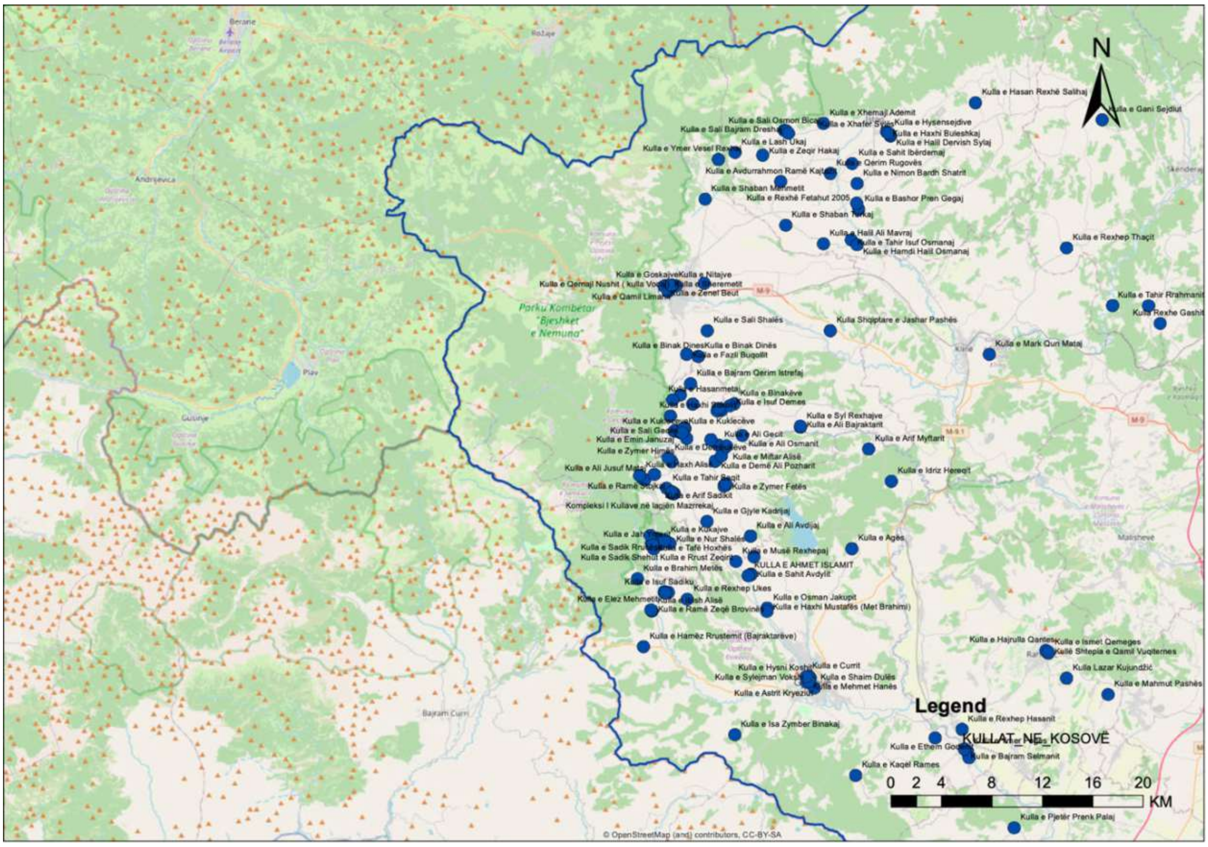

Fig. 40 Mapped kullas in Kosovo from CHwB Kosovo

PART II

THERMAL COMFORT OF HISTORIC BUILDINGS

PART II -

THERMAL COMFORT OF HISTORIC BUILDINGS

Communities always had environmental actions to create a healthier environment for living and working. Those efforts are best documented in the construction of architectural structures everywhere, from ancient history to the present time.

Demolishing and rebuilding take vast amounts of energy and materials, both of which are increasingly in short supply. Historic preservation and sustainability are natural partners. Preservation and reuse of historic buildings reduce resource and material consumption, puts less waste in landfills, and consumes less energy than demolishing buildings and constructing new ones.[153]

Prior to the industrial revolution, building efforts were frequently coordinated by a single architect, the so-called Master Builder, who was in charge of both design and construction. The master builder was solely responsible for the building's design and construction, including any engineering required. This paradigm allowed for the creation of a building that was built as a single system, with the means of providing heat, light, water, and other building services frequently being intimately interwoven into the architectural features. Sustainability predates these eras semantically if not conceptually, and some present unsustainable behaviors have yet to emerge. The purpose of yesterday's master builders was not sustainability in and of itself. Yet, in terms of construction, operation, and maintenance, some of the resulting structures appear to have achieved an admirable balance of long-term durability and sustainability. It's fascinating to compare the ecological footprint of Roman structures heated by radiant floors two millennia ago to that of a twentieth-century structure of equal size, location, and use. [154]

Sustainable historic building management necessitates striking a balance between cultural heritage preservation and energy efficiency. There is no conflict between these goals in most buildings. Simple energy-efficient solutions are often preferable to more elaborate and energy-

[153] Washington State Department of Archaeology and Historic Preservation (2011) *Sustainability and Historic Preservation*. Available from: https://dahp.wa.gov/.
[154] ASHRAE (2010) *ANSI/ASHRAE Standard 55-2010*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Available from: https://sustainabilityworkshop.autodesk.com/buildings/human-thermal-comfort#1AS HRAE. p.14.

intensive equipment for the preservation of objects and interiors. The situation is further complicated by human use of the structures. Because we need to heat in the winter and cool in the summer, it is the need for human comfort that consumes the most energy. Humans, too, require ventilation to maintain their health and comfort. To achieve all standards, historic buildings with permanent human occupation for living or working may require elaborate air conditioning systems. Most of our old buildings and furnishings have endured for centuries without being subjected to extreme weather. So, why has this become so important now? One explanation is that the climatic conditions in the surrounding area may alter over time. Whether or not this is a result of global warming, it will affect the indoor environment in the future. Furthermore, the needs for maintaining the indoor climate have evolved over time. This is attributable in part to a better understanding of deterioration processes, and in part to the fact that natural decay is not seen as an unavoidable aspect of existence. Another source of concern is that climate change will increase and geographically expand the risk of insect attacks, possibly introducing new species. In previous ages, fungicides and pesticides were used to keep mold and insects at bay, but most of these poisons have since been phased out, leaving climate control as the main option for long-term preservation of organic materials.[155]

[155] Poul Klenz Larsen and Tor Broström. (n.d.) *Climate Control in Historic Buildings*, p.1. Available at: http://eprints.sparaochbevara.se/862/1/Climate_control_in_historic_buildings.pdf.

6. UNDERSTANDING THE BASICS OF THERMAL COMFORT

One of the main steps towards having a sustainable building is optimizing its thermal comfort. So, what exactly is the meaning of thermal comfort? According to the ANSI/ASHRAE, Standard 55-2010, thermal comfort is defined as: *"that condition of mind which expresses satisfaction with the thermal environment and is assessed by subjective evaluation"*.[156] Thermal comfort is described as "that frame of mind that conveys happiness with the thermal environment and is judged by subjective evaluation," based on a plethora of study on the issue. ISO 10551, for example, describes a variety of subjective assessment scales. Those scales provide a set of responses to inquiries like "how do you feel right now?" or "please express how you would prefer to be right now," allowing them to collect data on a subject's thermal experience and preference in a specific location at a specific time.[157] If building occupants are not uncomfortable, they will be content with their surroundings. Thermal comfort is influenced by a variety of factors. Air temperature, humidity, air quality and movement, solar gain, and the emissivity and temperature of walls, floors, and ceilings are all factors to consider. Building inhabitants' clothing and physical activity also play an effect. Finally, the occupants' expectations, as well as their social and cultural attitudes, will influence their impression of thermal comfort. For example, someone who grew up in a colder environment may have different expectations for thermal comfort than someone who grew up in a warmer environment.[158]

In historic buildings, various elements affect their energy use and thermal comfort. The following are the most critical aspects that influence a building's energy consumption while it is in use:

- **Building location and orientation:** Regional climatic variations, as well as exposure to wind, rain, and sun, will affect the performance of a building envelope.
- **The physical qualities and condition** of the construction materials and components, as well as the form and design of the building envelope, have an impact on performance.

[156]ASHRAE (2010) *ANSI/ASHRAE Standard 55-2010*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Available from: https://sustainabilityworkshop.autodesk.com/buildings/human-thermal-comfort#1AS HRAE.
[157]Salvatore Carlucci (2013) *Thermal Comfort Assessment of Buildings*. Springer. ISSN 2282-2577, ISBN 978-88-470-5237-6, DOI 10.1007/978-88-470-5238-3. p. 5.
[158]Historic England (2018) *Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency*. Available at: https://historicengland.org.uk/images-books/publications/eehb-how-to-improve-energy-efficiency/. p.5.

– **Services and equipment for the building**: Energy is used in the heating, cooling, lighting, and ventilation of a structure. Equipment and appliances used in work, cooking, and leisure consume energy as well.

– **People:** People use their structures in a variety of ways. Their energy consumption differs as well. The number of people in a facility, the level of comfort they anticipate, and the technological services they require are all factors to consider.[159]

– **The setting of a building** has a big impact on how much energy it uses and how much it can save. These include wind, rain, and sun exposure. If a structure is routinely subjected to heavy rain and the walls are wet for long periods of time, wall insulation options may be limited. Similarly, where a structure receives a lot of sunlight, the possibility of summer warming or "reverse condensation" will influence wall insulation selections. Nearby characteristics that provide shelter or shade, or otherwise alter a building's microclimate, should be considered in assessments.[160]

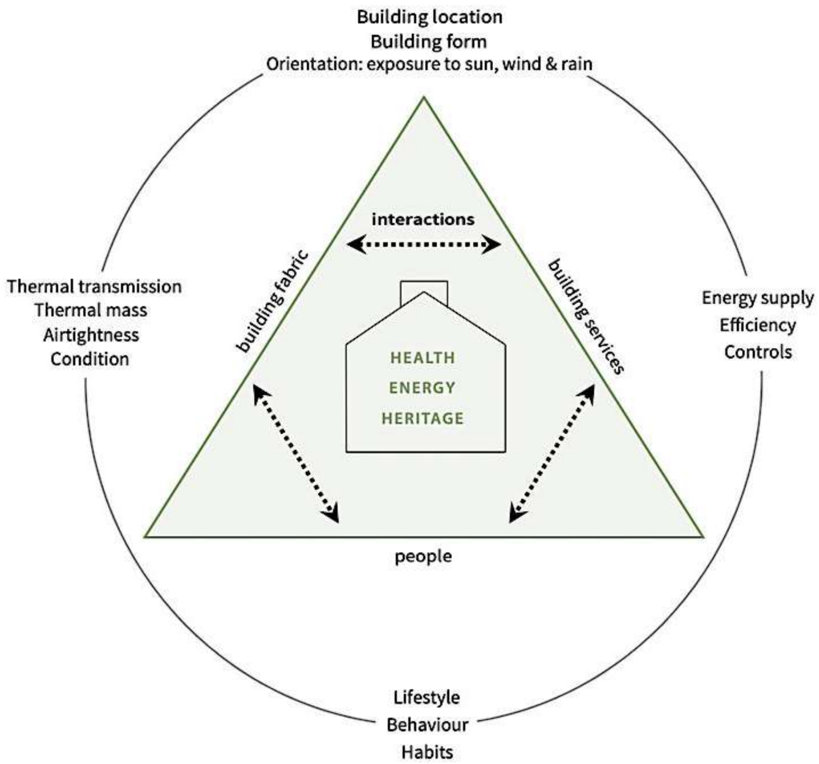

Fig. 41 Building performance triangle (Historic England, 2018, p.3)

[159] Historic England (2018) *Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency*. Available at: https://historicengland.org.uk/images-books/publications/eehb-how-to-improve-energy-efficiency/. p.2.
[160] Ibid. p.11.

The size, shape, and thermal performance of a building's envelope have a big impact on how much energy it takes to heat, cool, and light it. The flow of air, as well as the transport of heat and moisture through the building fabric, are all factors that affect thermal performance. The size, design, construction, and physical properties of the building's materials, as well as the division of the interior by partition walls and the presence of elements such as fireplaces and flues, all play a role.[161] Moisture permeable building materials include timber, lime mortars and plasters, porous stones, brick, and earth. They constantly absorb or release moisture in response to variations in their environment's humidity. These daily and seasonal swings tend to balance out over time in a well-maintained, sufficiently heated and ventilated structure without generating concerns. Many classic materials, in fact, provide a moisture buffering effect that helps to reduce the risk of condensation and preserve a healthy, comfortable indoor atmosphere. The moisture balance may be affected by several energy efficiency improvements. Internally insulated walls, for example, in a heated building, will be cooler, and thus wetter, during the winter months than uninsulated walls. Condensation risks are elevated when a building's airtightness is increased without appropriate ventilation to remove excess moisture. Furthermore, introducing new materials can pose issues if they limit the host fabric's ability to release moisture freely.[162]

Traditional buildings, including most historic structures, are typically solid-wall structures made of porous fabric that absorbs moisture but also allows it to dissipate quickly. This is typically referred to as the building fabric's ability to 'breathe,' or the fact that it has a low vapour resistance.[163] Moisture permeable building materials include timber, lime mortars and plasters, porous stones, brick, and earth. They constantly absorb or release moisture in response to variations in their environment's humidity. These daily and seasonal swings tend to balance out over time in a well-maintained, sufficiently heated and ventilated structure without generating concerns. Many classic materials, in fact, provide a moisture buffering effect that helps to reduce the risk of condensation and preserve a healthy, comfortable indoor atmosphere. The moisture balance may be affected by several energy efficiency improvements. Internally insulated walls, for example, in a heated building, will be cooler, and thus wetter, during the

[161] Historic England (2018) *Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency*. Available at: https://historicengland.org.uk/images-books/publications/eehb-how-to-improve-energy-efficiency/. p.13.
[162] Ibid. p.14.
[163] The Chartered Institution of Building Services Engineers- CIBSE (2002) *Guide to building services for historic buildings: Sustainable services for traditional buildings*. London: CIBSE. p. 15.

winter months than uninsulated walls.[164] Modern structures, on the other hand, are typically composed of harder, stronger, and less pervious materials. Physical barriers such as damp-proof courses and membranes, wall voids, and impermeable cladding are used to keep moisture out. Evaporation and ventilation are used in older buildings to keep the moisture in the walls at a safe level, one that does not promote deterioration, mold growth, or damage to the decorations. Many current insulation systems, on the other hand, contain impermeable vapour control layers, which are meant to prevent moisture from inside the home from diffusing out through the insulation and causing interstitial condensation. In a typical construction, however, these impervious layers can trap moisture already in the wall and prevent it from draining, making the wall damper and more prone to rot.[165]

The state of a building has a significant impact on energy use. Thermal performance can be significantly reduced by defects such as wet walls and poorly fitted doors and windows. As a result, identifying construction flaws is a critical assessment goal. Rainwater disposal mechanisms and drainage should always be checked for adequacy and condition, and wet areas should be recognized and diagnosed. Repairs are a significant energy-saving measure in and of itself. They are also required for some energy-saving upgrades, such as the installation of wall insulation. Failure to address leaking gutters and rainfall pipes, as well as improper drainage and moisture prior to installation, can result in significant damage. Buildings have become uninhabitable in some severe cases.[166]

The body's metabolic activities almost entirely produce heat, which must be continuously dispersed and managed in order to maintain normal body temperatures. Overheating (hyperthermia) arises from insufficient heat loss, while excessive heat loss results in physiological cooling (hypothermia). Pain is caused by skin temperatures of 45°C or less than 18°C. Skin temperatures of 33 to 34°C are connected with comfort during sedentary activities and decrease with increasing activity. Internal temperatures, on the other hand, rise when activity increases. At rest in comfort, the temperature regulating center in the brain is around

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[164] Historic England (2018) *Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency*. Available at: https://historicengland.org.uk/images-books/publications/eehb-how-to-improve-energy-efficiency/. p.14.
[165] The Chartered Institution of Building Services Engineers- CIBSE (2002) *Guide to building services for historic buildings: Sustainable services for traditional buildings*. London: CIBSE. p. 15.
[166] Historic England (2018) *Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency*. Available at: https://historicengland.org.uk/images-books/publications/eehb-how-to-improve-energy-efficiency/. p.14.

36.8°C, rising to around 37.4°C when walking and 37.9°C when jogging. A temperature of less than 28 degrees Celsius might cause significant cardiac arrhythmia and mortality, while a temperature of more than 43 degrees Celsius can cause lasting brain damage. As a result, maintaining a consistent body temperature is essential for comfort and health.[167]

The thermal environment within a building is critical not just for comfort, but also for occupant health and well-being, as well as the building fabric and its contents' long-term durability. Moisture and chemical pollutants linked to poor thermal control are linked to a deteriorating building envelope, as well as people who are uncomfortable or even sick.[168]

[167] American Society of Heating, Refrigerating and Air-conditioning Engineers- ASHRAE (2013) *Fundamentals*. ISBN: 9781936504466, ISSN: 15237230. Atlanta: ASHRAE. p.9.1.
[168] American Society of Heating, Refrigerating and Air-conditioning Engineers- ASHRAE (2013) *ASHRAE Green guide. Design, Construction, and Operation of Sustainable Buildings. 4th ed.* ISBN 978-1-936504-55-8. Atlanta: ASHRAE. p.181-182.

7. FACTORS AFFECTING THERMAL COMFORT

When dealing with many older buildings, moisture movement and ventilation are critical considerations. It is totally possible to successfully boost thermal performance and minimize energy use in a traditional building while preserving its character and fabric if these aspects are taken into account.[169]

Traditional structures were built with vents, windows, doors, and chimneys to allow for mild air flow, as well as circulation via rooms, stairwells, and gaps under floors and behind wall surfaces. This natural ventilation is critical for preventing moisture buildup and cleaning humid or stale air, as well as other vapours created in buildings. Excessive air movement, on the other hand, lowers internal temperatures and has a detrimental impact on thermal comfort. Finding a balance is challenging because if ventilation is restricted, air carrying water vapour cannot effectively escape, resulting in increased humidity, condensation, and unfavorable outcomes such as mold growth.[170]

Most historic buildings have been heated at some point during their lives, but not to the level of comfort that we demand today. Heating was necessary for human comfort and should continue to be utilized primarily for that purpose. Only structures with permanent occupants require constant heating. Otherwise, the heating should be adjusted according to the building's use, either in terms of time or space. Heat is not required for the preservation of the building or the objects, but it does assist keep the building dry, which is an advantage in most cases. However, if the climate becomes too dry, too much heating can pose problems. Heat is a potent medicine that should only be used in modest amounts.[171] Heat is lost from the building's interior in two ways: by transmission through the materials that make up the building's external envelope (measured as a U-value) and through ventilation (the exchange of air between the interior and the outside environment). Heat losses from a structure are expected to be as follows: Walls 35 %, Roofs 25 %, Floors 15 %, Draughts 15 %, Windows 10 %.[172]

Because around 25% of heat is lost through a building's roof, loft insulation is a typical and effective way to reduce heat loss. Insulating at the ceiling level, which creates a cold roof space,

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[169]Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.5. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1 1

[170]Ibid. p.5.

[171] Poul Klenz Larsen and Tor Broström. (n.d.) *Climate Control in Historic Buildings*, p.42. Available at: http://eprints.sparaochbevara.se/862/1/Climate_control_in_historic_buildings.pdf.

[172] Environment, Heritage and Local Government (2010) *Energy Efficiency in Traditional Buildings*. ISBN 978-1-4064-2444-7. Dublin: Government publications. p.16.

or between the rafters, which creates a reasonably warm roof space, are the two main techniques to roof insulation. Furthermore, a cold floor absorbs heat and might introduce cold air from beneath the floorboards, lowering thermal comfort dramatically.[173] Because windows are frequently the source of air leakage, greater sealing or the addition of an extra pane will minimize the rate of leakage. Outside pollutants, dust, and particles will be reduced as a result of this intervention. Depending on how much the building is heated, double glazing reduces heat loss. The biggest advantage for thermal comfort is that there is less cold draught beneath the windows.[174]

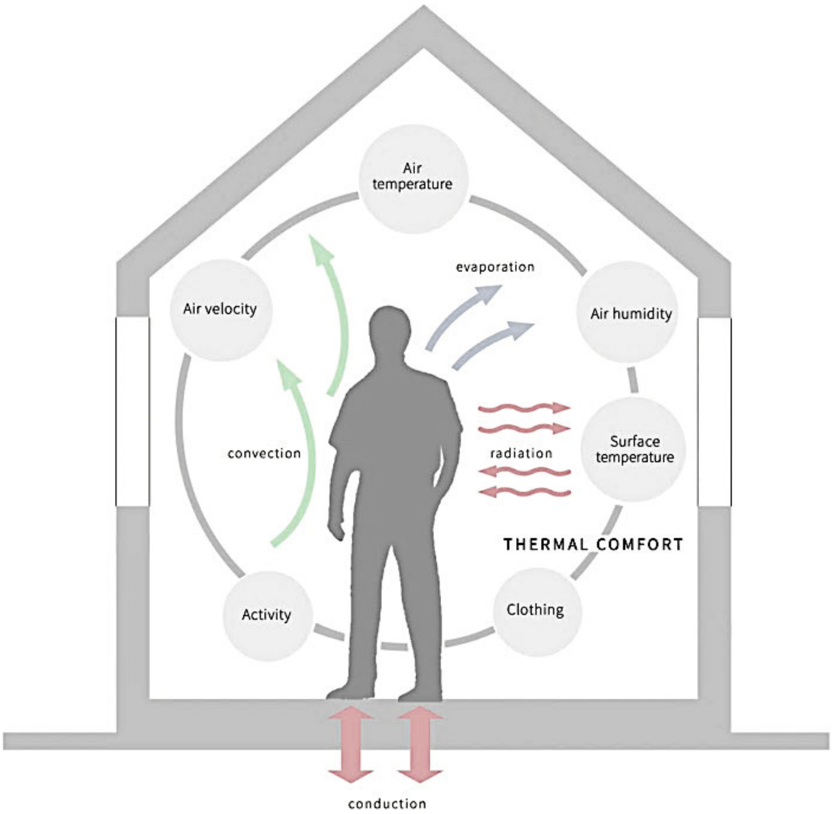

Fig. 42 Factors affecting thermal comfort (Historic England, 2018, p.5)

The building envelope is constantly exposed to the natural environment's climatic variables. The loss and gain of heat and moisture in buildings is governed by the outside temperature and humidity. The building's ability to protect the internal climate from outside influences is determined by its location, architectural design, and the materials and thickness of the structure. The size and orientation of the windows are particularly essential because they are important

[173] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.7-11. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1 1

[174] Poul Klenz Larsen and Tor Broström. (n.d.) *Climate Control in Historic Buildings*, p.37. Available at: http://eprints.sparaochbevara.se/862/1/Climate_control_in_historic_buildings.pdf.

sources of heat intake and loss through radiation. Because heat and humidity are exchanged by air infiltration, the air tightness of the building has a considerable impact on climatic stability. The intrinsic stability supplied by the structure and contents has been completely depended upon in these structures. This is known as passive climate control, distinguished from active climate control, which necessitates the use of technology and energy. [175]

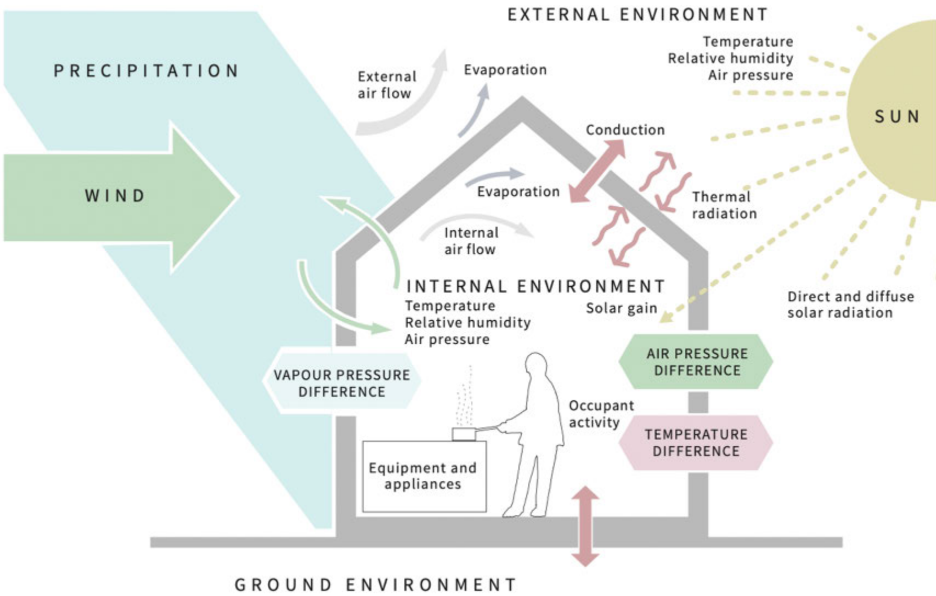

Fig. 43 Interactions between the building envelope and the environment (Historic England, 2018, p.13)

Rising and falling relative humidity cycles can be extremely destructive, causing re-crystallization of salts and causing objects constructed of mixed materials to expand and contract at varying rates. If a building does not need to be heated for comfort, is historically significant, and contains fixtures, fittings, or contents that are sensitive to variations in moisture content, then managing the heating to retain relative humidity within a reasonably narrow range may be considered. In the United Kingdom, this usually entails boosting the average internal temperature by roughly 5 degrees Celsius over the outdoor temperature. In the summer, solar gain is generally sufficient; in the winter, heat must be provided. [176] The major goal of managing relative humidity in historic structures is to avoid biological degradation due to high relative humidity and mechanical damage caused by low relative humidity. Mold growth has a lower

[175] Poul Klenz Larsen and Tor Broström. (n.d.) *Climate Control in Historic Buildings*, p.25. Available at: http://eprints.sparaochbevara.se/862/1/Climate_control_in_historic_buildings.pdf.
[176] The Chartered Institution of Building Services Engineers- CIBSE (2002) *Guide to building services for historic buildings: Sustainable services for traditional buildings*. London: CIBSE. p. 19-20.

limit of roughly 70% relative humidity, but some insects can survive at lower RH. For older buildings, a set point of roughly 60% RH is ideal, which is suitable for most objects. The magnitude and frequency of the variations determine the risk of mechanical damage caused by low RH. Small and quick changes are generally seen to be less damaging than large and sluggish variations, however this relies on the type and quality of the objects. For most materials, variations of +/- 10% RH are considered safe.[177]

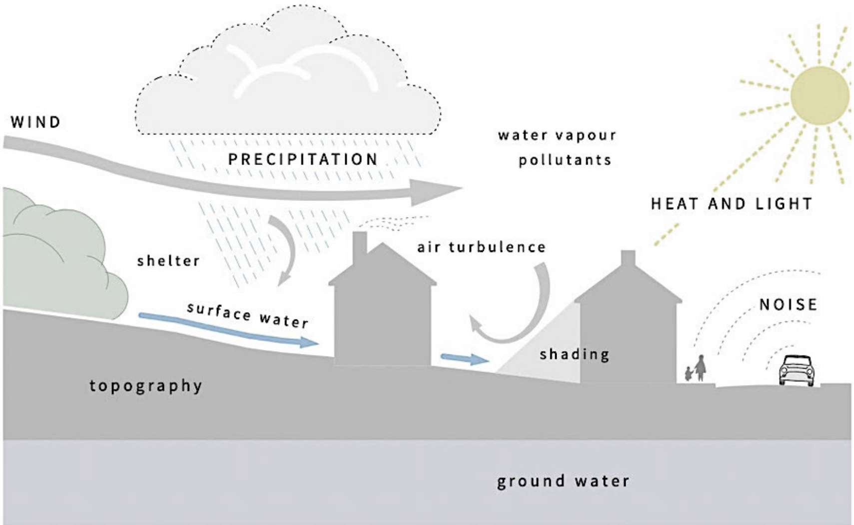

Fig. 44 Many factors of building's setting can affect energy use and the opportunities for improvements (Interactions between the building envelope and the environment (Historic England, 2018, p.11)

If we use the international ASHRAE-55 standard to define the pleasant zone, we get the following room conditioning measures for low-wind speed scenarios. It is too cold if the room temperature falls below this comfort zone, and heating should be provided. If internal heat loads or passive solar gain raise the temperature to nearly the minimal threshold, around 20 °C, but exterior temperatures are below freezing, traditional heating systems must be used. The air is excessively warm if it exceeds a temperature of around 26 °C. In theory, air containing more than 12 g/kg of water is too humid and should be dehumidified. Although there is no set lower limit for air humidity, the unpleasant consequences of low water content should be taken into account. Passive cooling strategies such as the utilization of storage mass and night ventilation can be used if the humidity is within comfortable ranges and the temperature is above 26 °C. When temperatures are high and humidity levels are low, evaporative cooling can be used. [178]

[177] Poul Klenz Larsen and Tor Broström. (n.d.) *Climate Control in Historic Buildings*, p.19-20. Available at: http://eprints.sparaochbevara.se/862/1/Climate_control_in_historic_buildings.pdf.
[178] Gerhard Hausladen, et.al. (2012) *Building to Suit the Climate: A Handbook*. Basel: Birkhäuser. p.38.

If we discuss about mold and insects, being one of the main enemies of historic buildings, data suggest that mold grows on the surface of most organic materials in damp environments. For most species, the lower limit for mold growth is 80 percent relative humidity at 20 degrees Celsius, rising to 90 percent relative humidity at 5 degrees Celsius and 100 percent relative humidity at 0 degrees Celsius. If the surface is treated with oil, wax, or other nutrients that promote mold infestation, the RH limit at 20 °C is reduced to 70% RH. For pests and insects on the other hand, in general, 60 percent RH is considered safe for all materials and types of biological degradation, however 70 percent appears to be suitable in specific circumstances. Temperature is a crucial factor in the movement and reproduction of insects. Many insects can survive at temperatures below 0 degrees Celsius, but they hibernate at temperatures below 10 degrees Celsius. To reproduce, most insects require a temperature of at least 20 degrees Celsius. A low temperature is always a smart method to keep insects at bay. [179] For energy-efficient climate control, accurate temperature and relative humidity data are required. The measurements are required for proper indoor and outdoor climate analysis, control, and documentation. [180] According to ASHRAE, apart from air temperature, wet-bulb temperature and relative humidity, the following thermal environment parameters: dew-point temperature, water vapor pressure, total atmospheric pressure, relative humidity and humidity ratio, must be measured or otherwise quantified to obtain accurate estimates of human thermal response.[181]

Other calculations intended for thermal comfort improvement in buildings are the U-value calculations of materials. However, the Approved Documents' typical procedures for calculating U-values aren't always appropriate for determining the heat conductivity of porous materials. This is due to the fact that they rely on steady-state models based on data from standardised hot-box testing. They can't account for the dynamic effects of heat and moisture movements, as well as their interrelationships across time. The ability of thermal masses to store and release heat is poorly understood, and the effects of moisture on the thermal characteristics of materials often overlooked. There are dynamic computation programs for assessing hygro-thermal behavior over time, but they have not been well proven for use on existing buildings. When interpreting stated U-value numbers for existing buildings, extreme caution should be applied. In many circumstances, the real thermal performance of permeable

[179] Poul Klenz Larsen and Tor Broström. (n.d.) *Climate Control in Historic Buildings*, p.19-20. Available at: http://eprints.sparaochbevara.se/862/1/Climate_control_in_historic_buildings.pdf.
[180] Ibid. p.19-20.
[181] American Society of Heating, Refrigerating and Air-conditioning Engineers- ASHRAE (2013) *Fundamentals.* ISBN: 9781936504466, ISSN: 15237230. Atlanta: ASHRAE. p.9.10.

materials will be significantly better than the estimated values suggest, leading to undue pressure to upgrade in ineffective ways. If there is any question in a critical situation, an in-situ measurement of the actual heat flow through a thermal element should be utilized as the foundation for upgrading ideas rather than estimates based on standardised material data.[182] To summarize, the main elements that affect the thermal comfort in historic buildings are described in the following table.

TEMPERATURE	RELATIVE HUMIDITY
Affected by heat loss of the building from:	Affected by the activities in the building:
- Vents - Windows - Doors - Chimney - Roof - Draughts - Building fabric.	- Cooking - Washing - Drying clothes inside - Using unflued gas heaters - Peoples' breathing - Water leakage through the building envelope - Damp ground - Retained construction moisture - Plumbing leaks.
Affected by the building's context/setting:	Affected by the building's context/setting:
- Geo-location and altitude - Sun radiation - Surrounding (mountains…) - Close setting (buildings, vegetation…) - Atmospheric conditions.	- Geo-location and altitude - Sun radiation - Surrounding (mountains…) - Close setting (vegetation…) - Atmospheric condition
Very high/low levels of temperature and RH directly affects the human comfort:	
- facilitates the growth of fungi (mould) and bacteria that can cause respiratory problems and/or allergic reactions - provides the conditions for dust mite populations to grow, which can affect asthma sufferers - results in odours in poorly ventilated spaces due to fungal growth - condenses on windows, walls, and ceilings that are colder than the air temperature, potentially damaging building materials, etc.	

Table 1 Elements affecting thermal comfort in historic buildings

[182]Historic England (2010) *Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings*, p.42-43.

8. OPTIMIZING THERMAL COMFORT IN HISTORIC BUILDINGS

Traditional building stone walls were modified during the course of years since their erection, sometimes to their harm, by the insertion of impermeable membranes. Cement renders were commonly used on the exteriors of stone walls, which can trap water behind them and cause moisture build-up and damage to the stonework. On occasion, the lath and plaster on the interior was removed and replaced with new plasterboard, which sometimes included a vapour/air barrier. If an air space was maintained behind the plasterboard, enough ventilation along the face of the wall was typically still possible, but in circumstances where it wasn't, interstitial condensation could occur. New impermeable floors, such as poured concrete slabs with a DPC layer, were occasionally built at ground level, forcing moisture from beneath the building to migrate out to the edges and up through the porous walls, causing rising damp. As previously existing air movements were interrupted, the installation of high efficiency double or triple glass windows could upset the balance within a space, generating condensation on either the window or the wall. However, there are other case studies, which optimized thermal comfort of historic buildings by applying the required measures.

Historic Scotland's research backs up the idea that there are two key principles for improving thermal performance in traditional buildings: first, the materials used should be appropriate for the structure and, in most cases, water vapour permeable, and second, adequate ventilation should be maintained to ensure the building's and occupants' health.[183] However, according to Historic England (2010) any improvement in a historic fabric should take into consideration the following principles: minimum intervention, compatibility, reversibility and authenticity.

Minimum intervention: The notion of minimum intervention applies at all scales, from a single brick to large-scale construction projects. If all works are reduced to a bare minimum, the historic fabric, and thus the significance it contains, will be conserved to the greatest extent possible.

Compatibility: All changes should be undertaken with materials and procedures that are compatible with the historic fabric, whether they are small-scale repairs or bigger adjustments. Modern materials are typically harder, less flexible, and less permeable than traditional

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[183]Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.5. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1

materials, and when used in conjunction with historic fabric, they can hasten the deterioration of the original work significantly. To guarantee that new work placed directly adjacent to historic fabric weathers preferentially to the more significant older work, it is considered recommended practice for all new work placed directly adjacent to historic fabric to be slightly weaker and more permeable.

Reversibility: Whenever possible, unavoidable changes that may be detrimental to a building's significance should be fully reversible. Adherence to this principle means that, even if the significance of the historic fabric is momentarily obscured, it can be returned to its former state without damage after the relevant addition's lifetime has elapsed. This technique can be implemented at all scales, from small localized repairs to large-scale building additions.

Authenticity: A building's authenticity can be preserved by respecting its history and fabric. This means that all new work should be available as soon as possible, speculative restoration should be avoided and nothing important to the significance of the structure should be removed. [184]

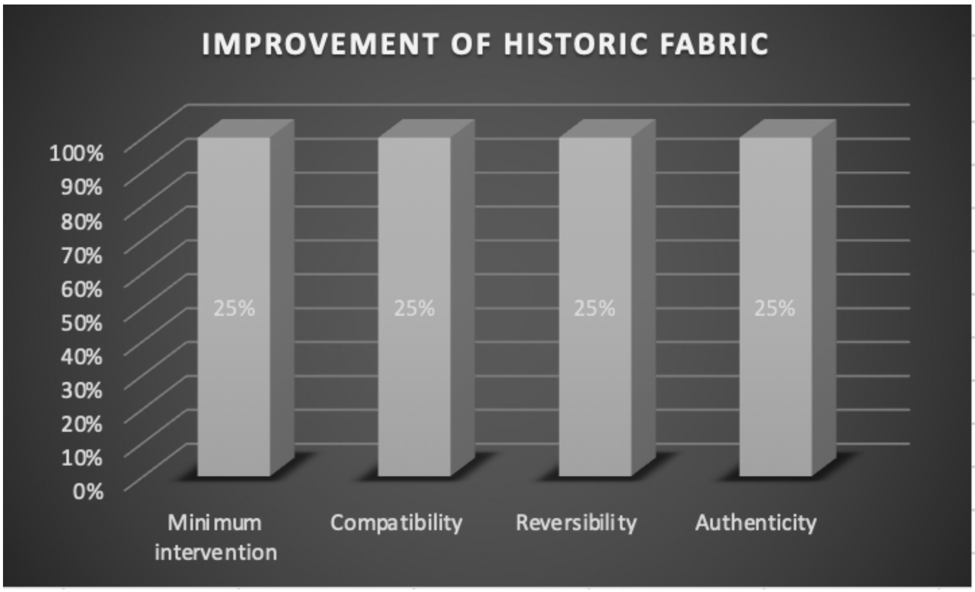

Fig. 45 Percentage of considerations when improving historic fabric

Taking into consideration the aforementioned principles, the thermal comfort of historic buildings can be improved by applying the following recommendations.

[184] Historic England (2010) Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings, p.27.

Draught-proofing

The first stage in creating suggestions for improving the energy efficiency of older buildings is to eliminate draughts or air intrusion. This is due to the fact that enormous amounts of energy can be lost through gaps in construction — a source of heat loss that can rapidly negate any worthwhile upgrades done elsewhere on a building. Heat lost from air penetration through holes, for example, will simply bypass any insulation added to the fabric. If a large percentage of the energy generated by local, sustainable micro-generation is just used to heat the external air, it will be used inefficiently as well. The following are examples of situations where controlling air infiltration will be reasonably simple and provide significant performance benefits: [185]

- fixing construction cracks and holes;
- filling in cracks in the structure caused by later alterations and service installations;
- adding draught-stripping to external doors and windows;
- inserting removable register plates to inhibit air passage up chimneys in the winter;
- restoring full functionality of window shutters; these are generally only used at night, but heat loss is highest during this time, when external temperatures are at their lowest;
- putting up heavy curtains and pelmets, which are usually only used at night but can be quite effective. Behind the curtains, pelmets keep convection currents at bay;
- putting down thick carpets, especially on suspended ground levels. Synthetic fiber carpets with impervious rubber backings, on the other hand, will severely limit the breathability of the surfaces they are installed over;
- installing secondary glazing. [186]

Loft insulation

When insulating a loft, it is frequently easier to lay insulation on the horizontal upper side of the ceiling in a loft rather than between the rafters; this results in a 'cold roof.' To ensure adequate humidity buffering and moisture control, a vapour permeable and hygroscopic material is added. Sustainable materials like sheep's wool or hemp fibre 'wool,' board-based materials like hemp and wood fiberboard, and loose-fill materials like cellulose are all suitable.

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[185] Historic England (2010) Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings, p.42.
[186] Ibid. p.42.

It's usually easier to use material that comes in flexible rolls, which can also lead to a tighter finish. Regardless of the material used, care must be taken not to fill the eaves or coom, which must remain ventilated. To be fully effective, at least 270 mm of insulation should be installed, regardless of the material used. If the attic area is to be utilised and a floor is needed, the joists may need to be deepened by adding additional timbers. The additional material can be put across the joists if access is not required. Top-up material can be applied between the joists or, if space is limited, across the joists if insulation is already in place with a gap of more than 50 mm to the top of the joists. Thermal bridge refers to a gap in insulation or a cooler place between insulated areas; closely fitting insulation or placing insulation over an existing layer helps to minimize this problem. To prevent warm damp air from entering the roof space, the access hatch to a loft space should be insulated and draught proofed.[187]

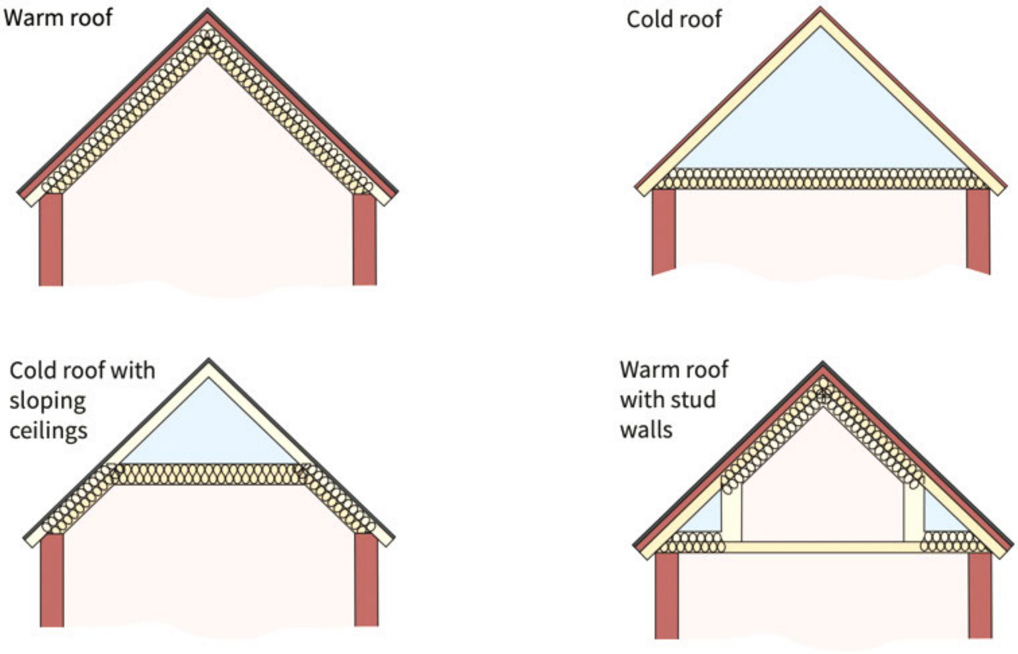

Fig. 46 Cold and warm roofs (Historic England, 2016, p.3)

Insulating roof slopes: Rafter insulation

The performance of the roof structure itself can be improved by insulating roof spaces. A warm roof space is the outcome of rafter-level insulation. It may be required to insulate between the rafters in a roof where it is not possible to insulate between the joists in a loft, if it is occupied.

[187] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.7. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1

A vapour permeable material should be utilized for insulation to best manage water vapour movement. A board base material or semi-flexible batt, such as sheep's wool/hemp fibreboard or a wood and wool blend, may be the most ideal for ease of working. To avoid gaps, any material used should fit snugly between the rafters.[188]

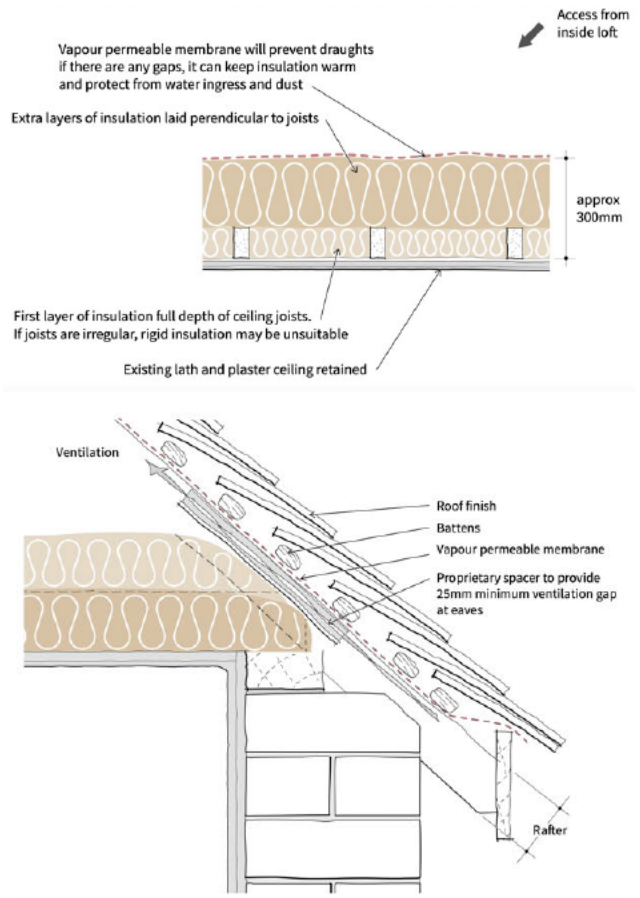

Fig. 47 Left: Insulation of loft, right: Insulation of rafters (Historic England, 2016)

Walls' insulation

Recent research from Historic Scotland has found that a small improvement to the inside surface of mass masonry walls can significantly increase their thermal performance. This increase in thermal performance can be accomplished in a variety of ways. Some of these solutions follow good conservation practice, are relatively inexpensive and less disruptive to residents, and allow the preservation of existing internal linings and finishes. The kind and thickness of material used, as well as the original circumstances and materials, will have an

[188] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.8. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1

impact on the thermal performance of internal walls. As a result, it's critical to select a suitable vapour permeable material to avoid forming a vapour barrier, which could lead to moisture build-up and subsequent degradation within the wall. The most likely material to achieve this is hemp or wood fiber board, a wood/wool hybrid, blown cellulose, or sheep's wool. While non-vapour permeable products are thermally efficient, they may not be suitable for use in historic structures due to the risk of moisture concentration and consequent fabric degradation.[189]There are cases when insulation is also applied behind new or existing lath and plaster of historic walls, as well as directly to masonry without framing.

In a similar way to cavity wall insulation, blown materials are used to improve the performance of lath and plaster wall finishes. This enables for the retention of existing linings while also minimizing disruption to historic materials and occupants. However, because this method reduces the ventilation of the cavity between the lath and plaster and the masonry wall, it is critical to use a vapour permeable, ideally a 'open-cell' material to allow modest air and water vapour circulation while preventing draughts behind the laths. Cellulose, polystyrene beads, perlite, and a water-based foam are examples of appropriate materials. When inserting or blowing this material beneath lath and plaster, great care must be taken to guarantee that the wall is dry when it is first installed and that it will remain dry by retaining or improving water vapour permeability. External maintenance, such as the appropriate functioning of rainwater goods such as gutters and downpipes, plays a critical part in attaining this. Modern exterior finishes, such as cement render, may reduce water vapour permeability, but every effort should be made to achieve the highest amount of permeability possible. In most homes, this will necessitate the removal of textured wallpapers and vinyl paint finishes, exposing the underlying plaster.[190]

When a wall was originally plastered 'on the hard,' it is possible to insulate directly into the existing plaster surface, reducing the impact on room proportions and facings. Materials used in this case are calcium silicate board, wood fibre-based products but other appropriate insulation materials can also be directly fastened to a mass wall. Before installing the insulated panels, any existing wallpaper and paint shall be removed from the brickwork and a vapour

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[189] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.20-22. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1
[190] Ibid. p.22-23.

permeable glue shall be applied to the wall. Finally, two coats of plaster and a permeable paint finish are applied to the board. New procedures are being developed employing an insulated lime plaster put internally 'on the hard'. In some cases, such an inside finish might be appropriate, particularly in vernacular buildings and service areas where plaster on the hard is common. To obtain a reasonable thermal improvement, 50–80 mm of insulated plaster shall be put, after the removal of any existing finishes. The material is pre-batch-applied in layers to get the necessary thickness, then plastered to provide a smooth surface. The final decorating is done with limewash or distemper.[191]

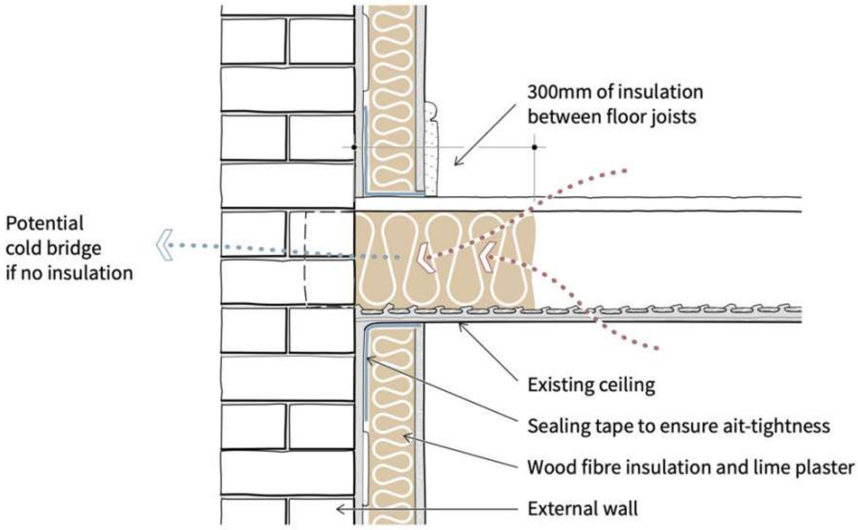

Fig. 48 Insulation of external walls and floor (Historic England, 2016 b, p.14)

Floors' insulation

Timber floors are most effectively insulated from below. A vapour permeable material, similar to loft insulation, should be used to avoid moisture accumulations, which can lead to rot or other types of damage. Hemp batts and wood fiberboard are two materials that can be used to insulate timber floors. However, the approach to floors is mostly determined by access, as well as the floor's quality and value. Original solid floors, such as flagstones, are generally suggested to be left in place due to the risk of damage. Where a floor must be lifted for another reason, or where original features have been lost and a more modern concrete floor has been installed,

[191] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.24. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1

insulation will improve thermal performance either by gluing an insulated board to the existing floor or excavating and laying a new insulated lime concrete floor in its place.[192]

Windows' insulation

Heat loss occurs in older structures as various building materials move and distort with time, resulting in cracks and gaps. This is particularly the case with windows and doors, which can be a significant source of heat loss. Before attempting any draught-proofing measures, windows and doors should be inspected for damage. Even if they are in bad shape, traditional windows and doors can nearly always be fixed.[193]

Double-glazed windows typically contain sealed glazing units with two panes of glass separated by an air gap (about 12-18 mm) that enhances thermal insulation, especially if the glass is coated and the air gap is filled with an inert gas. It's a key achievement that's resulted in huge energy savings and carbon dioxide reductions, especially in new buildings. The flatness of new glass and the need for thicker timber sections and glazing bars might result in a change in appearance when replacing existing windows with double glazed units. The weight of the glass (up to four times that of single glazing) and the balancing of the opening sashes contribute to the difficulty. Because the use of double glazing often results in the loss of major historic fabric, it is preferable to repair rather than replace in historic buildings. Adding secondary glazing is frequently the best solution.[194]Draught-proofing is always the best idea in terms of improving the thermal performance of windows. There are several types of draught-proofing available, each of which works in a different way. Some types are used as gap fillers and come in the form of mastic or foam. Other types of weatherproofing use silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins. A self-curing silicone rubber sealant can be injected into the gap between the window and the frame for steel and timber casements. The window is cleaned and reconditioned first to ensure that the hinges and catches are in good working order. The casement's opening edge is briefly covered with a

[192] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.11-12. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1
[193] Historic England (2016) *Energy Efficiency and Historic Buildings: Draught-proofing Windows and Doors*. p.3. Available at: https://historicengland.org.uk/images-books/publications/eehb-draught-proofing-windows-doors/
[194] Ibid. p.8.

non-stick gel. The silicone is then pumped into the untreated frame, but not to the coated casement edge.[195]

Doors' insulation

The majority of external doors on historic buildings were built of wood, with many of them having hardwood frames. Wherever possible, original or historically significant doors should be kept and repaired as needed. Solid doors have good insulating characteristics in most cases. Infiltration along the perimeter of the door or where gaps have occurred around panels, at the connection with the door closer, and through locks accounts for the majority of heat loss. Repairs and draught-proofing can be advantageous. An internal draught lobby with a well-fitting and, if necessary, well-insulated inner door may be a sensible solution when space allowed.[196]

Chimneys and flues

In traditional buildings, fireplaces (or chimneypieces) play a significant role in providing ventilation. The movement of air within the flues moves air through the rooms and aids in the removal of any moisture concentrations in the masonry, particularly at exposed gable ends. Closed flues are therefore prone to moisture accumulation if air flow is restricted, and prolonged hearth closure is not recommended. If a fireplace is no longer in use and it is desired to block it off to decrease draughts, it is critical to keep some type of air movement. In the winter, an inflated 'chimney balloon' can be used to reduce draughts, and in the summer, when enhanced ventilation and cooling are needed, it can be removed. A hearth board put over the aperture can also be used to temporarily close off a chimneypiece. All chimney heads, whether in use or not, can be equipped with a conical vented cowl to keep rain and birds out while still being used. Some modern enclosed grates, wood burning stoves, and biomass micro-renewable systems can be used to repurpose chimneys for new heating appliances.[197]

[195] Historic England (2010) Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings, p.49.
[196] Ibid. p.50.
[197] Historic Scotland (2013) Short Guide: *Fabric Improvements for Energy Efficiency in Traditional Buildings*. p.27. Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1

Natural insulation materials

When it comes to providing insulation to traditional buildings, natural fiber insulation materials can be very useful. Thatch, wool, hemp, flax, and recycled newspaper (cellulose) are common examples[198] as well as sheep's wool.[199] These materials not only allow moisture to pass through their air gaps, but they may also absorb and subsequently release moisture through evaporation. These characteristics are not present in synthetic insulating materials, like glass fiber and rock wool. Moisture vapour is balanced over the insulation layer by these natural insulation materials, allowing any condensation to escape.[200] Materials should be carefully chosen and specified to ensure that they create the least amount of pollution feasible throughout their life cycle: during extraction, manufacture, building or installation, usage, and removal for re-use, recycling, or disposal. The specifier must increasingly be mindful of the life cost and impact of each material used. [201]

Historic buildings are able of being upgraded to produce a substantially greater level of thermal performance. This can be accomplished by interventions that are sensitive to their appearance as well as their performance. In many cases, improvements can be made without removing all of the original building fabric or using materials that are incompatible with the structure's character.

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198 Historic England (2010) Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings, p.35, 58.

199 The Chartered Institution of Building Services Engineers- CIBSE (2002) Guide to building services for historic buildings: Sustainable services for traditional buildings. London: CIBSE. p.17.

200 Historic England (2010) Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings, p.35, 58.

201 The Chartered Institution of Building Services Engineers- CIBSE (2002) Guide to building services for historic buildings: Sustainable services for traditional buildings. London: CIBSE. p.9.

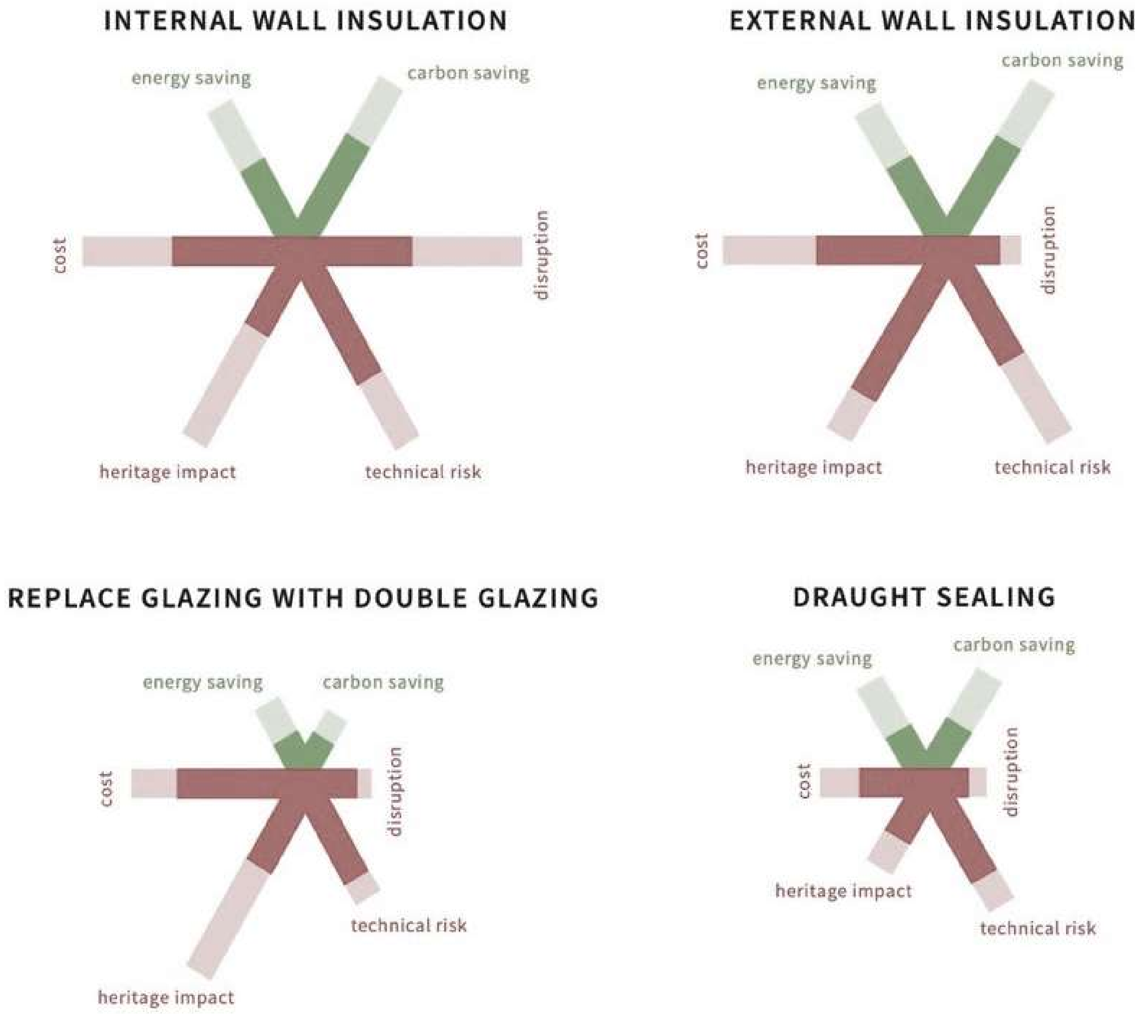

Fig. 49 Challenges of weighing up the costs and benefits of various measures (Historic England, 2018, p.20)

9. LEGISLATION AND GUIDELINES

Historic buildings are a symbol of European cities, towns, and villages; entire districts are a one-of-a-kind testament to the continent's cultural legacy. Approximately 35% of EU buildings are over 50 years old, and nearly 75% of the building stock is inefficient in terms of energy use. Many countries hold the belief that historic buildings, especially those with special protection, should be exempted from needing to be retrofitted with new energy-efficient technologies. Although caution should be exercised when designing restoration plans for historic buildings, the simple argument that they cannot be adapted in any way to incorporate renewable energy installations for fear of changing their nature and appearance is not always a strong argument in the societal move towards sustainability. Furthermore, existing building renovations have the potential to result in large energy savings, potentially reducing the EU's overall energy consumption by 5-6 percent and CO2 emissions by roughly 5%. New buildings today utilize half as much energy as typical buildings from the 1980s, thanks to the adoption of efficiency measures in construction rules.[202]

There are a dozen of initiatives on producing directives, regulations and guideline for energy improvement of historic buildings within the EU, UK, USA and beyond.

The Energy Performance of Buildings Directive (EPBD) 2010/31/EU and the Energy Efficiency Directive (EED) 2012/27/EU revised in 2018, have encouraged the development of energy efficiency in historic buildings in the EU. Because of the drive to incorporate energy efficiency criteria into national building laws, the political European agenda has had an impact on building energy use. Because historic buildings make up such a large part of Europe's building stock, these requirements also apply to existing structures. Furthermore, through its integrated national energy and climate plans, each EU country must outline its strategy for addressing energy in buildings for the period 2021-2030. The combined impact of these national efforts will contribute to the EU's overall aim of achieving a 32.5 percent energy efficiency target by 2030. [203]

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[202] Build up: The European Portal for Energy Efficiency in Buildings (2019) OVERVIEW | *Energy Efficiency in Historic Buildings: A State of the Art*. Available at: https://www.buildup.eu/en/news/overview-energy-efficiency-historic-buildings-state-art

[203] European Commission (2020) *In focus: Energy efficiency in buildings*. Available at: https://ec.europa.eu/info/news/focus-energy-efficiency-buildings-2020-feb-17_en

Another complication is that legally protected buildings are subject to strict protection requirements set by national legislation, which can limit the permissible activities in such structures. Recognizing this reality, European legislators adopted EPBD in 2012, which stated that Member States may choose not to set or apply their minimum energy performance requirements to: *'buildings officially protected as part of a designated environment or because of their special architectural or historical merit, in so far as compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance'.* Amendments to the EPBD adopted in 2018 added the following statement: *'research into, and the testing of, new solutions for improving the energy performance of historical buildings and sites should be encouraged, while also safeguarding and preserving cultural heritage.'* Such testing and study are an important next step in efforts to improve the energy efficiency of historic structures. [204]

The technical problems involving the possibility of energy retrofit in a historic environment were practically ignored, if not completely ignored, in EU directives. There was no mention of how to improve historic building energy efficiency while retaining its "function, quality, or character," and only a hazy concept of what an "officially protected structure" could be. Furthermore, the EU directives provide no guidance on how to deal with historic structures that are not on the list of officially protected buildings. [205] Further on, two specific standards were drafted and published one after another: the European Standard CSN EN 16883 Conservation of cultural heritage - Guidelines for improving the energy performance of historic buildings and the American standard, ASHRAE Guideline 34-2019, Energy Guideline for Historic Buildings. The European Standard establishes standards for increasing the energy performance of historic buildings, such as those that are historically, architecturally, or culturally significant, while maintaining their heritage significance. This criterion is applicable to historic structures of all types and ages, not just those having statutory heritage status. Based on an examination, analysis, and recording of the building, including its heritage significance, this European Standard establishes a normative working approach for identifying ways to improve energy performance. The approach evaluates the impact of those interventions on preserving the

[204] Europa Nostra & ICOMOS (2021) *European Cultural Heritage Green Paper.* p.25.
[205] REHVA- Federation of European Heating, Ventilation and Air Conditioning Associations (2018) *Energy Efficiency in Historic Buildings*, p.4.

building's character-defining components.[206] On the other hand, the Energy Guideline for Historic Buildings, ASHRAE Guideline 34-2019, provides extensive and detailed descriptions of the processes and procedures for upgrading historic buildings to attain higher measured efficiency. The guideline is designed to provide guidance on listed cultural heritage assets, which are those that have been formally designated or are eligible to be designated as historically significant by a governing body. [207] The European Union has made preventing severe climate change a top priority. As a result, Europe is working hard to significantly reduce its greenhouse gas emissions while also urging other nations and areas to do the same. In the meantime, international conventions such as the 1979 Convention on transboundary long-distance air pollution and its various protocols, the UN Framework Convention on Climate Change of 1992 and its now-famous Kyoto Protocol (December 1997), and the Paris Agreement (December 2015) have made significant progress.

The following UK's Approved Documents[208] recognise the special nature of historic buildings by providing guidance on the improvement of their energy efficiency:

- Approved Document L: Conservation of fuel and power;
- Approved Document C: Site preparation and resistance to moisture;
- Approved Document F: Ventilation;
- Approved Document J: Combustion appliances and fuel storage systems;
- Approved Document to support Regulation 7: Materials and workmanship.

Moreover, Historic England has also produced the following series of guidance documents, which provide advice on the principles, risks, materials and methods for improving the energy efficiency historic buildings:

- Insulating pitched roofs at rafter level/warm roofs;
- Insulating at ceiling level/cold roofs;
- Insulating flat roofs;
- Insulating thatched roofs;

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[206] European standards (2021) *CSN EN 16883 - Conservation of cultural heritage - Guidelines for improving the energy performance of historic buildings*. Available at: https://www.en-standard.eu/csn-en-16883-conservation-of-cultural-heritage-guidelines-for-improving-the-energy-performance-of-historic-buildings/
[207] ASHRAE (2019) *ASHRAE Publishes New Guideline on Energy Efficiency for Historic Buildings.* Available at: https://www.ashrae.org/about/news/2019/ashrae-publishes-new-guideline-on-energy-efficiency-for-historic-buildings
[208] Government of UK (2021) *Approved documents*. Available at: https://www.gov.uk/government/collections/approved-documents

- Open fires chimneys and flues;
- Insulating dormer windows;
- Insulating timber-framed walls;
- Insulating solid walls;
- Early cavity walls;
- Draught-proofing windows and doors;
- Secondary glazing for windows;
- Insulation of suspended ground floors;
- Insulating solid ground floors;
- Energy Efficiency and Historic Buildings - Application of Part L of the Building Regulations to historic and traditionally constructed buildings;
- Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency.[209]

In addition to that, Historic Scotland published the following Technical Papers regarding energy efficiency in historic buildings:

- Technical Paper 1 Thermal Performance of Traditional Windows;
- Technical Paper 2 In situ U-value Measurements in Traditional Buildings;
- Technical Paper 6 Indoor Air Quality and Energy Efficiency in Traditional Buildings
- Technical Paper 9 Slim-profile double glazing;
- Technical Paper 10 U-values and Traditional Buildings;
- Technical Paper 12 Indoor Environmental Quality in Refurbishment.[210]

In conclusion, despite the approvement of international directives and guidance on energy efficiency improvements of historic buildings, various countries in Europe but also in the world, have conducted a number of research projects on the topic, have organized a dozen of conferences and have implemented various case studies- where historic buildings have been upgraded in terms of energy efficiency. However, on the other hand, Kosovo (not an EU member state), Albania and Montenegro (both candidates for EU member states) have no requirements on energy efficiency upgrade of historic buildings in their national cultural heritage laws and regulations. Moreover, no guidance on the topic has been produced as yet by these states and only a few historic buildings have been sustainably upgraded.

[209] Historic England (2021) *Publications*. Available at: https://historicengland.org.uk/images-books/publications
[210] Historic Scotland (2021) *Publications*. Available at: http://www.historic-scotland.gov.uk/conservation-research.htm

10. GOOD PRACTICES

When excellent implemented practices are taken into account, implementing energy efficiency regulations and policies in historic buildings in Kosovo, Montenegro, and Albania, for which this dissertation is dedicated, becomes easier, as it does in any other subject. In the absence of success stories in the region, several examples from the United Kingdom have been used to impose thermal comfort on kullas of these three countries. It is worth noting that CHwB Kosova has implemented measures aimed at long-term sustainability but not driven by thermal comfort principles (despite the Ilucidare project on the thermal comfort improvement of the Kulla of Deli Gjonbalaj in Vuthaj). The author chose to focus on UK examples not only because she is familiar with and has studied in that context, but also because Historic England and Historic Scotland guidelines have always inspired provisions throughout Europe and beyond, as they have been at the forefront in the development of cultural heritage preservation principles.

To create a reasonable framework of upgrade interventions that can be implemented in kullas, three cases of interventions lead by thermal comfort improvement are taken as examples. The three examples are historic stone houses, and the interventions for thermal comfort upgrade can easily be applied to kullas as well. There will be a hypothetical scenario in tabular form at the end of this chapter that suggests / selects possible types of actions that could be implemented in the case study of kulla.

10.1. Wells o' Wearie, Edinburgh: Thermal upgrades to walls, roof, floors & glazing[211]

The thermal upgrade of the historic cottage in Edinburgh was implemented by Historic Scotland. The goal of the project was to show that effective thermal upgrades may be performed in a traditional stone building without causing the owner undue expense or disturbance, and without necessitating considerable removal or damage to the building fabric. There was also an intention to use natural materials whenever possible, which allowed enough water vapour flow through the building fabric. The information about this project was taken from the Historic Scotland Refurbishment Case Study 2 report, as cited in the title.

Building description

[211] Historic Scotland (2012) *Historic Scotland Refurbishment Case Study 2*. ISBN 978 1 84917 098 7. p.5-16. Available at: www.historic-scotland.gov.uk/refurbcasestudies.

The cottage used in this upgrade project is a tiny single-story detached building with an addition to the east that dates from c.1880 and is listed as Category 'B'. It's constructed of rubble sandstones with ashlar quoins and margins, and it's lime-bound. Kullas are also built by stones bound with lime mortar. The majority of the external masonry facades have been cement pointed to varying degrees since then. The roof is covered by Scots slates on sarking with zinc ridges. Three rooms, as well as a bathroom and kitchen, make up the accommodation. Historic Scotland manages the site as part of Holyrood Park's policy, and it was recently unoccupied due to a lease expiration.

Fig. 50 Wells o' Wearie, Edinburgh (Julio Bros-Williamson, et.al., 2014)

Carried out works:

Upgrade of roof space

The ceiling was made of lath and plaster, with a polystyrene coving added afterwards. The loft room contained a little amount of mineral wool that had been installed some time ago and had collapsed in places. It was decided to replace the mineral wool with a sheep's wool product to a depth of 280 mm. Additional height for the ceiling joists was not required because there was no storage demand, but it could be added if needed. Additional roof ventilation is sometimes required when insulating such roof spaces, effectively changing a warm attic space into a cold one. The slates were connected directly to the sarking in this example, with no roofing or under-slate felt, and the ventilation to the roof space was deemed adequate. This intervention is quite feasible for application in kullas in Kosovo, Albania and Montenegro, but especially in the Dukagjini Plain in Kosovo, as the sheep shearing ritual is quite common, and the wool can be used for insulating the loft spaces of the roof.

Upgrade of windows

The existing windows had a traditional sash and case design and were in fine operating order. The cost of installing double glazed units into the existing sashes would have been considerable for such a little glazed space because the sashes were '6 over 6' (each sash had six panes). Because traditional secondary glazing would have been prohibitively expensive, an alternative polycarbonate system was used, which consists of a single sheet cut to size and adhered to the timber bearers within the staff beads with magnetic strips. While not up to the standards of more mainstream solutions, this glazing system allowed the shutters to function, addressed thermal heat losses and air leakage, and made a substantial impact. This intervention can be definitely applied to all case study kullas in the enlarged existing windows, but not in the original small ones.

Fig. 51 Left: Sheep’s wool insulation, right: Polycarbonate secondary glazing in place (Historic Scotland, 2012, p.9)

Improvement of floor

Upgrading floors can make a substantial difference in an occupant's impression of thermal comfort, because warm feet make you feel thermally more comfortable, and one will be pleased with a modest air temperature. As a result, the floor was an important aspect of the project that needed to be addressed. The main aim was to use guiding principle of water vapour permeable materials, and as such vapour barriers were not used in this project. As a result, a wood fiberboard was chosen, as it can buffer variations in humidity and control water vapour at this critical junction in the building fabric. Originally, the floor was a suspended timber floor with planks set on standard-sized timber joists. The solum was dry and well ventilated, with two conventional cast iron grilles in two positions through the walls, with a void height of roughly 200 mm. In order to prevent damage to the boards when lifting, the feathers of the boards were cut with a ‘skill saw’ to facilitate simple prising up. After the joists were determined to be in good condition, timber rails were secured to the lower edge of each joist with ring shank nails.

Although the skirting boards were removed, the disruption was kept to a minimum by limiting the quantity of boards taken. Bats were carved from 80 mm thick proprietary wood fibreboard to fit between the joists. The bats were then put into the gap between the joists and secured with a fixed rail. After that, the floorboards were replaced. This intervention is not feasible in the case studies of kullas, since the floor is not in suspended in the first place. Moreover, the insulation of the floor of any kind is more feasible where the timber floor is damaged, so that the authenticity is not lost on purpose, but the floor improvement (and insulation) is needed.

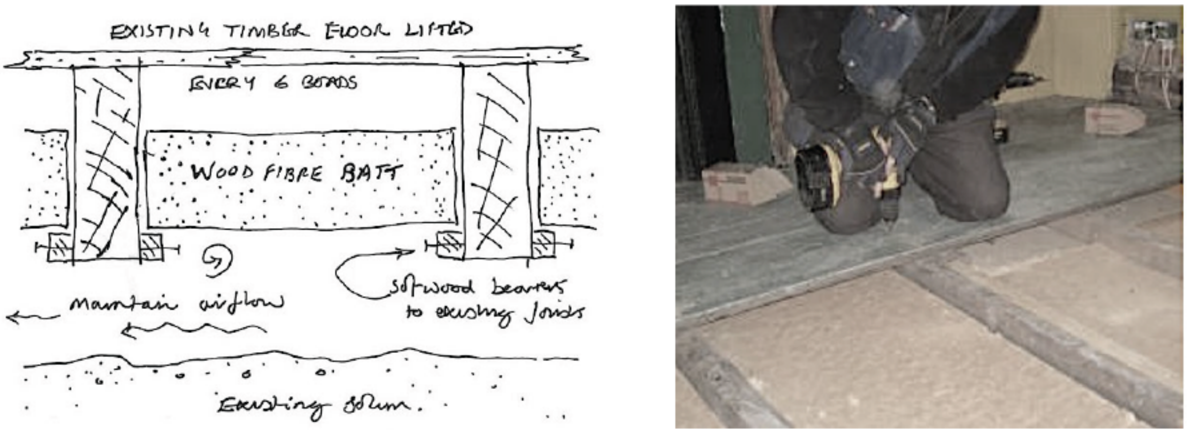


Fig. 52 Left: Detail of the floor insulation, right: Floor being fixed down over wood fibre bats (Historic Scotland, 2012, p.10-11)

Upgrade of external walls

Internal wall linings were lath and plaster with some plasterboard patching, with a space of around 40 mm behind the plaster. Because the space had three external walls, three distinct upgrade options were tested without removing the existing linings. Two of these procedures included blowing insulating material into the void behind the lath and plaster, while the third entailed applying a thin coating of high-performance insulant to the existing lining's surface. The correct operation of blown insulants requires that both faces of the masonry wall be kept vapour permeable to allow any vapour buildup to be dispersed and that the wall is not subjected to significant water loading, such as in an exposed location where wind driven rain is common. Wells o' Wearie Cottage is situated in a sheltered location, so wind-driven rain isn't a problem. Because of this, as well as the good state of the masonry, the walls were dry, and blown measures were regarded adequate.

All decorative coverings were removed prior to the work, and any faulty plaster was repaired. This was necessary not just for the later decorative work, but also to ensure that the plaster surface could manage moisture. A series of 25 mm diameter holes were drilled at 1-meter intervals over the face of the wall. The material was then blown into the void, starting at the bottom and working up. After the blowing in work was completed, the facings and skirting boards were restored, the holes were filled, and lining paper was put. Distemper paint was applied to the lining paper to test the potential benefits of better regulating humidity in upgraded buildings with reduced ventilation levels. On the second wall, a blown aerogel (a bead-type high-performance silica product) was tested as part of this project. The blower's pressures, however, were too high for the material, which, despite being in a bead form, broke apart in the hose and when it came into contact with the wall, resulting in a fine dust that was difficult to regulate. Because the material was able to get into the solum and through very small holes in the skirting boards, and the levels in the wall void were not rising much, the trial was called off. This product, which is a highly effective insulator, according to Historic Scotland, will be tested again in the future with a different delivery technique.

The infilling of the void behind the linings should not be undertaken if there are worries about wind-driven water penetration into mass walls, as the vented void plays a crucial role in water dispersal. Instead, an insulating material might be added to the existing linings' surface. A 10 mm layer of aerogel blanket was utilized in this project, which was secured to the wall behind an expanded mesh sheet using thermally decoupled fixings. The skirting boards and facings were removed to provide proper coverage of the wall, and two coats of renovating plaster were applied to finish. Vapour permeability is not a concern in this scenario since the existing void below the lining is properly controlling the vapour, and water vapour passing through the plaster layer is unimportant from a building fabric standpoint. Similarly, the type of paint used on the plaster is unimportant because moisture transmission is not necessary. Skirting boards were replaced, and the wall was covered with lining paper and a modern distemper, as with other measures. This is an excellent example of wall insulation, but it is inappropriate for the kulla case studies because the walls are made entirely of stones, plastered inside with lime mortar but without lath. This intervention, however, can be used in other kullas or historic buildings that qualify.

Fig. 53 Left: Blowing in the cellulose fiber, right: Aerogel blanket held behind mesh, right: First coat of plaster on top of the mesh/insulation layer (Historic Scotland, 2012, 13-14)

<u>Improvement of chimney</u>

Flues are blocked off and stacks are demolished in many energy-efficiency upgrading projects. This reduces air leakage and advection heat loss, but it also eliminates a vital source of ventilation. Furthermore, chimneystacks are generally a distinguishing element of traditional houses, thus their preservation was deemed critical in this project. Because other sources of air infiltration (from the floor and window) had been handled, it was thought necessary not just to maintain the stack open, but also to keep the flue open, permitting passive ventilation of the space. A chimney balloon was installed in the flue slightly above the grate as an alternative to permanent closure to restrict air passage in the winter and during heavy winds. When ventilation is desired, such as during the summer and other warm months, the balloon can be removed. This intervention can be applied in all kulla case studies when the chimneys are not used for stoves and the weather is hot (or in those chimneys that are not used).

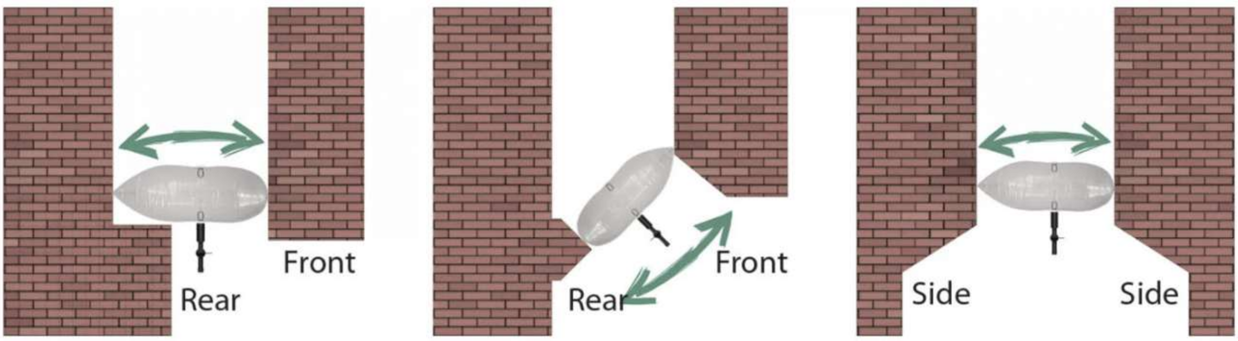


Fig. 54 The most suitable locations to fit chimney balloon (Chimney balloon, 2022)

To conclude, this project has demonstrated that in a traditionally constructed structure, a variety of basic and appropriate procedures can yield significant benefits.

10.2. Wee Causeway, Culross: Insulation of walls & roof[212]

The thermal upgrade of the historic cottage in Culross, Fife, owned by the National Trust for Scotland was implemented by Historic Scotland. One of the project's key goals was to achieve the maximum gain in thermal performance by employing vapour permeable materials where possible to allow the building fabric to breathe while keeping as much of the existing building fabric as possible. The information about this project was taken from the Historic Scotland Refurbishment Case Study 3 report, as cited in the title.

Building description

The 'Wee Causeway,' a detached cottage dating from the mid-eighteenth century, was used in this upgrading project. The building is made of lime-bound sandstone rubble masonry, although it's been re-pointed in a few places with cement. Kullas in Vuthaj and Valbona have also inappropriate interventions with cement mortar. It has a pitched pantile roof, which is popular along Scotland's east coast. The single-glazed sash and case windows possibly date from a 1960s renovation. In one ground-floor chamber, the walls were lath and plastered, while the others were plastered 'on the hard'- directly onto the masonry.

Fig. 55 View of the Wee Causeway cottage (Wanderintwo, 2022)

[212] Historic Scotland (2012 b) *Historic Scotland Refurbishment Case Study* 3. ISBN 978 1 84917 099 4. p.5-10. Available at: www.historic-scotland.gov.uk/refurbcasestudies.

Carried out works:

Improvements of external walls

A 10 mm thick aerogel blanket was utilized to insulate all external walls in the first-floor rooms (excluding the bathroom). Aerogel has a reasonable level of vapour permeability, according to experiments conducted by Historic Scotland, therefore it was thought appropriate to apply it directly to conventionally constructed mass masonry. Thermally decoupled expansion fasteners were used to secure it to the wall. After that, metal mesh was used to enable the application of a plaster finish. A thin timber bead was installed below the cornice when the plaster was applied to enable a clean transition to the new plasterwork.

Another trial was putting the calcium silicate board insulation directly to the interior face of the masonry in one room on the ground floor. Calcium silicate board is made from sand and lime that has been heated to create an open-pored structure that allows water vapour to pass through. As a result, the board has a high capillary action and is vapour open, which aids in humidity regulation. The previous wallpaper and paint were removed from the wall prior to the application in order to provide a good platform for the adhesive mortar, which secures the board to the masonry. A 15 mm thick board was installed, which was trimmed to shape using a normal hand saw when necessary. Two coats of plaster were applied to the board: a rough base coat and a smooth top coat.

These are excellent examples of wall insulation, but are inappropriate for kulla case studies because the walls are made entirely of stones, plastered inside with lime mortar and as such this intervention will totally affect the authenticity of these buildings. This intervention, however, can be used in other kullas or historic buildings that qualify.

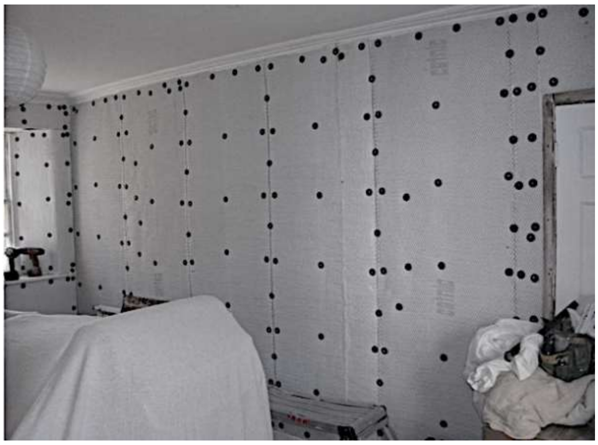


Fig. 56 Left: Aerogel insulation before applying the plaster finish, right: Calcium silicate board being applied to the masonry wall (Historic Scotland, 2012 b, p.5-10)

Upgrade of roof space

The roof area was the second component of the building fabric to be upgraded. This was achieved by putting 250 mm thick hemp wool insulation in the loft consisting of two layers of 100 mm and one layer of 50 mm. Hemp wool was chosen for its ability to absorb and release moisture as well as the ease with which it could be fitted. The roof space was cleansed of debris and old insulation before the operation began. This intervention is quite feasible for application in kullas in Kosovo, Albania and Montenegro, but first it has to be checked that hemp wool is locally available, or in other case a rather more vernacular material can be used for insulation, such as hay.

To conclude, this project has provided useful insight into a variety of mass masonry wall insulation systems. Two solutions for direct application to masonry that retain the vapour permeability inherent in traditionally constructed mass masonry were tested with good results in terms of ease of application and original fabric conservation. Simple work to insulate the loft resulted in a significant improvement, demonstrating that insulating a roof space is a good place to start when trying to enhance the thermal efficiency of traditionally constructed structures.

10.3. Holyrood Park Lodge, Edinburgh: Thermal performance upgrade[213]

This project, implemented in 2019 by Historic Building Energy Retrofit Atlas, consisted of a thermal upgrade and general upgrades to an 1858 Listed building in Edinburgh. It was a whole-house approach with historic fabric preservation as a top emphasis. The results were positive, and the energy performance rating (EPC) was improved. Various traditional characteristics have also been repaired and repurposed for the new usage of the building. The information about this project was taken from the Historic Building Energy Retrofit Atlas website, as cited in the title.

Building description

Holyrood Park Lodge is a Category B listed Victorian lodge building in Edinburgh, built in 1857 in the neo-gothic style and situated at the entrance to Holyrood Park. It is surrounded on one side by the Palace of Holyrood house and on the other by the Scottish Parliament, and was originally built for the constables who patrolled the Royal Park. The lodge is mostly traditional

[213] Historic Building Energy Retrofit Atlas (2019) *Holyrood Park Lodge.* Available at: https://www.hiberatlas.com/en/holyrood-park-lodge--2-120.html#section3.

in design, with coursed rubble and ashlar exterior masonry, lath and plaster interior linings upstairs, and a combination of lath and plaster and modern plasterboard downstairs. By 1994, the outside alterations had been restored to a more conventional form, and new timber window casements had been fitted. The floors were covered in a cord type commercial carpet, but underneath they were all made of timber and in decent shape.

Fig. 57 View of Holyrood Park Lodge (Historic Building Energy Retrofit Atlas, 2019)

Works carried out:

Improvement of external walls

A new layer of insulation was added internally, in the form of cellulose material that was blown in below the original plaster lining. Internal insulation was blown into the existing void beneath the plaster linings, allowing it to be preserved and upgraded. This ensured that the walls' vapour open qualities were preserved. These is an excellent example of wall insulation, but is inappropriate for kulla case studies because the walls are made entirely of stones, plastered inside with lime mortar and as such this intervention will totally affect the authenticity of these buildings. This intervention, however, can be used in other kullas or historic buildings that qualify.

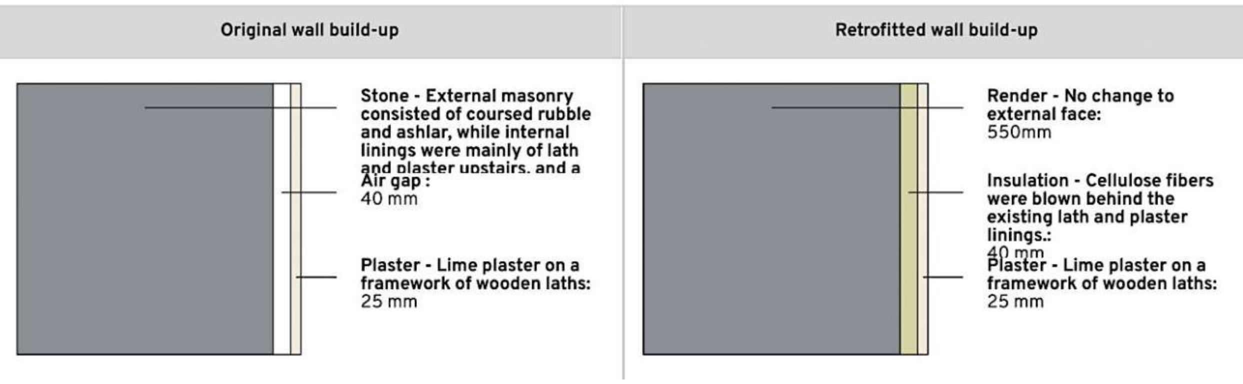


Fig. 58 Detail of before and after wall insulation materials View of Holyrood Park Lodge (Historic Building Energy Retrofit Atlas, 2019)

Windows upgrade

The decision was made to maintain the timber frames because they were in good shape. In the casements, however, new slim profile of double-glazed glass units was inserted. The casements were taken to the workshop and replaced with new double-glazed pieces. This intervention can be definitely applied to all case study kullas in the enlarged existing windows, but not in the original small ones.

Fig. 59 Left: One of the double-glazed units before installation, right: Draught strips added to casements (Historic Building Energy Retrofit Atlas, 2019)

Roof insulation

There were two roof areas in the lodge, separated by the chimney breast. Larger access hatches were installed in both attics to enable for safe working and visitation. This insulation was chosen since it buffers humidity in the roof areas and fits well with the project's natural material concept. The south facing gable of one of the roof spaces was equipped with wood fiber board fastened between the rafters to create a 'warm roof.' The other, west-facing attic, was fitted with wood fiber board between the ceiling joists, resulting in a 'cold roof.' This intervention is quite feasible for application in kullas in Kosovo, Albania and Montenegro, but first it has to be checked that wood fiber insulation is locally available, or in other case a rather more vernacular material can be used for insulation, such as hay.

Fig. 60 Left: The warm roof with wood fiber between the rafters, right: The cold roof with wood fiber insulation between the rafters (Historic Building Energy Retrofit Atlas, 2019)

Before and after the work, the temperature and relative humidity were measured. This was done to see how much human comfort had improved as a result of the study. After the implementation of the works, the inside conditions of the building have improved significantly. To conclude, the table below gives the options of possible thermal comfort upgrade interventions implemented in the above-mentioned case studies, that could easily be used in the kulla case studies in Kosovo, Albania and Montenegro.

INTERVENTIONS	CASE STUDY 1	CASE STUDY 2	CASE STUDY 3
Insulation of external walls	X	X	X
Insulation of roof space	Sheep's' wool	Hemp insulation	Wood fiber board
Insulation of timber floors	X		
Upgrade of windows	Polycarbonate second glazing		Double-glazed glass units and draught strips added to casements
Closing the chimney	Chimney balloon		

Table 2 Options of possible thermal comfort upgrade interventions in kullas based on the above good practices

PART III

THERMAL COMFORT ANALYSIS OF CASE STUDIES

KULLA OF ISUF MAZREKAJ- DRANOC
KULLA OF SELIMAJ FAMILY- VALBONA
KULLA OF DELI GJONBALAJ-VUTHAJ

PART III -

THERMAL COMFORT ANALYSIS OF CASE STUDIES: Kulla of Isuf Mazrekaj- Dranoc, Kulla of Selimaj Family- Valbona, Kulla of Deli Gjonbalaj-Vuthaj

Since thermal comfort is the main contributor towards achieving a sustainable use of historic buildings, this part focuses on bringing the main aspects of thermal comfort into light, by conducting various analysis on three case studies: Kulla of Isuf Mazrekaj-Dranoc, Kulla of Selimaj Family-Valbona, and Kulla of Deli Gjonbalaj-Vuthaj. The study of the climate and sun in the context, in this case the villages of Dranoc, Valbona, and Vuthaj, was conducted. Furthermore, the sun study of kullas setting was examined during all seasons of the year. The data loggers' temperature and relative humidity readings for Summer and Aumtun 2021 are shown. The final chapter provides an overview of kulla heating and ventilation as well as presents the defects and pathology of these three buildings.

11. CLIMATE AND SUN STUDY OF THE CONTEXT

11.1. DRANOC, KOSOVO

The village of Dranoc lies in the south of the Municipality of Deçan in Kosovo, which has declared Dranoc as a touristic area because of its rich cultural and natural heritage. Dranoc is conveniently situated in the middle of Dukagjini Plain, with very good connections to three of its surrounding towns, Peja, Gjakova, and Deçan. Dranoc is also close to villages of Junik and Isniq, which are renowned for their historical cores with kullas. The village is a settlement in the form of raised hills and plains of the clustered type, with houses built close to each other. Two rivers that pass through Dranoc and the nearby mountains represent an important resource for agricultural development. Almost every family has stalls in the mountains, where they spend most of the summer season. However, the village is mainly known for the intact historical core "Neighborhood of Mazrekaj", which consists of kullas and stone houses.[214] Kosovo's climate is largely continental, with warm summers and harsh winters influenced by Mediterranean and Alpine influences (average temperatures in the nation range from +30 °C in the summer to –10 °C in the winter).[215] The Kulla of Isuf Mazrekaj is located in this neighborhood, at the altitude elev. 593 m – (42°30'47" N, 20°17'43.5" E).

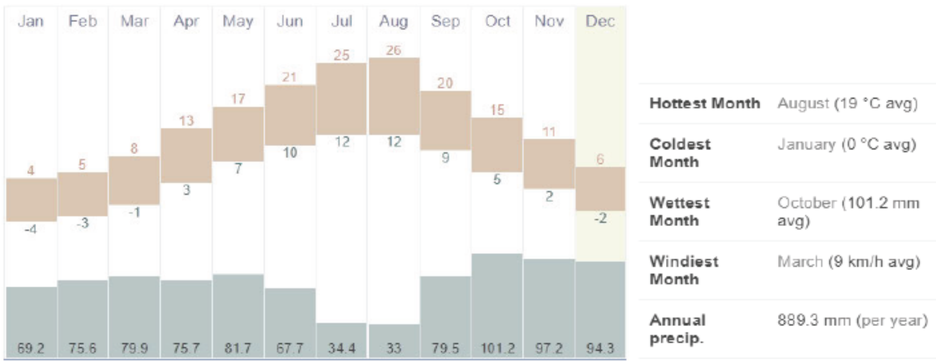


Fig. 61 Annual weather averages in Kukes (Time and date, 2022)

The climate data in the above plate were taken from the region of Kukës, in Albania, which is 55 km far from Dranoc, as there are no measured data for the village. The only updated measured climate data for Kosovo are those in the capital city of Prishtina, which is furtherer to Dranoc than Kukës and has a totally different geographic composition.

[214] CHwB Kosova (2021) *Creative Rural Kosovo.* Unpublished research. A project managed by the author.
[215] Republic of Kosovo (2022) *The Independent Commission of Mines and Minerals.* Climatic Conditions. Available at: https://kosovo-mining.org/kosovo/climatic-conditions/?lang=en.

Also, in order to get a slightly clearer picture of the temperatures in Dranoc, for the purposes of this thesis, the online Time and date calculator was used, where according to the data analysis, the following diagram is obtained.

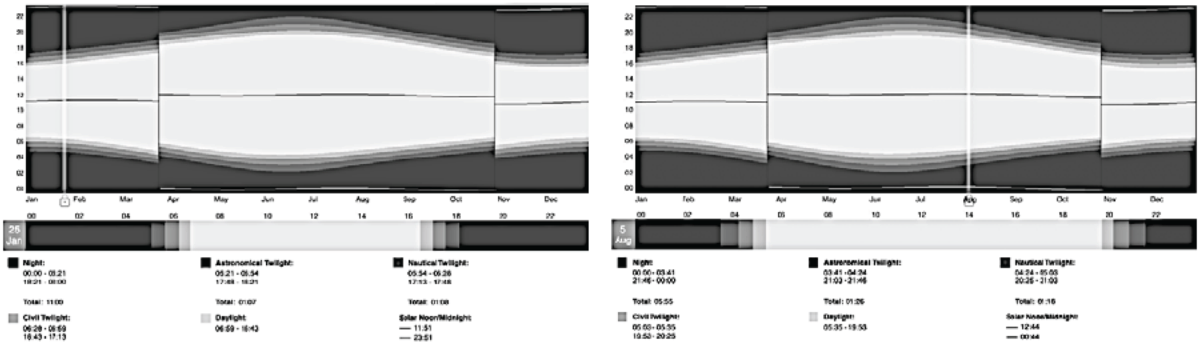


Fig. 62 Sun Graph for Dranoc (Time and date, 2022)

According to the above plates, both the one indicating the annual weather averages and the one for the sun graph, it can be seen that the hottest month in the region is August with the average temperature of 19 °C, whereas the coldest month is January with the average temperature of 0 °C. The windiest month is March, followed by October at the wettest month. The average annual precipitation is 889.3. In terms of the sun position to the village, the above plate indicates that during the hottest month of the summer, in 2021 the village had about 14 hours of daylight, and about 6 hours of night. On the other hand, during the coldest month of the year, the village had less than 10 hours of daylight, and 11 hours of night. The climate data for every season has been analyzed for the village of Dranoc, and the results are given below.

SPRING (21 March until 20 June- 92 days) Measurements: 05:00, 06:00, 07:00, 08:00, 12:00, 16:00, 17:00, 18:00, 19:00, (in total 9 measurements); average measurement of mid-spring (5 May, day 46).

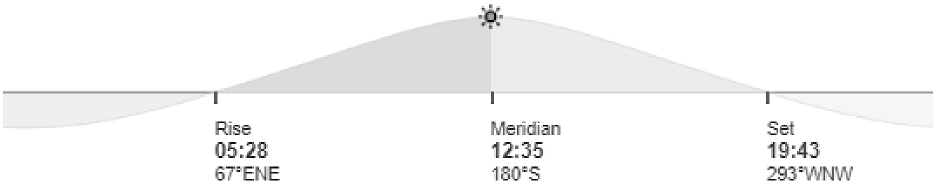


Fig. 63 Sunrise and sunset in Dranoc on 5th of May 2021 (Time and date, 2022)

Fig. 64 Sun study of Dranoc on 5th of May 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 05:00 o'clock, middle: 06:00 o'clock, right: 07:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 65 Sun study of Dranoc on 5th of May 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 08:00 o'clock, middle: 12:00 o'clock, right: 16:00 o'clock (pictures calculated from Google Earth, by the author)

Fig. 66 Sun study of Dranoc on 5th of May 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 17:00 o'clock, middle: 18:00 o'clock, right: 19:00 o'clock (pictures calculated from Google Earth, by the author)

	Temperature	Humidity	Pressure
High	31 °C (25 May, 17:00)	91% (20 May, 08:00)	1026 mbar (20 May, 08:00)
Low	7 °C (9 May, 08:00)	6% (12 May, 02:00)	1004 mbar (17 May, 14:00)
Average	18 °C	57%	1015 mbar

Fig. 67 Weather averages in Dranoc in May 2021 (Time and date, 2022)

	Conditions		Comfort				
Time	Temp	Weather	Wind		Humidity	Barometer	Visibility
05:00 Wed, 5 May	15 °C	Passing clouds.	11 km/h	↑	64%	1014 mbar	10 km
08:00	15 °C	Scattered clouds.	15 km/h	↑	63%	1013 mbar	10 km
11:00	17 °C	Partly sunny.	22 km/h	↑	45%	1012 mbar	10 km
14:00	20 °C	Partly sunny.	33 km/h	↑	39%	1011 mbar	10 km
17:00	21 °C	Partly sunny.	26 km/h	↗	37%	1010 mbar	10 km
20:00	19 °C	Overcast.	19 km/h	↗	49%	1010 mbar	10 km
23:00	16 °C	Passing clouds.	15 km/h	↗	61%	1010 mbar	10 km

Fig. 68 Weather conditions and comfort in Dranoc on 5th of May 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Spring, in Dranoc, the sun rises at 05:28 and sets at 19:43, and the total sun timespan is 14 hrs. and 15 min. The sun calculations from Google Earth, show that during Spring, the Kulla of Isuf Mazrekaj is not overshadowed during the day, but only from 18:00 o'clock, because of the position of its location and since it is not surrounded immediately by mountains. The main shadowed area of Dranoc is emphasized in the west. As far as the temperatures are concerned, the highest temperature during May 2021 is 31°C, whereas the lowest is 7 °C. The average temperature during this month is 18 °C, whereas the average relative humidity is 57%. On the other hand, on 5th of May 2021, the highest temperature was 21°C, the lowest is 15°C, whereas the relative humidity lowest value was 37%at 17:00 rising to 64 % at 05:00.

SUMMER (21 June until 20 September- 92 days) Measurements: 05:00, 06:00, 07:00, 08:00, 12:00, 16:00, 17:00, 18:00, 19:00, 20:00, (in total 10 measurements); average measurement of mid-Summer (5 August, day 46).

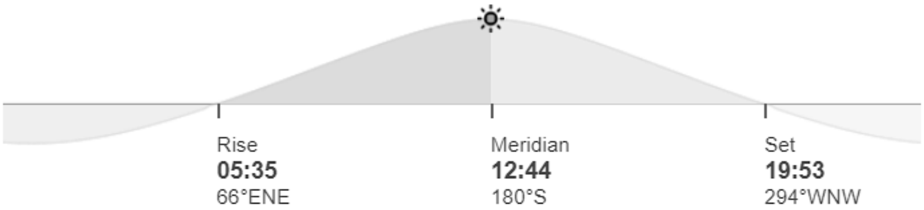


Fig. 69 Sunrise and sunset in Dranoc on 5th of August 2021 (Time and date, 2022)

Fig. 70 Sun study of Dranoc on 5th of August 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 05:00 o'clock, middle: 06:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 71 Sun study of Dranoc on 5th of August 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 12:00 o'clock, middle: 16:00 o'clock, right: 17:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 72 Sun study of Dranoc on 5th of May 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 18:00 o'clock, middle: 19:00 o'clock, right: 20:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	38 °C (10 Aug, 17:00)	92% (26 Aug, 11:00)	1023 mbar (26 Aug, 11:00)
Low	2 °C (11 Aug, 23:00)	18% (5 Aug, 14:00)	1005 mbar (6 Aug, 20:00)
Average	25 °C	51%	1013 mbar

Fig. 73 Weather average in Dranoc in August 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
14:00 Thu, 5 Aug		37 °C	Partly sunny.	37 km/h	↗	18%	1006 mbar	10 km
17:00		35 °C	Scattered clouds.	33 km/h	↗	27%	1006 mbar	10 km
23:00		30 °C	Passing clouds.	26 km/h	↗	36%	1006 mbar	10 km

Fig. 74 Weather conditions and comfort in Dranoc on 5th of August 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Summer, in Dranoc, the sun rises at 05:35 and sets at 19:53 and the total sun timespan is 14 hrs. 30 min. The sun calculations from Google Earth, show that during Summer, the Kulla of Isuf Mazrekaj is not overshadowed during the day, but only before sunrise and from 18:00 o'clock onwards, because of the position of its location and since it is not surrounded immediately by mountains. The main shadowed area of Dranoc is emphasized in the west. As far as the temperatures are concerned, the highest temperature during August 2021 is 38°C, whereas the lowest is 2 °C. The average temperature during this month is 25 °C, whereas the average relative humidity is 51%. On the other hand, on 5th of August 2021, the highest temperature was 37°C, the lowest is 30°C, whereas the relative humidity lowest value was 18% at 14:00 rising to 36 % at 23:00.

AUTUMN (21 September until 20 December- 91 days). Measurements: 06:00, 07:00, 08:00, 09:00, 12:00, 15:00, 16:00, 17:00, 18:00, (in total 9 measurements); average measurement of mid-Autumn (5 November, day 46).

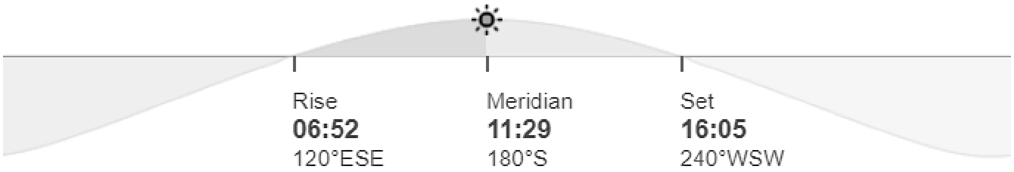


Fig. 75 Sun rise and sun set in Dranoc on 5th of November 2021 (Time and date, 2022)

Fig. 76 Sun study of Dranoc on 5th of November 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 06:00 o'clock, middle: 07:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 77 Sun study of Dranoc on 5th of November 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 09:00 o'clock, middle: 12:00 o'clock, right: 15:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 78 Sun study of Dranoc on 5th of November 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 16:00 o'clock, middle: 17:00 o'clock, right: 18:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	26 °C (4 Nov, 16:00)	97% (14 Nov, 07:00)	1032 mbar (14 Nov, 07:00)
Low	0 °C (25 Nov, 10:00)	35% (13 Nov, 10:00)	998 mbar (29 Nov, 07:00)
Average	10 °C	77%	1018 mbar

Fig. 79 Weather averages Dranoc in November 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
07:00 Fri, 5 Nov		16 °C	Sunny.	19 km/h	↗	72%	1013 mbar	10 km
16:00		24 °C	Partly sunny.	19 km/h	↗	50%	1013 mbar	10 km
19:00		22 °C	Passing clouds.	22 km/h	↗	57%	1016 mbar	10 km
22:00		20 °C	Passing clouds.	11 km/h	↗	61%	1018 mbar	10 km

Fig. 80 Weather conditions and comfort in Dranoc on 5th of November 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Autumn, in Dranoc, the sun rises at 06:52 and sets at 16:05, and the total sun timespan is 9 hrs. 22 min. The sun calculations from Google Earth, show that during Autumn, the Kulla of Isuf Mazrekaj is overshadowed from sunrise to 08:00 o'clock and then again before 16:00 o'clock onwards. The main shadowed area of Dranoc is emphasized in the west. As far as the temperatures are concerned, the highest temperature during November 2021 is 26°C, whereas the lowest is 0 °C. The average temperature during this month is 10 °C, whereas the average relative humidity is 77%. On the other hand, on 5th of November 2021, the highest temperature was 24°C, the lowest is 16°C, whereas the relative humidity lowest value was 50% at 16:00 rising to 72 % at 07:00.

WINTER (21 December until 20 March- 90-91 days). Measurements: 06:00, 07:00, 08:00, 09:00, 12:00, 15:00, 16:00, 17:00, (in total 8 measurements); average measurement of mid-Winter (3 February, day 44).

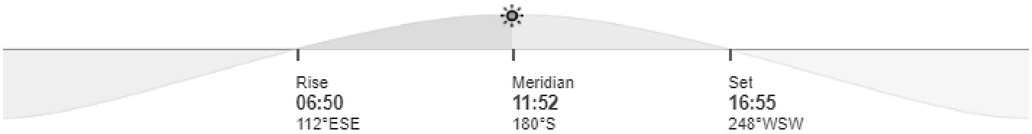


Fig. 81 Sunrise and sunset in Dranoc on 3rd of February 2021 (Time and date, 2022)

Fig. 82 Sun study of Dranoc on 3rd of February 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 06:00 o'clock, middle: 07:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 83 Sun study of Dranoc on 3rd of February 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 09:00 o'clock, middle: 12:00 o'clock, right: 15:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

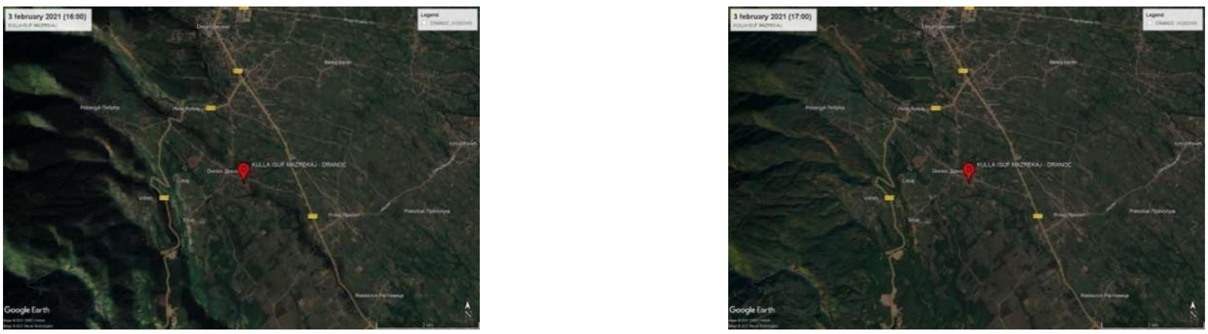


Fig. 84 Sun study of Dranoc on 3rd of February 2021(Location of Kulla of Isuf Mazrekaj in red pin), left: 16:00 o'clock, right: 17:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	21 °C (6 Feb, 16:00)	91% (11 Feb, 13:00)	1036 mbar (11 Feb, 13:00)
Low	-8 °C (15 Feb, 07:00)	34% (6 Feb, 16:00)	997 mbar (8 Feb, 13:00)
Average	7 °C	67%	1021 mbar

Fig. 85 Weather average in Dranoc in February 2021 (Time and date, 2022)

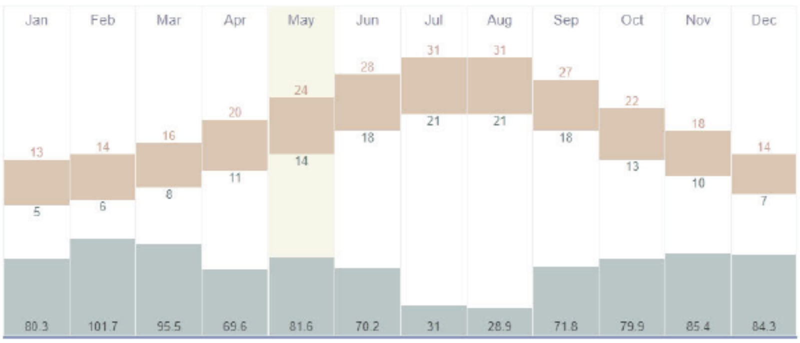
	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
01:00 Wed, 3 Feb		8 °C	Passing clouds.	No wind	↓	75%	1019 mbar	10 km
07:00		5 °C	Sunny.	No wind	↓	90%	1020 mbar	10 km
13:00		14 °C	Sunny.	15 km/h	↑	60%	1018 mbar	15 km
16:00		16 °C	Passing clouds.	19 km/h	↗	49%	1016 mbar	15 km
19:00		11 °C	Passing clouds.	22 km/h	↗	58%	1016 mbar	15 km
22:00		10 °C	Clear.	7 km/h	↗	67%	1017 mbar	10 km

Fig. 86 Weather conditions and comfort in Dranoc on 3rd of February 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Winter, in Dranoc, the sun rises at 06:50 and sets at 16:55, and the total sun timespan is 10 hrs. 8 min. The sun calculations from Google Earth, show that during Winter, the Kulla of Isuf Mazrekaj is overshadowed from sunrise to 08:00 o'clock and then before 16:00 o'clock onwards. The main shadowed area of Dranoc is emphasized in the west. As far as the temperatures are concerned, the highest temperature during February 2021 is 21°C, whereas the lowest is -8 °C. The average temperature during this month is 7 °C, whereas the average relative humidity is 67%. On the other hand, on 3rd of February 2021, the highest temperature was 16°C, the lowest is 8°C, whereas the relative humidity lowest value was 49% at 16:00 rising to 90 % at 07:00.

11.2. VALBONA, ALBANIA

Valbona village is part of Margegaj Administrative Unit of the Municipality of Tropoja in Albania. This village is part of Valbona National Park, which is widely known for its pristine natural biodiversity. Valbona is located in the northern part of Tropoja municipality and is a very attractive area visited by many local and foreign tourists. The village has about 60 houses, mainly two and three-story old kulla and stone houses with characteristic alpine roof with timber boards. The area is composed geologically by rocky formations, throughout which crosses the river "Valbona", which is about 50 km long, and is one of the most torrential rivers in the North Alps of Albania. Agriculture is cultivated mainly in the form of small, family-run alpine farming, i.e., summer grazing of livestock up to the alpine pastures (June to September) and winter sheltering down in the valleys.[216] The climate in Valbona is characterized by cold winters and fresh summers. [217] The Kulla of Selimaj family is located in the village of Valbona, at the altitude elev. 930 m – (42°27’09” N, 19°53’39” E).



Hottest Month	July (26 °C avg)
Coldest Month	January (9 °C avg)
Wettest Month	February (101.7 mm avg)
Windiest Month	December (14 km/h avg)
Annual precip.	880.1 mm (per year)

Fig. 87 Annual weather averages in Kukes (Time and date, 2022)

The climate data in the above plate were taken from the region of Shkodra, in Albania, which is 49 km far from Valbona village, as there are no particular measured data for the village.

[216] CHwB Kosovo (2021) Ilucidare Capacity Building: *“Mapping, assessing and valuing kulla in Valbona”*. A Project managed by the author.
[217] Erjola Keçi & Elisabeth Krog (2011) *Thethi & Valbona Valley National Parks, and Gashi River Strict Nature Reserve Management Plan*. The European Union’s IPA 2010 programme for Albania. p.13-14.

Also, in order to get a slightly clearer picture of the temperatures in Valbona, for the purposes of this thesis, the online Time and date calculator was used, where according to the data analysis, the following diagram is obtained.

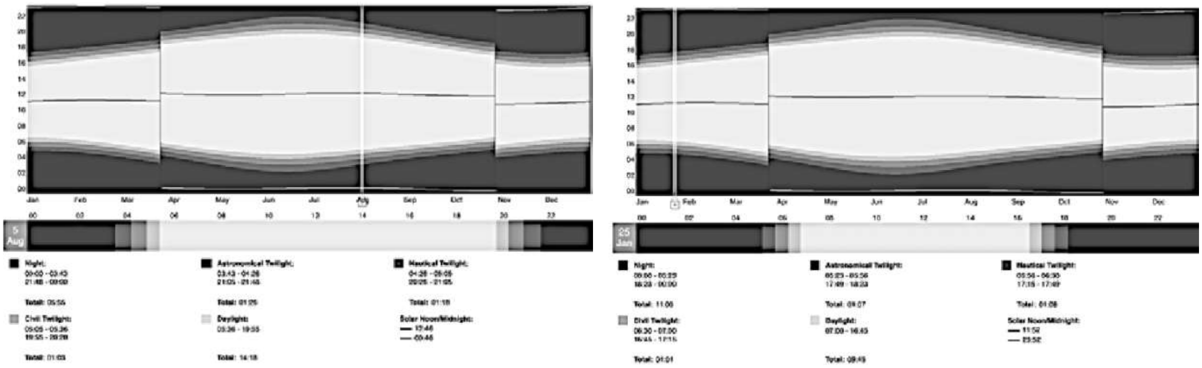


Fig. 88 Sun Graph for Valbona (Time and date, 2022)

According to the above plates, both the one indicating the annual weather averages and the one for the sun graph, it can be seen that the hottest month in the region is July with the average temperature of 26 °C, whereas the coldest month is January with the average temperature of 9 °C. The windiest month is December, followed by February at the wettest month. The average annual precipitation is 880.1. In terms of the sun position to the village, the above plate indicates that during the hottest month of the summer, in 2021 the village had about 14 hours of daylight, and about 6 hours of night. On the other hand, during the coldest month of the year, the village had less than 10 hours of daylight, and 11 hours of night. The climate data for every season has been analyzed for the village of Valbona, and the results are as follow.

SPRING (21 March until 20 June- 92 days) Measurements: 05:00, 06:00, 07:00, 08:00, 12:00, 16:00, 17:00, 18:00, 19:00, (in total 9 measurements); average measurement of mid-spring (5 May, day 46).

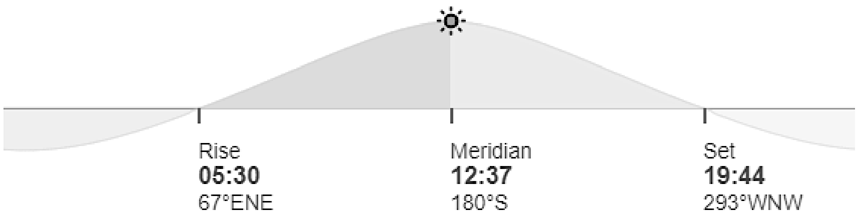


Fig. 89 Sunrise and sunset in Valbona on 5th of May 2021 (Time and date, 2022)

Fig. 90 Sun study of Valbona on 5th of May 2021(Location of Kulla of Selimaj family in red pin), left: 05:00 o’clock, middle: 06:00 o’clock, right: 07:00 o’clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 91 Sun study of Valbona on 5th of May 2021(Location of Kulla of Selimaj family in red pin), left: 08:00 o’clock, middle: 12:00 o’clock, right: 16:00 o’clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 92 Sun study of Valbona on 5th of May 2021(Location of Kulla of Selimaj family in red pin), left: 17:00 o’clock, middle: 18:00 o’clock, right: 19:00 o’clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	29 °C (24 May, 17:00)	100% (4 May, 05:00)	1022 mbar (4 May, 05:00)
Low	2 °C (23 May, 23:00)	18% (25 May, 14:00)	1009 mbar (13 May, 11:00)
Average	19 °C	66%	1015 mbar

Fig. 93 Weather average in Valbona in May 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
05:00 Wed, 5 May		16 °C	Passing clouds.	11 km/h	←	74%	1013 mbar	10 km
17:00		22 °C	Partly sunny.	11 km/h	↗	38%	1013 mbar	15 km
20:00		19 °C	Passing clouds.	11 km/h	↑	66%	1013 mbar	15 km
23:00		18 °C	Passing clouds.	7 km/h	↖	88%	1013 mbar	10 km

Fig. 94 Weather conditions and comfort in Valbona on 5th of May 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Spring, in Valbona, the sun rises at 05:30 and sets at 19:44 and has a total sun timespan of 14 hrs. and 23 min. The sun calculations from Google Earth, show that during Spring, the Kulla of Selimaj family is overshadowed from sunrise to 07:00 o'clock and then after 17:00 o'clock onwards. The shadowing comes from mountains surrounding the kulla in all directions. As far as the temperatures are concerned, the highest temperature during May 2021 is 29°C, whereas the lowest is 2 °C. The average temperature during this month is 19 °C, whereas the average relative humidity is 66%. On the other hand, on 5th of May 2021, the highest temperature is 22°C, the lowest is 16°C, whereas the relative humidity lowest value is 38% at 17:00 rising to 88 % at 23:00.

SUMMER (21 June until 20 September- 92 days) Measurements: 05:00, 06:00, 07:00, 08:00, 12:00, 16:00, 17:00, 18:00, 19:00, 20:00, (in total 10 measurements); average measurement of mid-Summer (5 August, day 46).

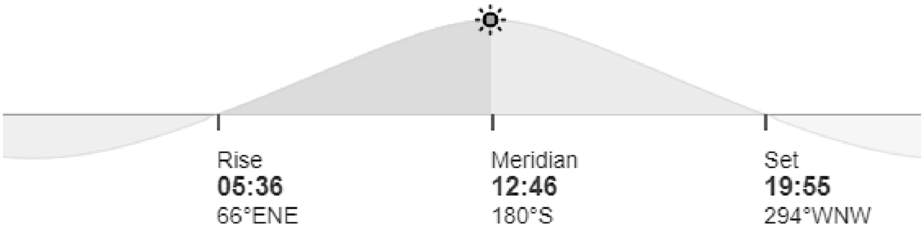


Fig. 95 Sunrise and sunset in Valbona on 5th of August 2021 (Time and date, 2022)

Fig. 96 Sun study of Valbona on 5th of August 2021(Location of Kulla of Selimaj family in red pin), left: 05:00 o'clock, middle: 06:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 97 Sun study of Valbona on 5th of August 2021(Location of Kulla of Selimaj family in red pin), left: 08:00 o'clock, middle: 12:00 o'clock, right: 16:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 98 Sun study of Valbona on 5th of August 2021(Location of Kulla of Selimaj family in red pin), left: 17:00 o'clock, middle: 18:00 o'clock, right: 19:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	38 °C (12 Aug, 17:00)	93% (27 Aug, 23:00)	1020 mbar (27 Aug, 23:00)
Low	15 °C (31 Aug, 08:00)	3% (12 Aug, 14:00)	1006 mbar (6 Aug, 17:00)
Average	27 °C	54%	1013 mbar

Fig. 99 Weather average in Valbona in August 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
14:00 Thu, 5 Aug		32 °C	Partly sunny.	22 km/h	↗	60%	1010 mbar	20 km
17:00		33 °C	Partly sunny.	15 km/h	↗	58%	1009 mbar	20 km
23:00		28 °C	Passing clouds.	No wind	↓	76%	1007 mbar	10 km

Fig. 100 Weather conditions and comfort in Valbona on 5th of May 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Summer, in Valbona, the sun rises at 05:36 and sets at 19:55 and has a total sun timespan of 14 hrs. and 32 min. The sun calculations from Google Earth, show that during Spring, the Kulla of Selimaj family is overshadowed from sunrise to 07:00 o'clock and then after 18:00 o'clock onwards. The shadowing comes from mountains surrounding the kulla in all directions. As far as the temperatures are concerned, the highest temperature during August 2021 is 38°C, whereas the lowest is 15 °C. The average temperature during this month is 27 °C, whereas the average relative humidity is 54%. On the other hand, on 5th of August 2021, the highest temperature is 33°C, the lowest is 28°C, whereas the relative humidity lowest value is 58% at 17:00 rising to 76 % at 23:00.

AUTUMN (21 September until 20 December- 91 days). Measurements: 06:00, 07:00, 08:00, 09:00, 12:00, 15:00, 16:00, 17:00, 18:00, (in total 9 measurements); average measurement of mid-Autumn (5 November, day 46).

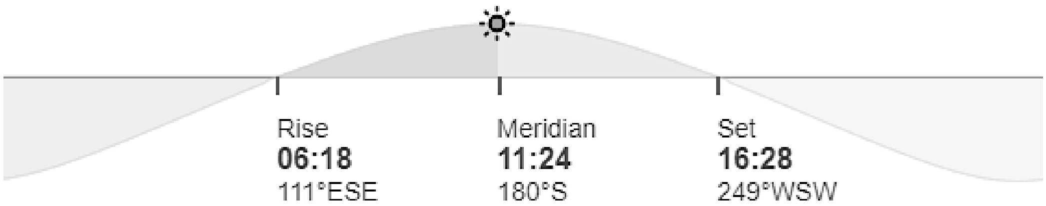


Fig. 101 Sunrise and sunset in Valbona on 5th of November 2021 (Time and date, 2022)

Fig. 102 Sun study of Valbona on 5th of November 2021(Location of Kulla of Selimaj family in red pin), left: 06:00 o'clock, middle: 07:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 103 Sun study of Valbona on 5th of November 2021(Location of Kulla of Selimaj family in red pin), left: 09:00 o'clock, middle: 12:00 o'clock, right: 15:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 104 Sun study of Valbona on 5th of November 2021(Location of Kulla of Selimaj family in red pin), left: 16:00 o'clock, middle: 17:00 o'clock, right: 18:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	24 °C (7 Nov, 16:00)	98% (5 Nov, 16:00)	1028 mbar (5 Nov, 16:00)
Low	1 °C (30 Nov, 22:00)	26% (30 Nov, 16:00)	997 mbar (28 Nov, 22:00)
Average	14 °C	75%	1016 mbar

Fig. 105 Weather averages in Valbona, in November 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
07:00 Fri, 5 Nov		15 °C	Scattered clouds.	7 km/h	↘	85%	1014 mbar	10 km
16:00		21 °C	Rain showers. Overcast.	15 km/h	↖	98%	1019 mbar	7 km
19:00		18 °C	Overcast.	4 km/h	←	89%	1019 mbar	10 km
22:00		18 °C	Overcast.	No wind	↓	87%	1019 mbar	10 km

Fig. 106 Weather conditions and comfort in Valbona on 5th of November 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Autumn, in Valbona, the sun rises at 06:18 and sets at 16:28 and has a total sun timespan of 10 hrs. and 17 min. The sun calculations from Google Earth, show that during Autumn, the Kulla of Selimaj family is overshadowed from sunrise to 09:00 o'clock and then after 15:00 o'clock onwards. The shadowing comes from mountains surrounding the kulla in all directions. As far as the temperatures are concerned, the highest temperature during November 2021 is 24°C, whereas the lowest is 1 °C. The average temperature during this month is 14 °C, whereas the average relative humidity is 75%. On the other hand, on 5th of November 2021, the highest temperature is 21°C, the lowest is 15°C, whereas the relative humidity lowest value is 85% at 07:00 rising to 98 % at 16:00.

WINTER (21 December until 20 March- 90-91 days). Measurements: 06:00, 07:00, 08:00, 09:00, 12:00, 15:00, 16:00, 17:00, (in total 8 measurements); average measurement of mid-Winter (3 February, day 44).

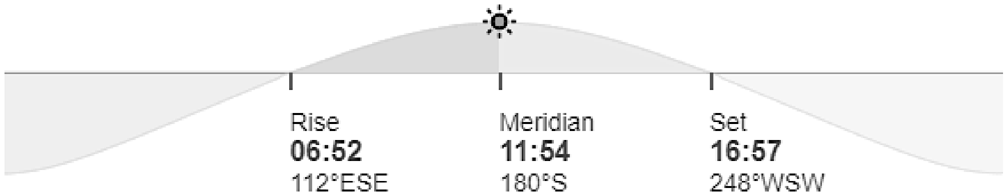


Fig. 107 Sunrise and sunset in Valbona on 3rd of February 2021 (Time and date, 2022)

Fig. 108 Sun study of Valbona on 3rd of February 2021(Location of Kulla of Selimaj family in red pin), left: 06:00 o'clock, middle: 07:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 109 Sun study of Valbona on 3rd of February 2021 (Location of Kulla of Selimaj family in red pin), left: 09:00 o'clock, middle: 12:00 o'clock, right: 17:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 110 Sun study of Valbona on 3rd of February 2021 (Location of Kulla of Selimaj family in red pin), left: 16:00 o'clock, right: 17:00 o'clock (pictures calculated from Google Earth- sun tool, by the author

	Temperature	Humidity	Pressure
High	22 °C (24 Feb, 16:00)	100% (1 Feb, 13:00)	1034 mbar (1 Feb, 13:00)
Low	-3 °C (16 Feb, 07:00)	10% (27 Feb, 16:00)	999 mbar (8 Feb, 10:00)
Average	9 °C	65%	1021 mbar

Fig. 111 Weather averages in Valbona, in November 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
01:00 Wed, 3 Feb		9 °C	Passing clouds.	4 km/h	←	88%	1017 mbar	10 km
07:00		6 °C	Partly sunny.	7 km/h	↖	88%	1018 mbar	10 km
13:00		12 °C	Sunny.	11 km/h	↘	84%	1020 mbar	20 km
16:00		16 °C	Passing clouds.	No wind	↓	50%	1019 mbar	20 km
19:00		12 °C	Clear.	11 km/h	←	88%	1019 mbar	10 km
22:00		9 °C	Clear.	11 km/h	←	91%	1019 mbar	10 km

Fig. 112 Weather conditions and comfort in Valbona, on 3rd of February 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Winter, in Valbona, the sun rises at 06:52 and sets at 16:57 and has a total sun timespan of 10 hrs. and 8 min. The sun calculations from Google Earth, show that during Winter, the Kulla of Selimaj family is overshadowed from sunrise up to before noon and then after 15:00 o'clock onwards. The shadowing comes from mountains surrounding the kulla in all directions. As far as the temperatures are concerned, the highest temperature during February 2021 is 22°C, whereas the lowest is -3 °C. The average temperature during this month is 9 °C, whereas the average relative humidity is 65%. On the other hand, on 3rd of February 2021, the highest temperature is 16°C, the lowest is 6°C, whereas the relative humidity lowest value is 50% at 16:00 rising to 91 % at 22:00.

11.3. VUTHAJ, MONTENEGRO

Vuthaj is a picturesque village in the Municipality of Guci in Montenegro. The municipalities of Guci and Plavë, known as a province in the southeastern Montenegro, constitute a territory of about 486 km², and are inhabited predominantly by Albanians. The province is bordered by the Republic of Kosovo from the east, while from the south and southwest by the Republic of Albania. The province of Plavë and Guci consists of four relief units: the plain of Plavë and Guci with the glacial terminal basin of Lake Plava, Polimja, Bjeshkët e Nëmuna and the group of mountains Visitor and Zeletin.[218] The village of Vuthaj is widely known for its geo-biodiversity, mountain tourism as well as for vernacular stone houses and kullas. The climate of the Plava-Gucia valley is continental with two variants: the medium continental in the valley and the harsh mountainous in the mountainous area. The Kulla of Deli Gjonbalaj is located in the village of Vuthaj, at the altitude elev. 942 m – (42°31’40” N, 19°50’15” E).

Hottest Month	August (27 °C avg)
Coldest Month	January (6 °C avg)
Wettest Month	December (89.4 mm avg)
Windiest Month	March (11 km/h avg)
Annual precip.	528.2 mm (per year)

Fig. 113 Annual weather averages in Podgorica (Time and date, 2022)

The climate data in the above plate were taken from the city of Podgorica, in Montenegro, which is 52 km far from Vuthaj village, as there are no particular measured data for the village.

[218] Labeatët (2021) *Kullas in Plavë and Guci*. Ilucidare project. Unpublished research project.

Also, in order to get a slightly clearer picture of the temperatures in Vuthaj, for the purposes of this thesis, the online Time and date calculator was used, where according to the data analysis, the following diagram is obtained.

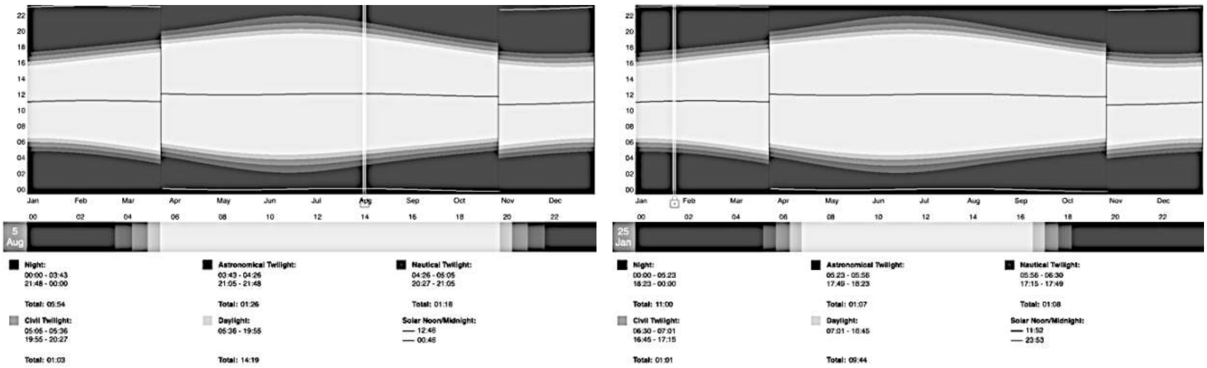


Fig. 114 Sun graph in Vuthaj (Time and date, 2022)

According to the above plates, both the one indicating the annual weather averages and the one for the sun graph, it can be seen that the hottest month in the region is August with the average temperature of 27 °C, whereas the coldest month is January with the average temperature of 6 °C. The windiest month is March, followed by December ats the wettest month. The average annual precipitation is 528.2. In terms of the sun position to the village, the above plate indicates that during the hottest month of the summer, in 2021 the village had about 14.19 hours of daylight, and about 6 hours of night. On the other hand, during the coldest month of the year, the village had less than 10 hours of daylight, and 11 hours of night. The climate data for every season has been analyzed for the village of Vuthaj, and the results are as follow.

SPRING (21 March until 20 June- 92 days) Measurements: 05:00, 06:00, 07:00, 08:00, 12:00, 16:00, 17:00, 18:00, 19:00, (in total 9 measurements); average measurement of mid-spring (5 May, day 46).

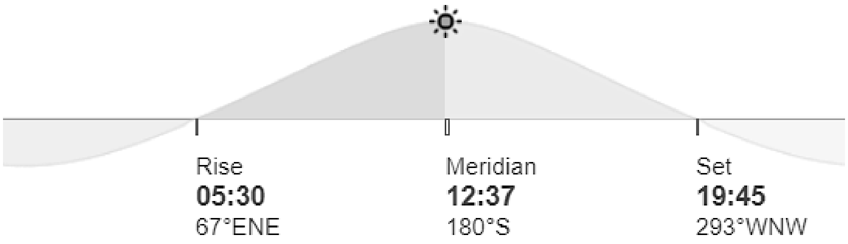


Fig. 115 Sunrise and sunset in Vuthaj on the 5th of May 2021 (Time and date, 2022)

Fig. 116 Sun study of Vuthaj on 5th of May 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 05:00 o'clock, middle: 06:00 o'clock, right: 07:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 117 Sun study of Vuthaj on 5th of May 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 08:00 o'clock, middle: 12:00 o'clock, right: 16:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 118 Sun study of Vuthaj on 5th of May 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 17:00 o'clock, middle: 18:00 o'clock, right: 19:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	31 °C (24 May, 16:00)	100% (2 May, 02:00)	1020 mbar (2 May, 02:00)
Low	10 °C (4 May, 04:30)	17% (9 May, 16:00)	1008 mbar (12 May, 15:30)
Average	19 °C	59%	1014 mbar

Fig. 119 Weather averages in Vuthaj in May 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
00:00 Wed, 5 May		17 °C	Passing clouds.	No wind		49%	1014 mbar	N/A
03:00		15 °C	Passing clouds.	6 km/h		63%	1013 mbar	N/A
04:00		15 °C	Passing clouds.	2 km/h		63%	1013 mbar	N/A
06:00		15 °C	Light rain. Overcast.	6 km/h		68%	1013 mbar	N/A
09:00		16 °C	Mostly cloudy.	11 km/h		68%	1014 mbar	N/A
12:00		18 °C	Broken clouds.	9 km/h		52%	1013 mbar	N/A
15:00		20 °C	Broken clouds.	6 km/h		43%	1012 mbar	N/A
18:00		21 °C	Scattered clouds.	11 km/h		38%	1011 mbar	N/A
21:00		16 °C	Passing clouds.	11 km/h		72%	1012 mbar	N/A

Fig. 120 Weather conditions and comfort in Vuthaj, on 5th of May 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Spring, in Vuthaj, the sun rises at 05:30 and sets at 19:45 and has a total sun timespan of 14 hrs. and 25 minutes. The sun calculations from Google Earth, show that during Spring, the Kulla of Deli Gjonbalaj family is overshadowed from sunrise up to 07:00 o'clock and then from 18:00 o'clock onwards. From sunrise, the shadows come from mountains surrounding the kulla on the east, whereas approaching the sunset, kulla in shadowed by the mountains from west. As far as the temperatures are concerned, the highest temperature during May 2021 is 31°C, whereas the lowest is 10 °C. The average temperature during this month is 19 °C, whereas the average relative humidity is 59%. On the other hand, on 5th of May 2021, the highest temperature is 21°C, the lowest is 15°C, whereas the relative humidity lowest value is 38% at 18:00 rising to 72 % at 21:00.

SUMMER (21 June until 20 September- 92 days) Measurements: 05:00, 06:00, 07:00, 08:00, 12:00, 16:00, 17:00, 18:00, 19:00, 20:00, (in total 10 measurements); average measurement of mid-Summer (5 August, day 46).

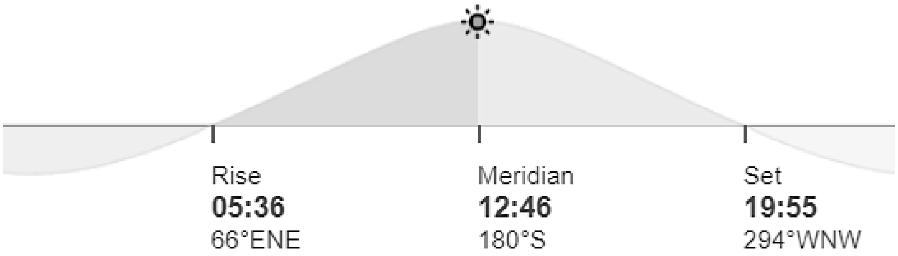


Fig. 121 Sunrise and sunset during mid-Summer 2021 in Vuthaj (Time and date, 2022)

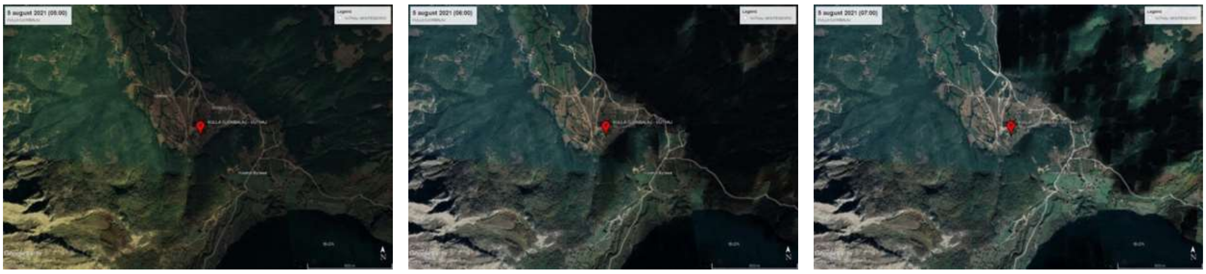


Fig. 122 Sun study of Vuthaj on 5th of August 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 06:00 o'clock, middle: 06:00 o'clock, right: 07:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 123 Sun study of Vuthaj on 5th of August 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 08:00 o'clock, middle: 12:00 o'clock, right: 16:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

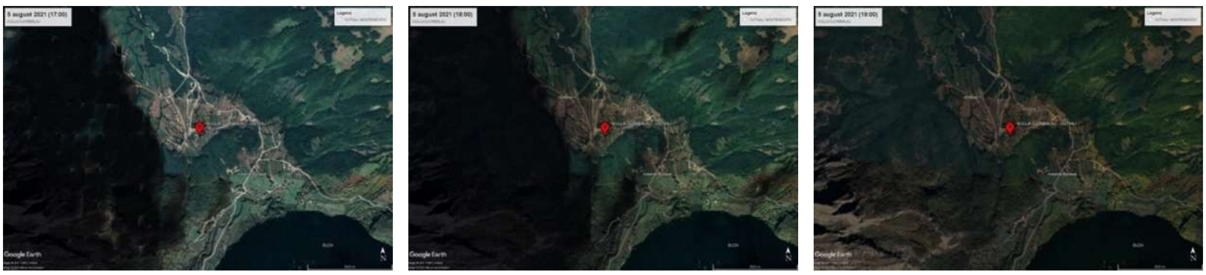


Fig. 124 Sun study of Vuthaj on 5th of August 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 17:00 o'clock, middle: 18:00 o'clock, right: 19:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	39 °C (1 Aug, 15:00)	100% (25 Aug, 05:30)	1019 mbar (25 Aug, 05:30)
Low	15 °C (31 Aug, 05:30)	13% (8 Aug, 13:00)	1005 mbar (6 Aug, 13:30)
Average	28 °C	44%	1013 mbar

Fig. 125 Weather averages in Vuthaj in May 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
00:00 Thu, 5 Aug		26 °C	Clear.	4 km/h		45%	1013 mbar	16 km
03:00		24 °C	Passing clouds.	9 km/h		50%	1011 mbar	N/A
06:00		23 °C	Passing clouds.	9 km/h		53%	1010 mbar	N/A
09:00		30 °C	Broken clouds.	6 km/h		38%	1009 mbar	N/A
12:00		32 °C	Scattered clouds.	26 km/h		41%	1008 mbar	N/A
15:00		32 °C	Passing clouds.	20 km/h		43%	1008 mbar	N/A
18:00		31 °C	Broken clouds.	7 km/h		43%	1007 mbar	N/A
21:00		28 °C	Passing clouds.	7 km/h		55%	1007 mbar	N/A

Fig. 126 Weather conditions and comfort in Vuthaj, on the 5th August 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Summer, in Vuthaj, the sun rises at 05:36 and sets at 19:55 and has a total sun timespan of 14 hrs. and 13 min. The sun calculations from Google Earth, show that during Summer, the Kulla of Deli Gjonbalaj family is overshadowed from sunrise up to 07:00 o'clock and then from 18:00 o'clock onwards. From sunrise, the shadows come from mountains surrounding the kulla on the east, whereas approaching the sunset, kulla in shadowed by the mountains from west. As far as the temperatures are concerned, the highest temperature during August 2021 is 39°C, whereas the lowest is 15 °C. The average temperature during this month is 28 °C, whereas the average relative humidity is 44%. On the other hand, on 5th of August 2021, the highest temperature is 31°C, the lowest is 23°C, whereas the relative humidity lowest value is 38% at 09:00 rising to 53 % at 18:00.

AUTUMN (21 September until 20 December- 91 days). Measurements: 06:00, 07:00, 08:00, 09:00, 12:00, 15:00, 16:00, 17:00, 18:00, (in total 9 measurements); average measurement of mid-Autumn (5 November, day 46).

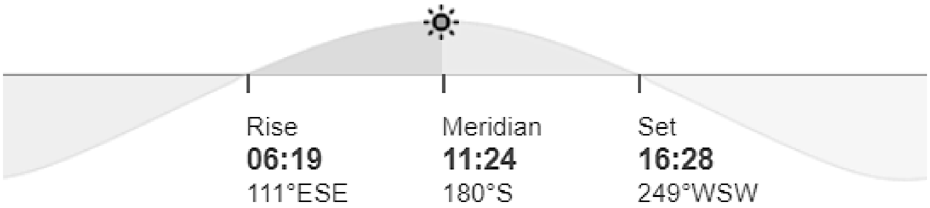


Fig. 127 Sunrise and sunset in Vuthaj during November 2021 (Time and date, 2022)

Fig. 128 Sun study of Vuthaj on 5th of November 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 06:00 o'clock, middle: 07:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 129 Sun study of Vuthaj on 5th of November 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 09:00 o'clock, middle: 12:00 o'clock, right: 15:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 130 Sun study of Vuthaj on 5th of November 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 16:00 o'clock, middle: 17:00 o'clock, right: 18:00 o'clock (pictures calculated from Google Earth- sun tool, by the author

	Temperature	Humidity	Pressure
High	25 °C (7 Nov, 14:00)	100% (2 Nov, 04:30)	1029 mbar (2 Nov, 04:30)
Low	4 °C (1 Nov, 06:00)	40% (1 Nov, 12:30)	1003 mbar (2 Nov, 06:00)
Average	14 °C	85%	1018 mbar

Fig. 131 Weather averages in Vuthaj during May 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
00:00 Fri, 5 Nov		13 °C	Fog.	2 km/h		100%	1013 mbar	1 km
03:00		14 °C	Passing clouds.	6 km/h		100%	1014 mbar	7 km
06:00		15 °C	Partly cloudy.	9 km/h		100%	1014 mbar	N/A
09:00		21 °C	Light rain. Broken clouds.	11 km/h		78%	1015 mbar	N/A
12:00		22 °C	Light rain. Broken clouds.	11 km/h		73%	1015 mbar	N/A
15:00		20 °C	Light rain. Broken clouds.	9 km/h		94%	1017 mbar	N/A
18:00		18 °C	Rain. Mostly cloudy.	9 km/h		100%	1019 mbar	7 km
21:00		17 °C	Passing clouds.	6 km/h		100%	1018 mbar	N/A

Fig. 132 Weather conditions and comfort in Vuthaj on the 5th of May 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Autumn, in Vuthaj, the sun rises at 06:19 and sets at 16:28 and has a total sun timespan of 10 hrs. and 15 min. The sun calculations from Google Earth, show that during Autumn, the Kulla of Deli Gjonbalaj family is overshadowed from sunrise up to 09:00 o'clock and then from 15:00 o'clock onwards. From sunrise, the shadows come from mountains surrounding the kulla on the east, whereas approaching the sunset, kulla in shadowed by the mountains from west. As far as the temperatures are concerned, the highest temperature during November 2021 is 25°C, whereas the lowest is 4 °C. The average temperature during this month is 14 °C, whereas the average relative humidity is 85%. On the other hand, on 5th of November 2021, the highest temperature is 22°C, the lowest is 13°C, whereas the relative humidity lowest value is 73% at 12:00 rising to 100 % at various hours during the day.

WINTER (21 December until 20 March- 90-91 days). Measurements: 06:00, 07:00, 08:00, 09:00, 12:00, 15:00, 16:00, 17:00, (in total 8 measurements); average measurement of mid-Winter (3 February, day 44).

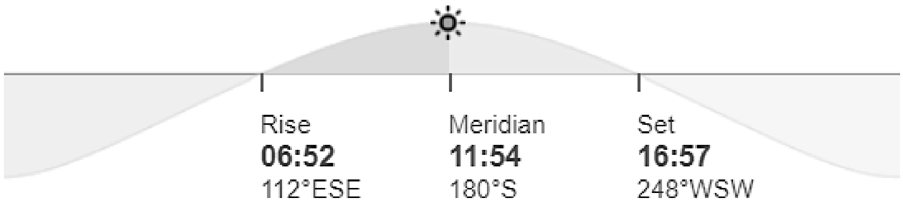


Fig. 133 Sunrise and sunset during in Vuthaj, during February 2021 (Time and date, 2022)

Fig. 134 Sun study of Vuthaj on 3rd of February 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 06:00 o'clock, middle: 07:00 o'clock, right: 08:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

Fig. 135 Sun study of Vuthaj on 3rd of February 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 09:00 o'clock, middle: 12:00 o'clock, right: 15:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

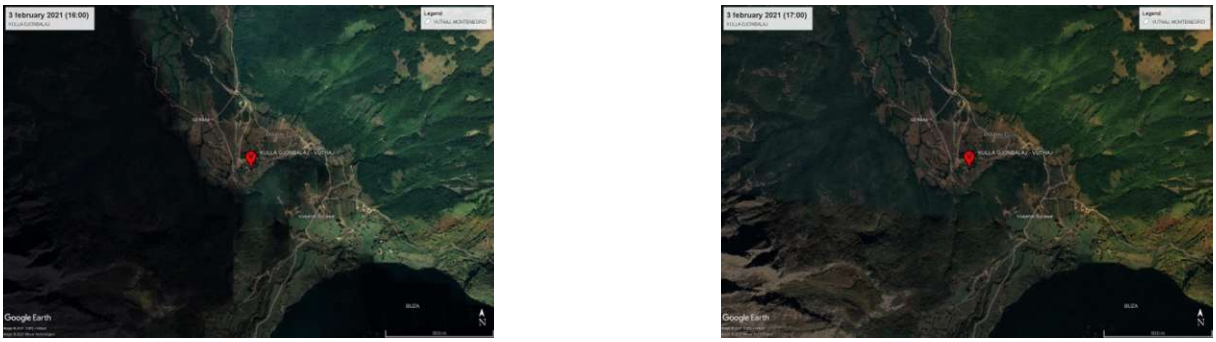


Fig. 136 Sun study of Vuthaj on 3rd of February 2021 (Location of Kulla of Deli Gjonbalaj in red pin), left: 06:00 o'clock, right: 17:00 o'clock (pictures calculated from Google Earth- sun tool, by the author)

	Temperature	Humidity	Pressure
High	23 °C (25 Feb, 15:30)	100% (1 Feb, 00:00)	1034 mbar (1 Feb, 00:00)
Low	-3 °C (13 Feb, 22:00)	15% (12 Feb, 14:00)	996 mbar (8 Feb, 07:30)
Average	8 °C	66%	1021 mbar

Fig. 137 Weather averages in Vuthaj, during February 2021 (Time and date, 2022)

	Conditions			Comfort				
Time		Temp	Weather	Wind		Humidity	Barometer	Visibility
00:00 Wed, 3 Feb		6 °C	Fog.	4 km/h		100%	1016 mbar	0 km
03:00		4 °C	Fog.	4 km/h		100%	1017 mbar	0 km
06:00		4 °C	Fog.	4 km/h		100%	1018 mbar	2 km
09:00		8 °C	Passing clouds.	4 km/h		100%	1019 mbar	N/A
12:00		13 °C	Passing clouds.	4 km/h		72%	1019 mbar	N/A
15:00		15 °C	Scattered clouds.	6 km/h		59%	1018 mbar	N/A
18:00		10 °C	Clear.	2 km/h		82%	1018 mbar	16 km
21:00		7 °C	Clear.	6 km/h		93%	1019 mbar	16 km

Fig. 138 Weather conditions and comfort in Vuthaj, on the 3rd of February 2021 (Time and date, 2022)

As can be seen from the data in the above plates, during mid- Winter, in Vuthaj, the sun rises at 06:52 and sets at 16:57 and has a total sun timespan of 10 hrs. and 8 minutes. The sun calculations from Google Earth, show that during Winter, the Kulla of Deli Gjonbalaj family is overshadowed from sunrise up to 10:00 o'clock and then from 16:00 o'clock onwards. From sunrise, the shadows come from mountains surrounding the kulla on the east, whereas approaching the sunset, kulla in shadowed by the mountains from west. As far as the temperatures are concerned, the highest temperature during February 2021 is 23°C, whereas the lowest is -3 °C. The average temperature during this month is 8 °C, whereas the average relative humidity is 66%. On the other hand, on 3rd of February 2021, the highest temperature is 15°C, the lowest is 4°C, whereas the relative humidity lowest value is 59% at 15:00 rising to 100 % at various hours during the day.

Based on individual calculations for each of the three settlements, a comparison table has been created:

CONTEXT ANALYSIS					
DRANOC					
SEASON	SUN TIMESPAN	HIGHEST TEMP.	LOWEST TEMP.	RELATIVE HUMID.	SHADOW
SPRING	14,25	31 °C	7 °C	57%	W
SUMMER	14.30	38 °C	2 °C	51%	W
AUTUMN	9,22	26 °C	0 °C	77%	W
WINTER	10,08	21 °C	-8 °C	57%	W
AVERAGE	11,18	29 °C	0.25 °C	61%	W
VALBONA					
SEASON	SUN TIMESPAN	HIGHEST TEMP.	LOWEST TEMP.	RELATIVE HUMID.	SHADOW
SPRING	14,23	29 °C	2 °C	66%	WESN
SUMMER	14.32	38 °C	15 °C	54%	WESN
AUTUMN	10,17	24 °C	1 °C	75%	WESN
WINTER	10,08	22 °C	-3 °C	65%	WESN
AVERAGE	11,49	29 °C	0.25 °C	65%	WESN
VUTHAJ					
SEASON	SUN TIMESPAN	HIGHEST TEMP.	LOWEST TEMP.	RELATIVE HUMID.	SHADOW
SPRING	14,25	31 °C	10 °C	59%	EW
SUMMER	14,32	39°C	15 °C	44%	EW
AUTUMN	10,15	25 °C	4 °C	85%	EW
WINTER	10,08	23°C	-3 °C	66%	EW
AVERAGE	12,20	29 °C	0.25 °C	64%	EW

Table 3 Analysis of sun timespan, temperatures, RH and shadowing in Dranoc, Valbona and Vuthaj

The above table shows that in terms of sun timespan, there are only slight to no differences between the three locations. Throughout the year, the longest sun timespan is in Vuthaj, whereas the shortest is in Dranoc. The same issue is with the highest and lowest temperature averages, which is the same for the three locations throughout all seasons. In terms of relative humidity, the data from the above table shows that the highest average relative humidity is in Valbona, with the value of 65 %, and the lowest value is in Dranoc, with 61%. Finally, in terms of overshadowing the kullas from their surroundings, the data analysis shows that apart from the north façade, which perimetric walls would need thermal insulation. The data shows that the kulla in Valbona needs insulation in all external walls, since it is overshadowed from all directions. On the other hand, the kulla in Vuthaj apart from the north façade, would also need thermal insulation in the east and west external walls. Finally, the less overshadowed kulla is the one in Dranoc, with shadows covering the west façade. This means that the west and north oriented external walls would need thermal insulation.

12. SUN STUDY OF THE SETTING OF KULLAS

The sun study analyses of the setting of the Kulla of Isuf Mazrekaj in Dranoc, Selimaj family in Valbona and Deli Gjonbalaj in Vuthaj was performed by modelling the kullas and their close setting as well as the mountains surrounding them. The study was performed in Archicad, by applying the exact coordinates of kullas, as well as the dates of mid-seasons, from sunrise to sunset.

12.1. KULLA OF ISUF MAZREKAJ, DRANOC, KOSOVO

This building is surrounded by one to three story houses and other auxiliary buildings. The analysis below shows the impact that these buildings might have in kulla, in terms of sunlight exposure and shadowing.

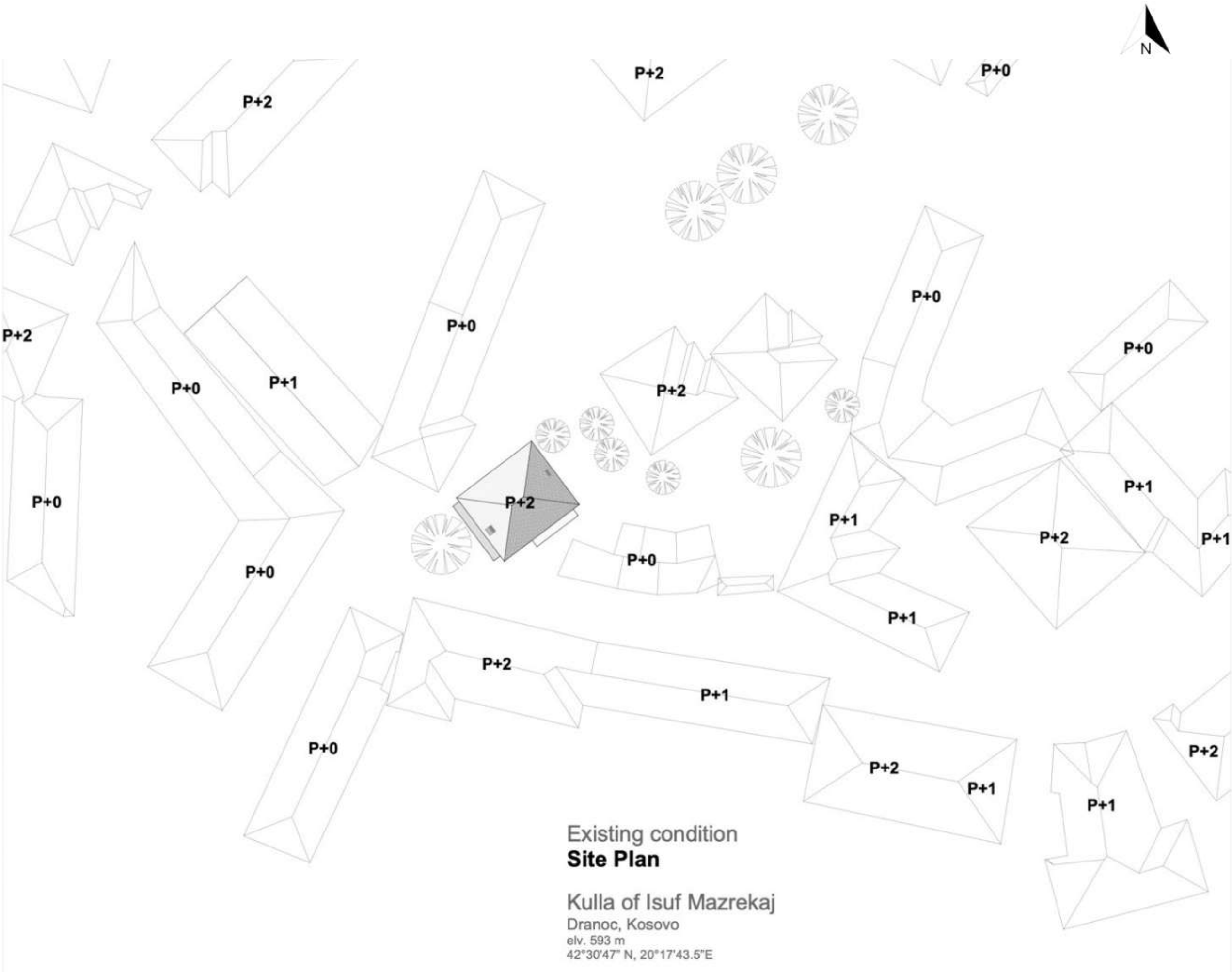
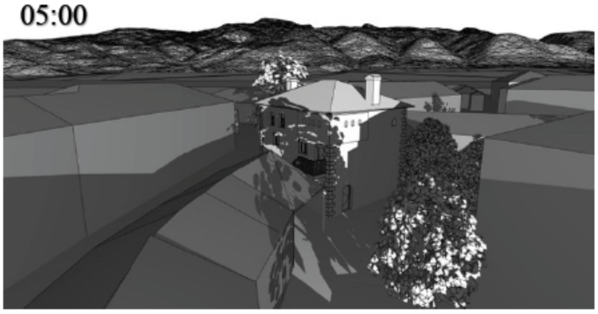


Fig. 139 Site plan of the Kulla of Isuf Mazrekaj in Dranoc

12.1.1. Sun study during mid-Spring

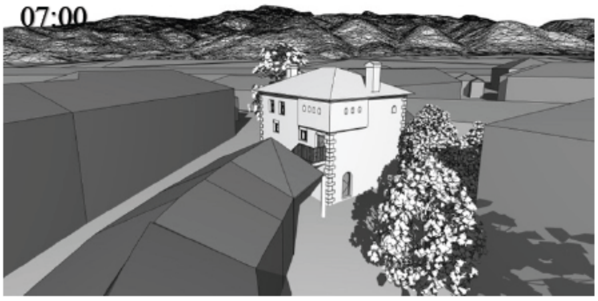
The sun study of the setting of Kulla during mid-Spring, shows that the building is shadowed from sunrise until 06:00 o'clock and then from 14:00 o'clock onwards. Even during this time interval, the north-east façade is shadowed from the surrounding buildings and landscape most of the time. So, during 5th of May 2021, Kulla is partially under sunlight for about 8 hours.

05:00

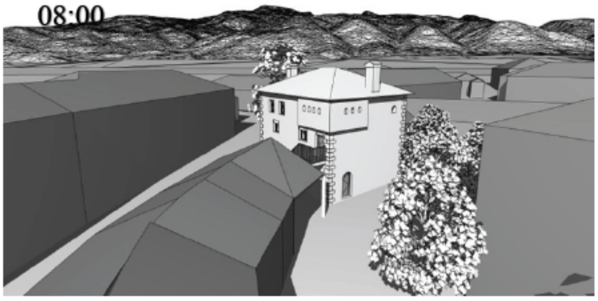


06:00

07:00

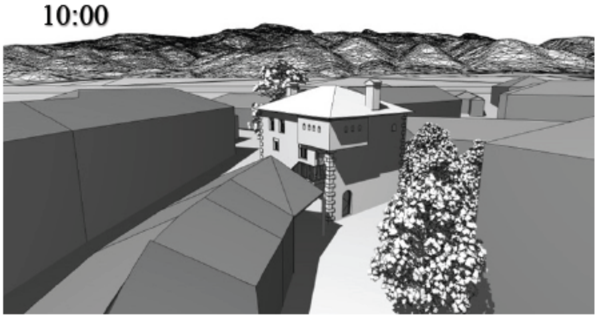


08:00

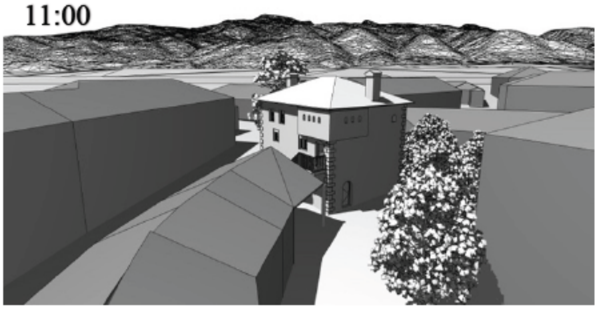


09:00

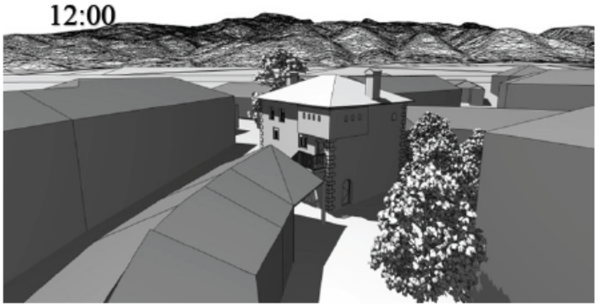
10:00



11:00



12:00



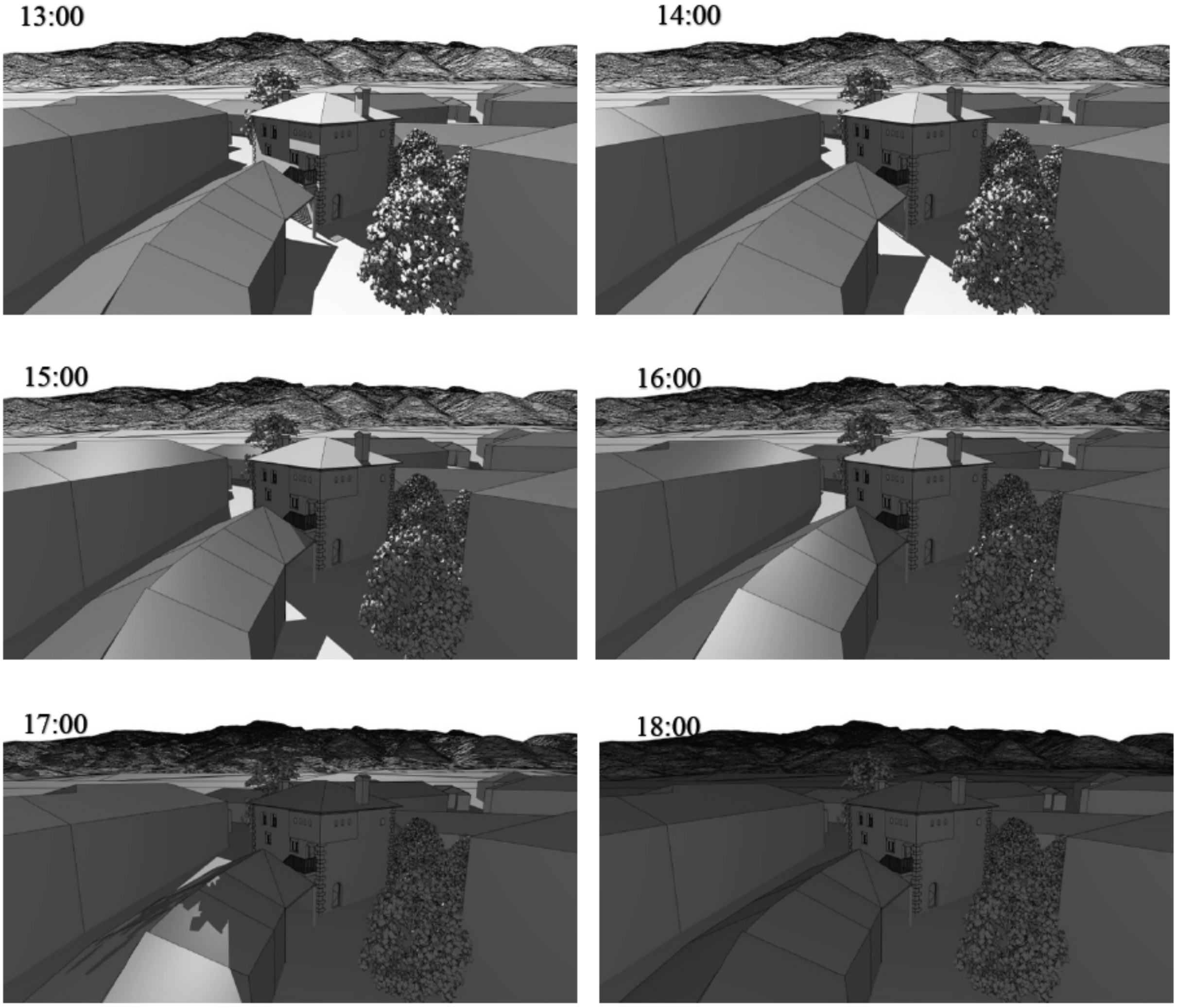
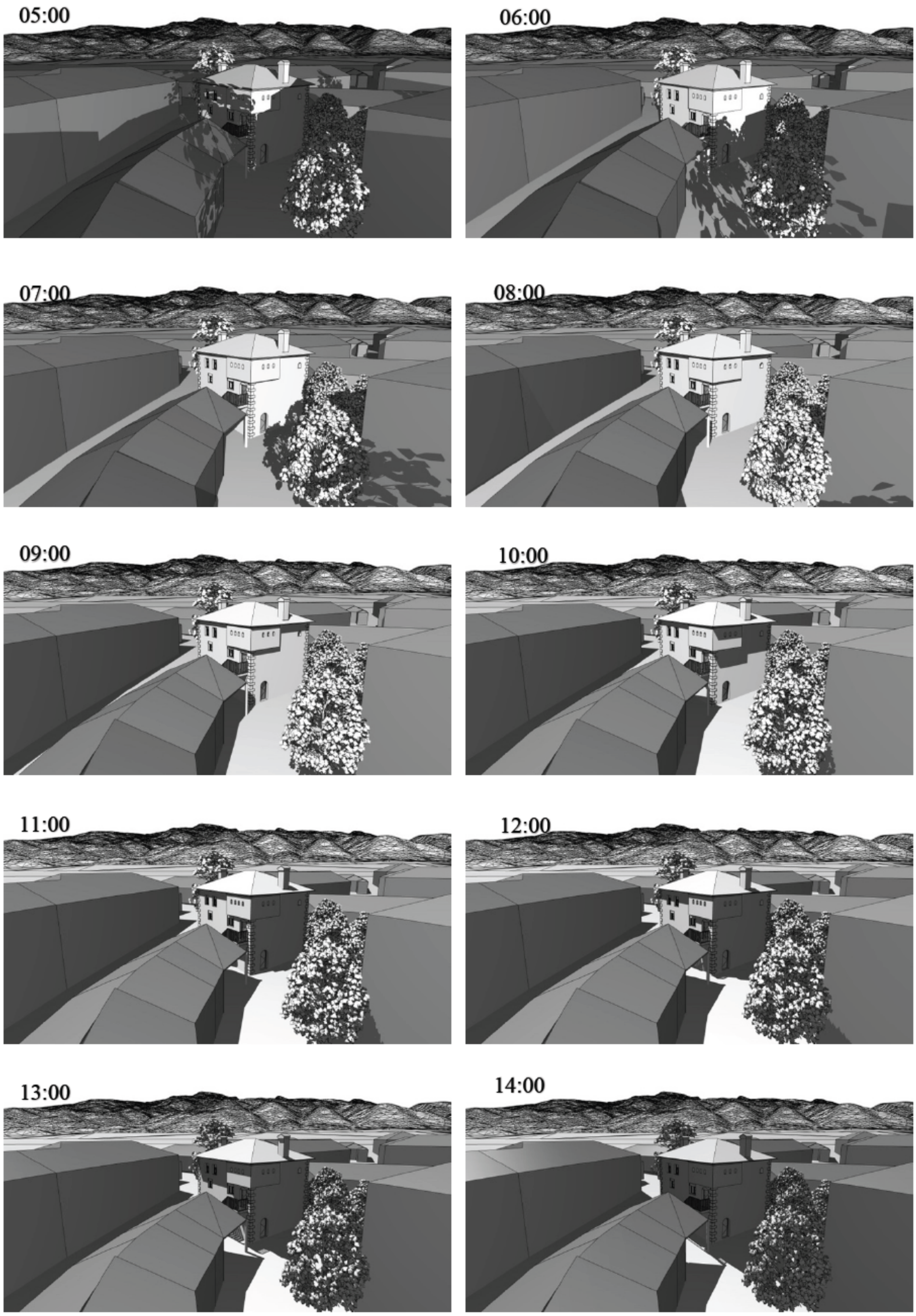


Fig. 140 Sun study of Kulla's context on the 5th of May 2021, every hour from 05:00 until 18:00 o'clock

12.1.2. Sun study during mid-Summer

The sun study of the setting of Kulla during mid-Summer, shows that the building is shadowed from sunrise until 06:00 o'clock and then from 14:00 o'clock onwards. Even during this time interval, the north-east façade is shadowed from the surrounding buildings and landscape most of the time. So, during 5th of August 2021, Kulla is partially under sunlight for about 8 hours.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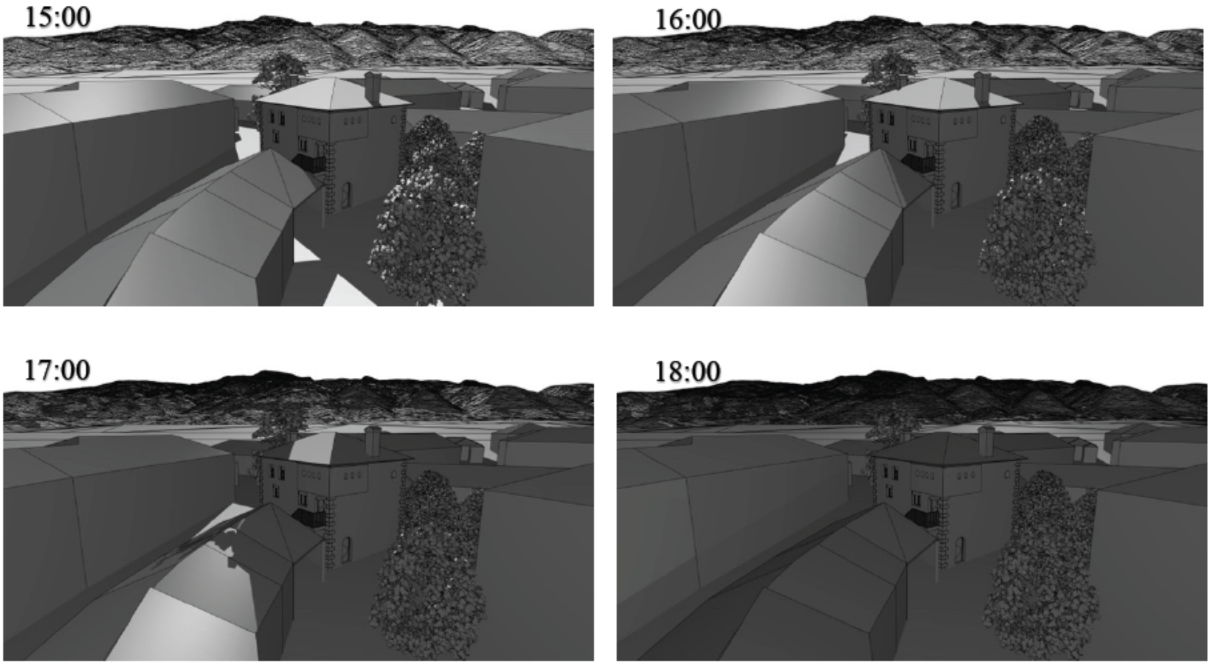
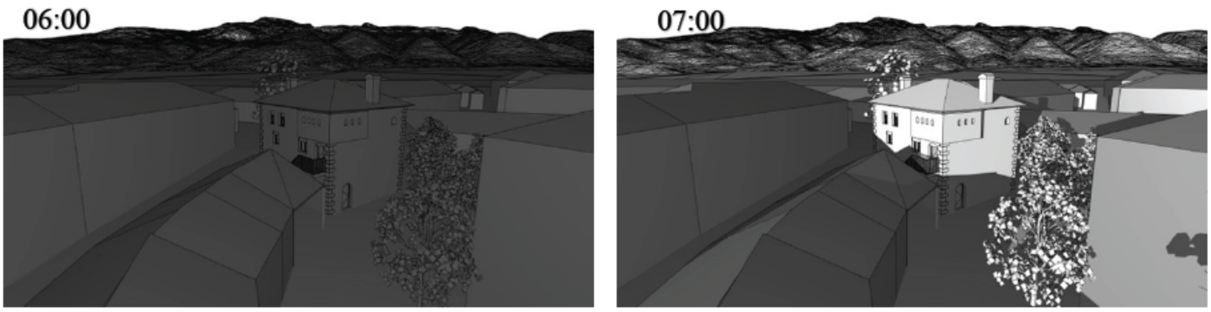


Fig. 141 Sun study of Kulla's context on the 5th of August 2021, every hour from 05:00 until 18:00 o'clock

12.1.3. Sun study during mid-Autumn

The sun study of the setting of Kulla during mid-Autumn, shows that the building is shadowed from sunrise until 07:00 o'clock and then from 15:00 o'clock onwards. Even during this time interval, the north-east façade is shadowed from the surrounding buildings and landscape most of the time. So, during 5th of August 2021, Kulla is partially under sunlight for about 8 hours.



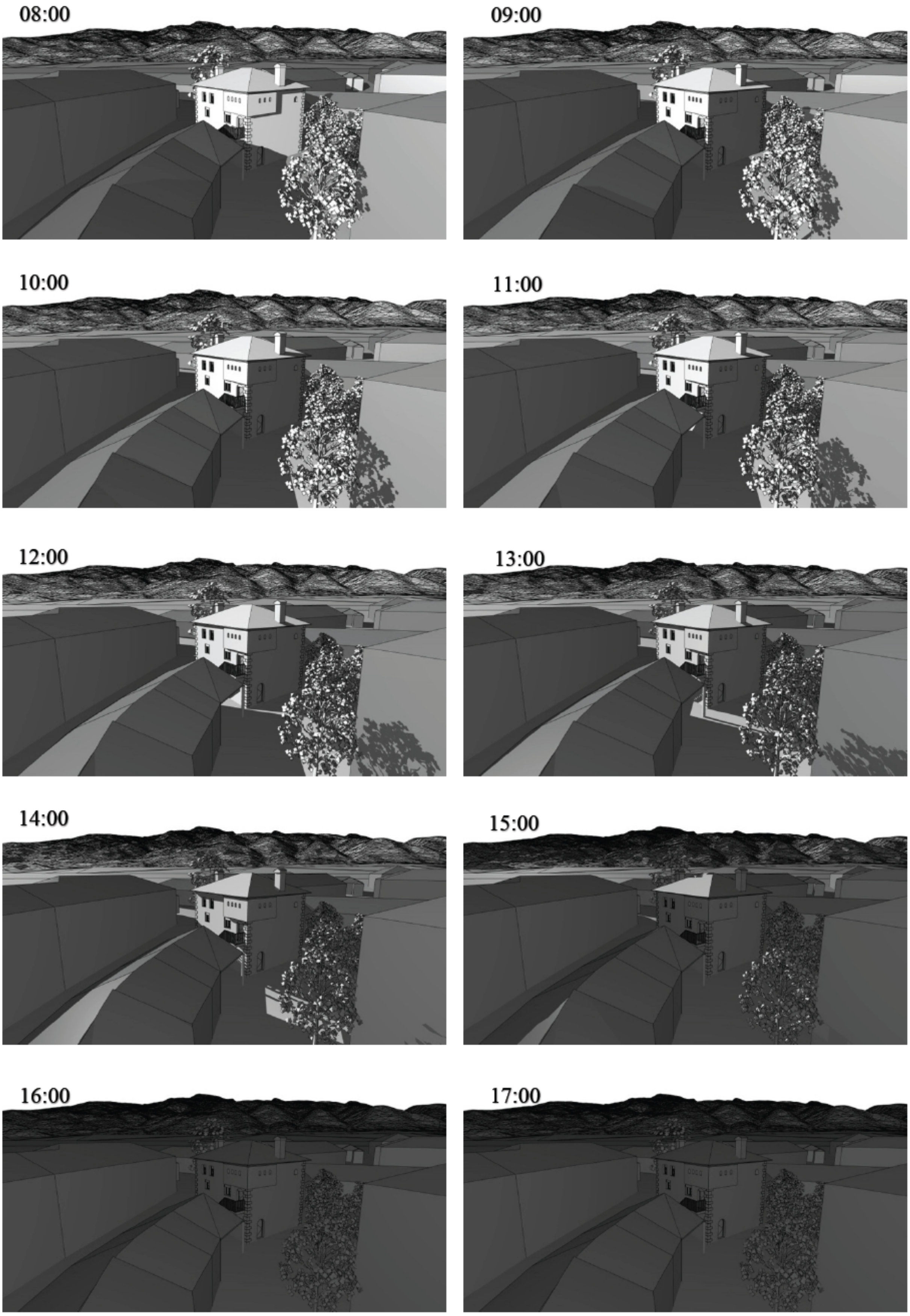
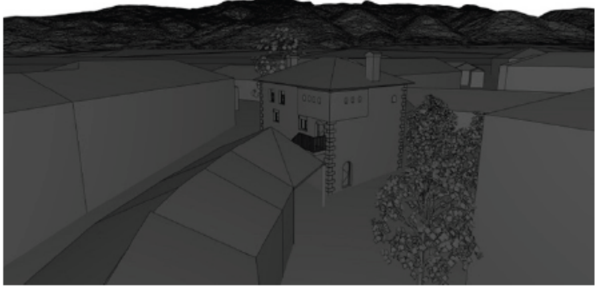


Fig. 142 Sun study of Kulla's context on the 5th of November 2021, every hour from 06:00 until 17:00 o'clock

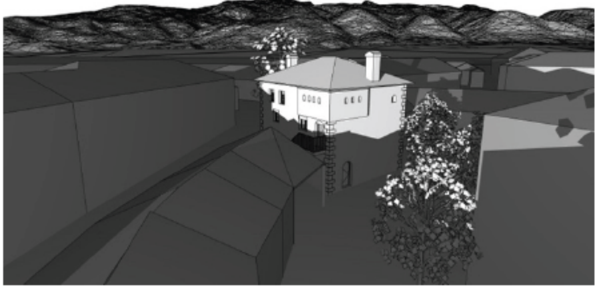
12.1.4. Sun study during mid-Winter

The sun study of the setting of Kulla during mid-Autumn, shows that the building is shadowed from sunrise until sometime after 07:00 o'clock and then from 15:00 o'clock onwards. Even during this time interval, the north-east façade is shadowed from the surrounding buildings and landscape most of the time, basically it is under sunlight only for 2 hours. So, during 3rd of February 2021, Kulla is partially under sunlight for about 8 hours.

06:00

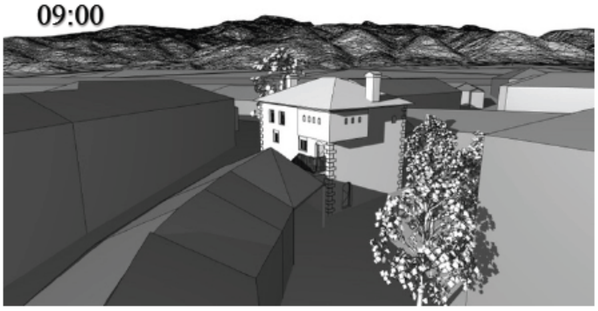


07:00

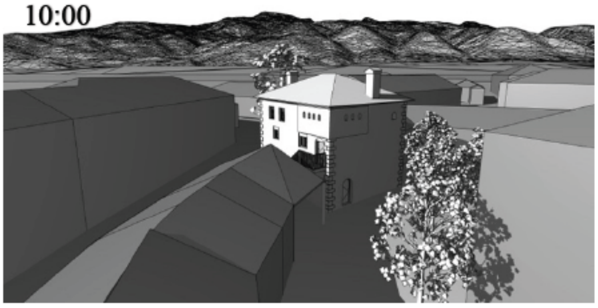


08:00

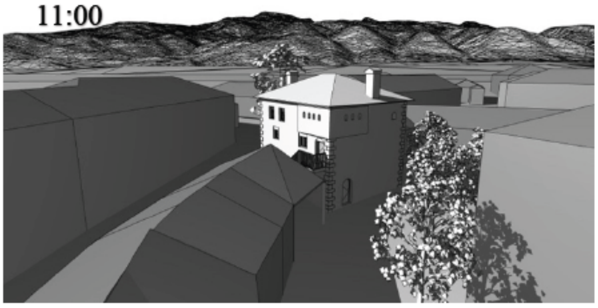
09:00



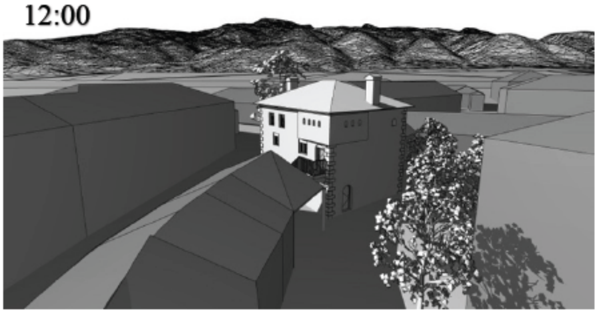
10:00



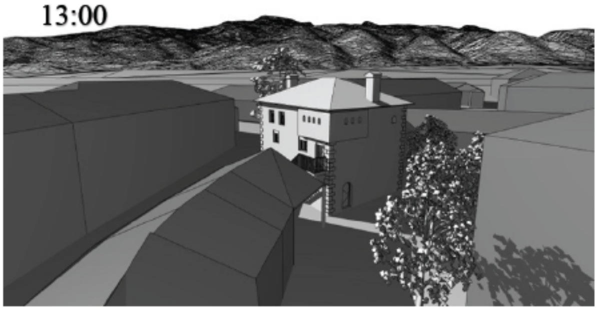
11:00



12:00



13:00



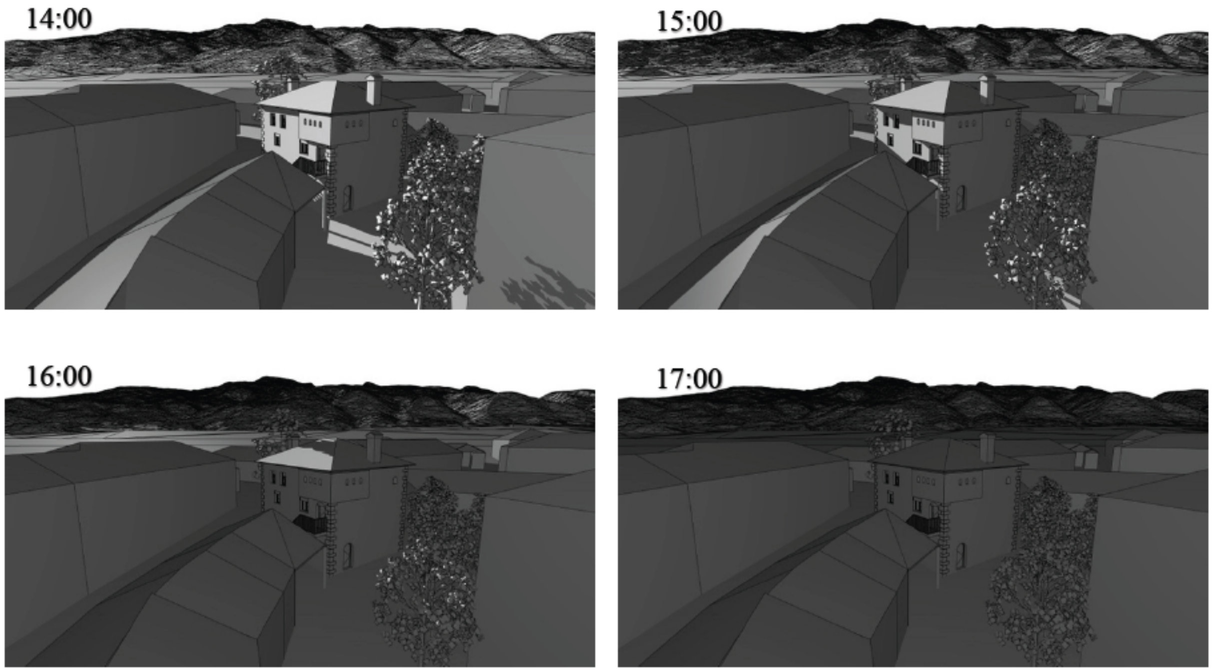


Fig. 143 Sun study of Kulla's context on the 3rd of February 2021, every hour from 06:00 until 17:00 o'clock

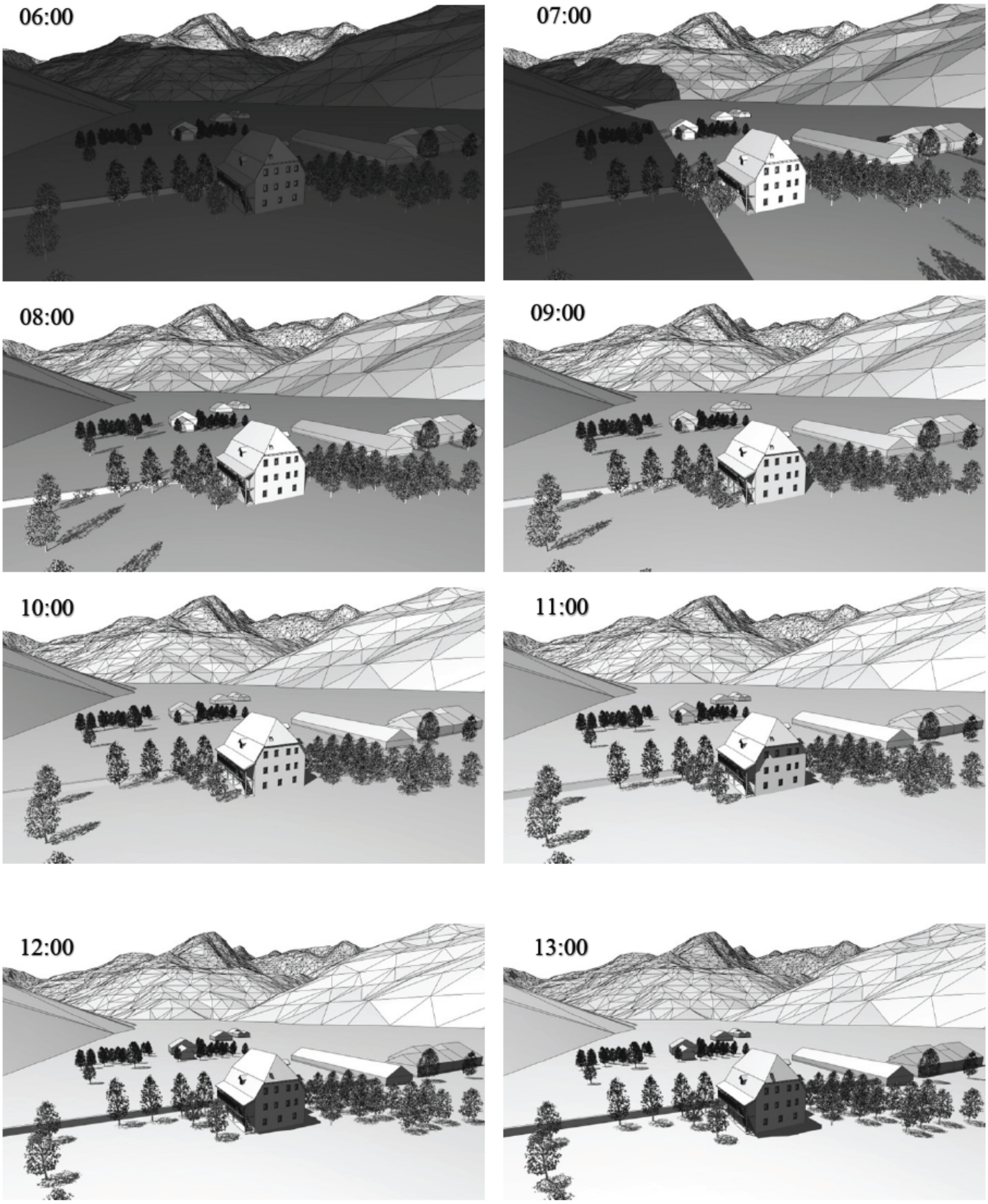
12.2. KULLA OF SELIMAJ FAMILY, VALBONA, ALBANIA

This building is surrounded by one story houses and other auxiliary buildings. The analysis below shows the impact that these buildings might have in kulla, in terms of sunlight exposure and shadowing.

Fig. 144 Site plan of the Kulla of Selimaj family in Valbona

12.2.1. Sun study during mid-Spring

The sun study of the setting of Kulla during mid-Spring, shows that the building is shadowed from sunrise until 07:00 o'clock and then from sometime after 18:00 onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 5th of May 2021, Kulla is under sunlight for about 11 hours.



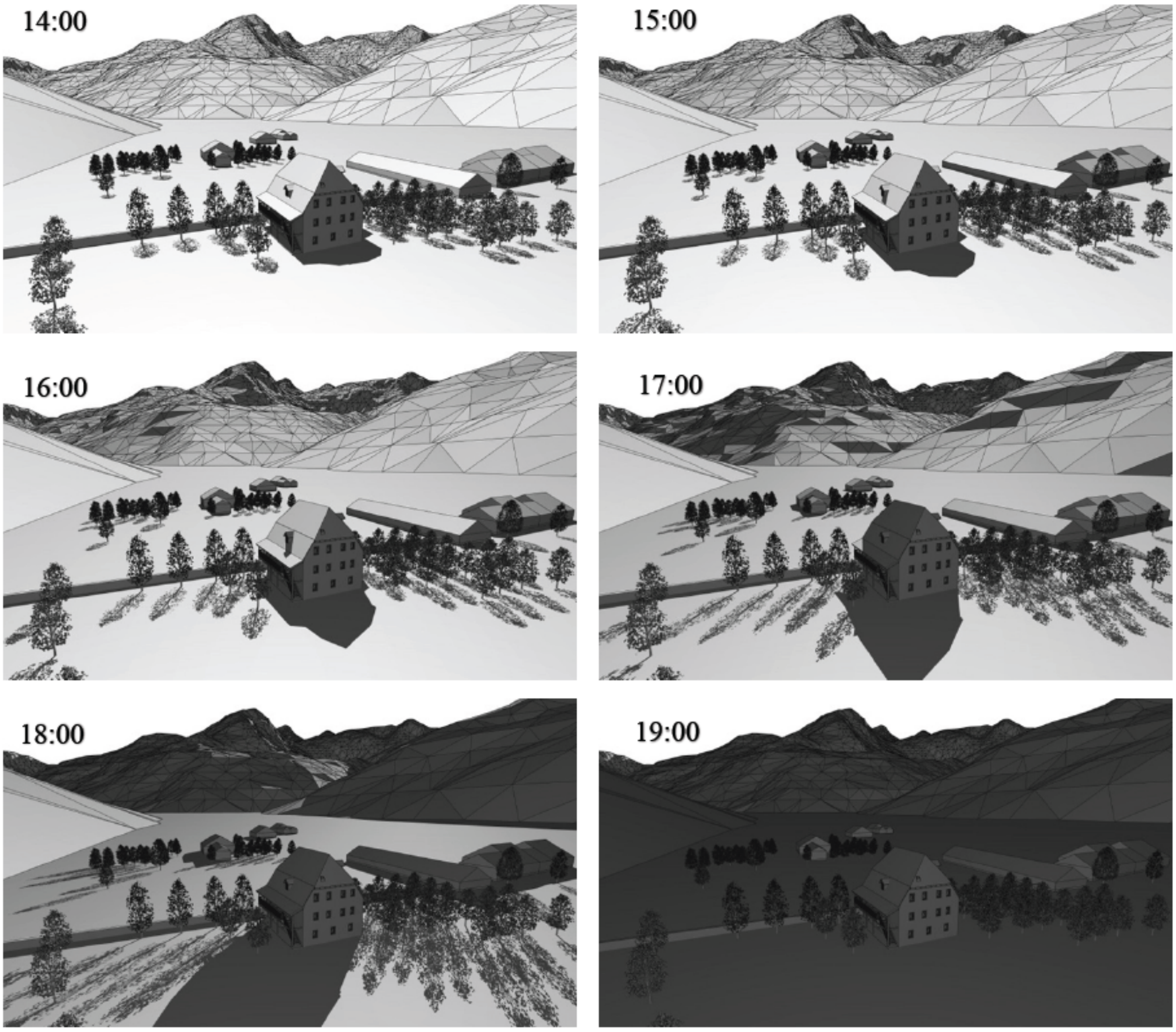
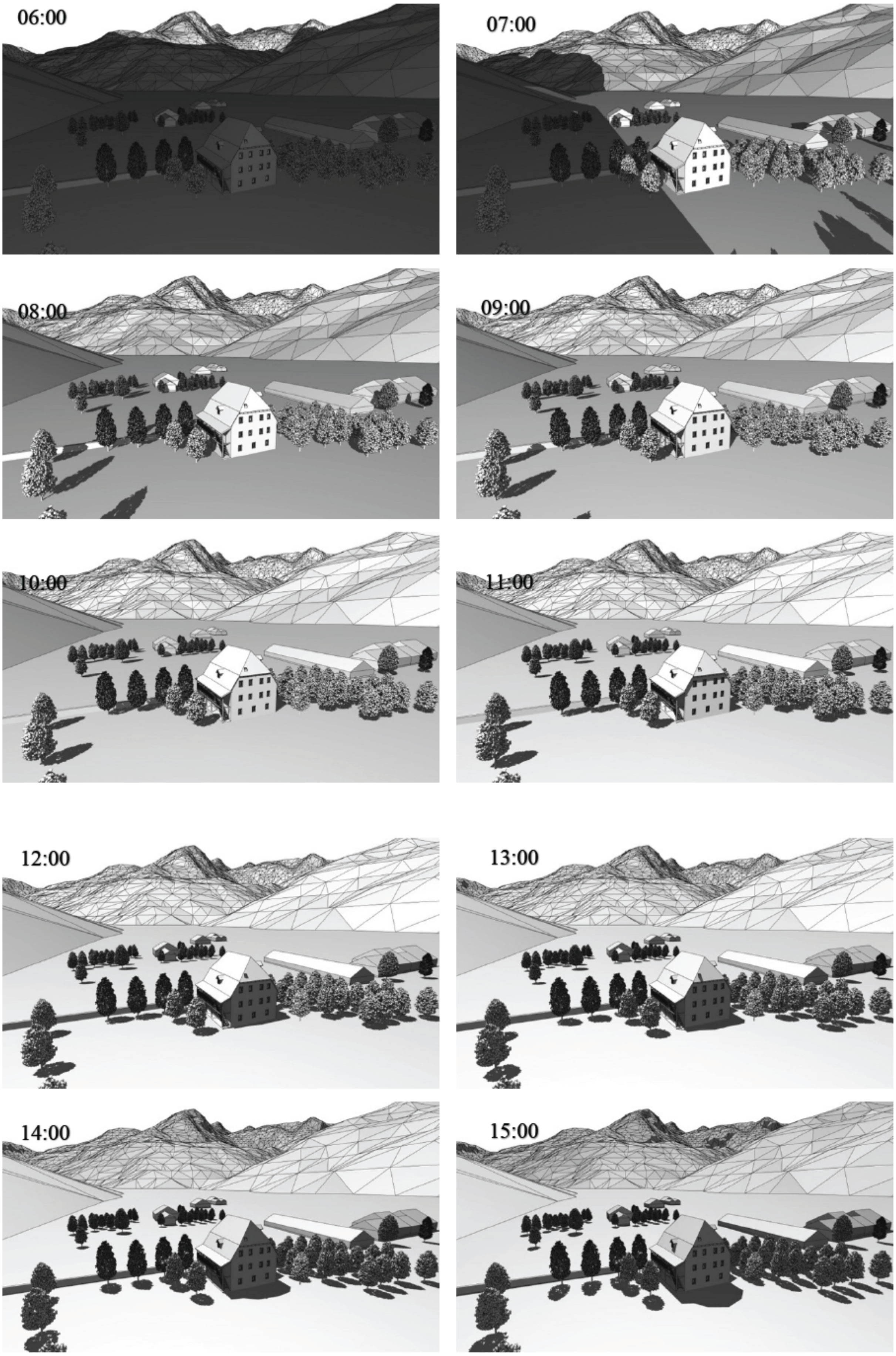


Fig. 145 Sun study of Kulla's context on the 5th of May 2021, every hour from 06:00 until 19:00 o'clock

12.2.2. Sun study during mid-Summer

The sun study of the setting of Kulla during mid-Summer, shows that the building is shadowed from sunrise until 07:00 o'clock and then from sometime after 18:00 onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 5th of August 2021, Kulla is under sunlight for about 11 hours.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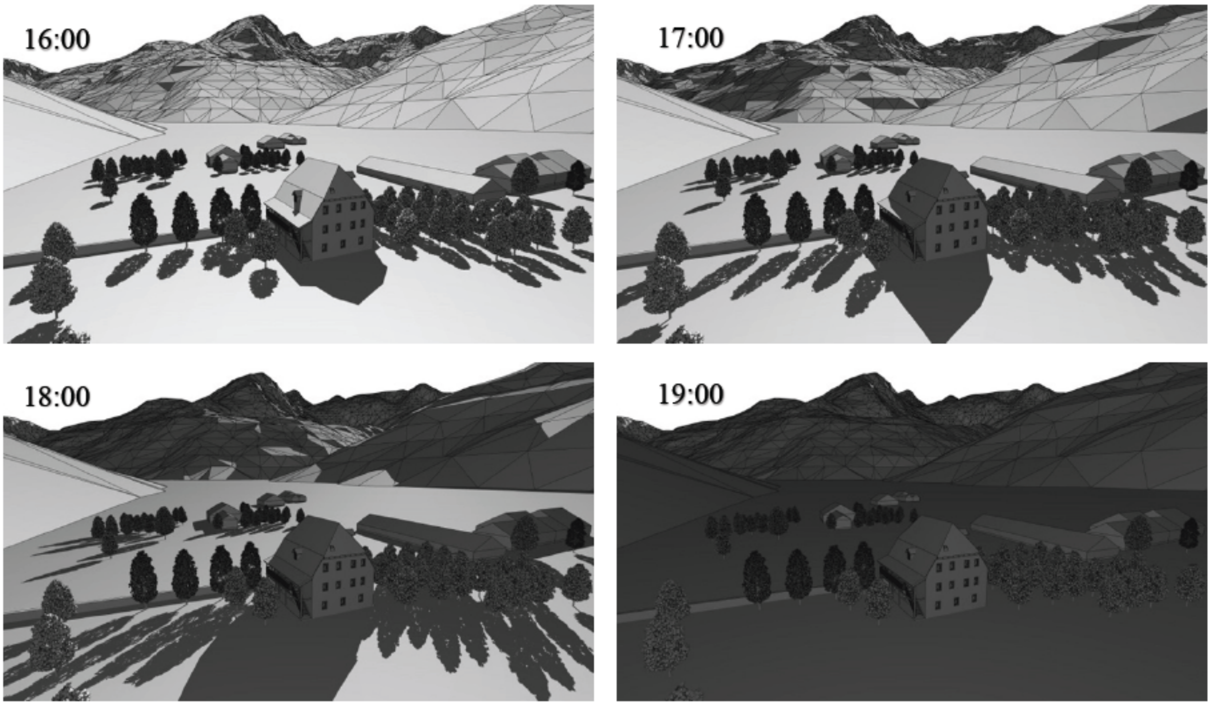
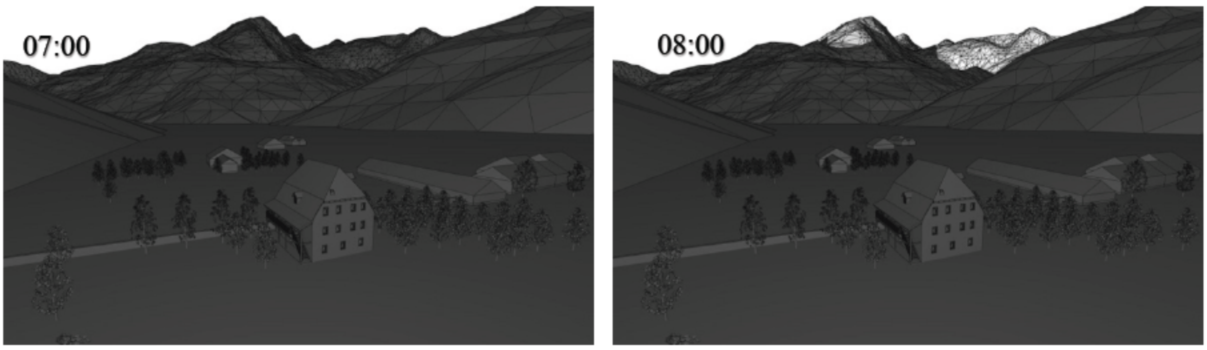


Fig. 146 Sun study of Kulla's context on the 5th of August 2021, every hour from 06:00 until 19:00 o'clock

12.2.3. Sun study during mid-Autumn

The sun study of the setting of Kulla during mid-Autumn, shows that the building is shadowed from sunrise until 11:00 o'clock and then from sometime after 16:00 onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 5th of November 2021, Kulla is under sunlight for about 5 hours.



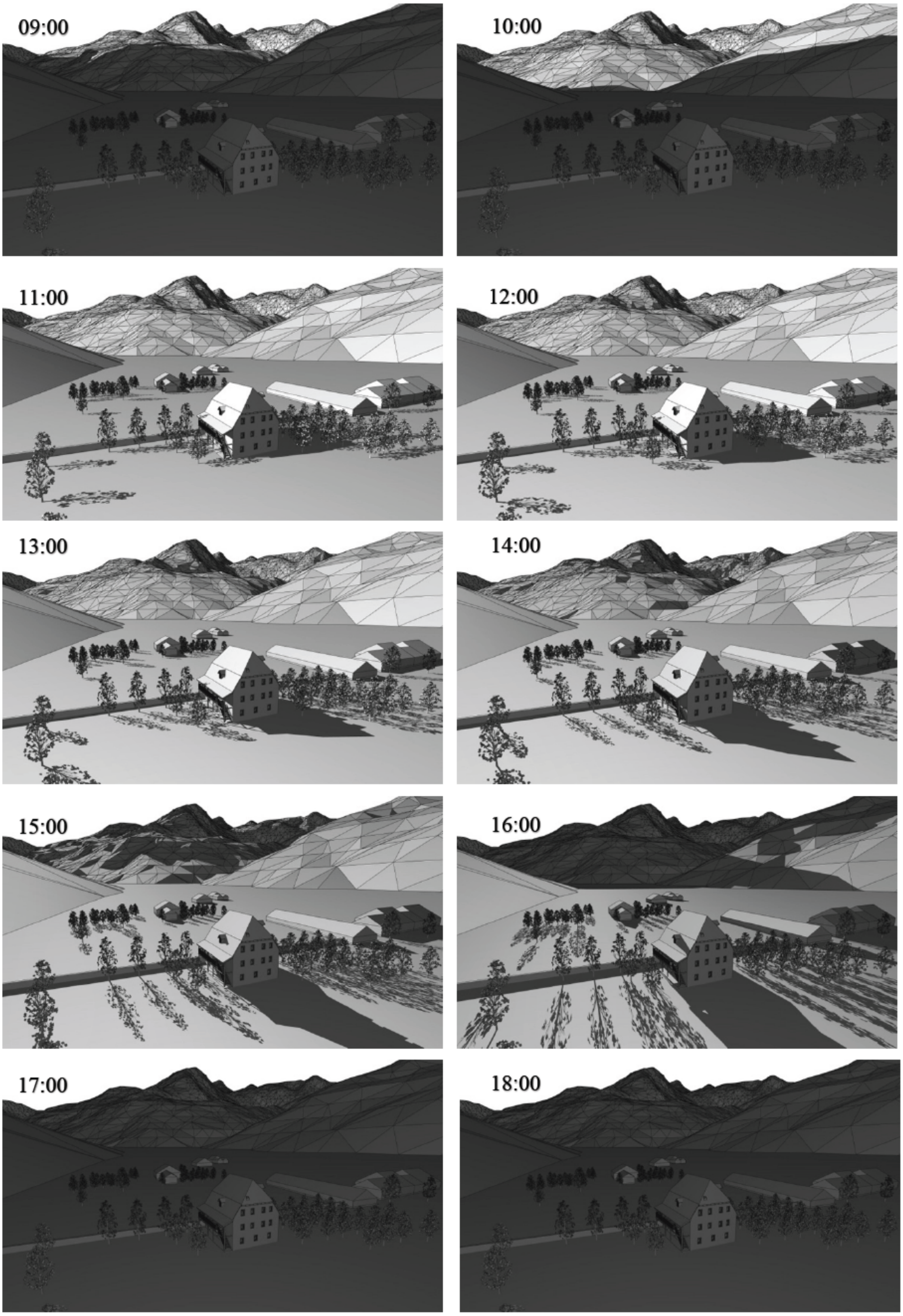
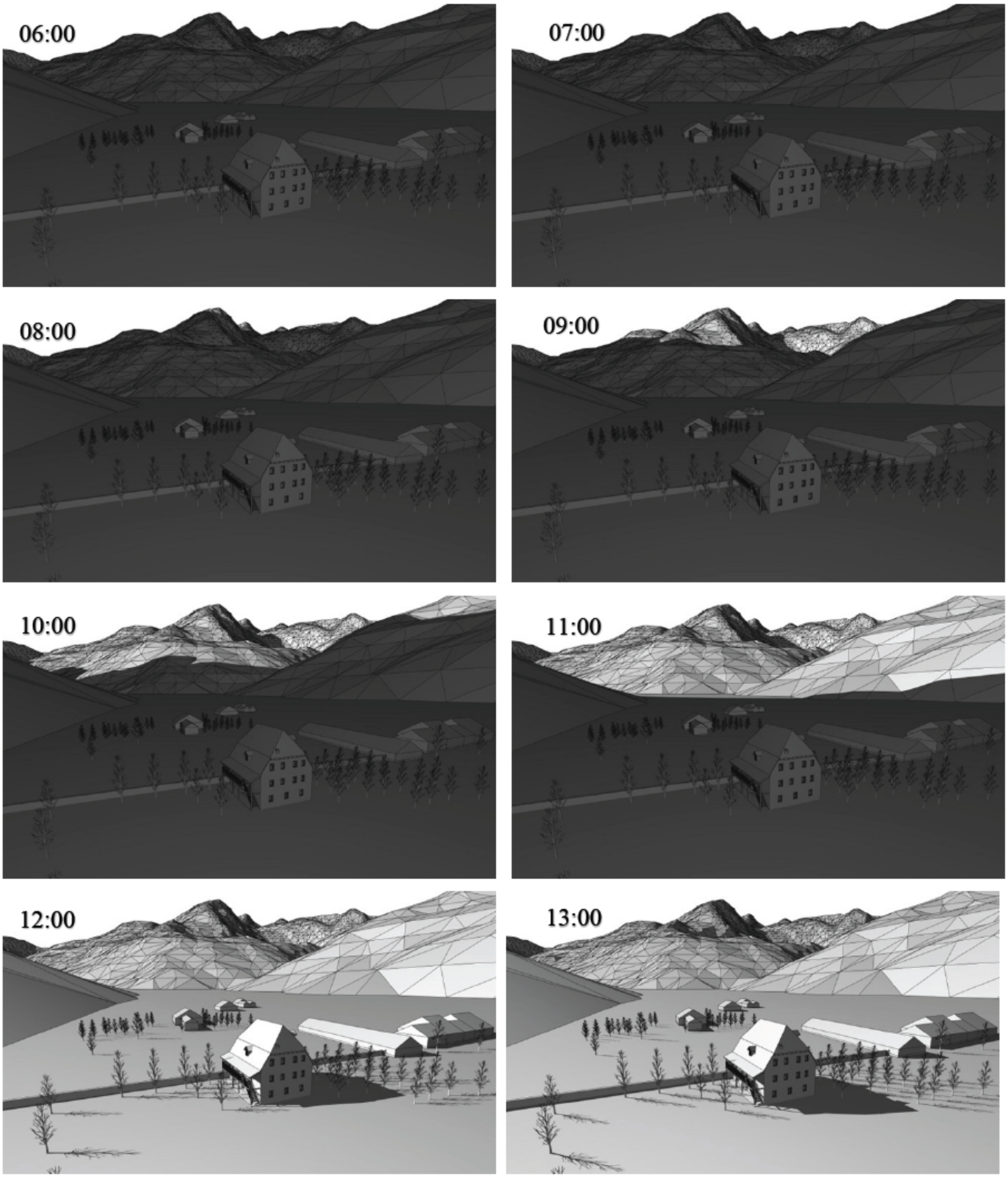


Fig. 147 Sun study of Kulla's context on the 5th of November 2021, every hour from 07:00 until 18:00 o'clock

12.2.4. Sun study during mid-Winter

The sun study of the setting of Kulla during mid-Winter, shows that the building is shadowed from sunrise until 12:00 o'clock and then from sometime after 16:00 onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 3rd of February 2021, Kulla is under sunlight for about 4 hours.



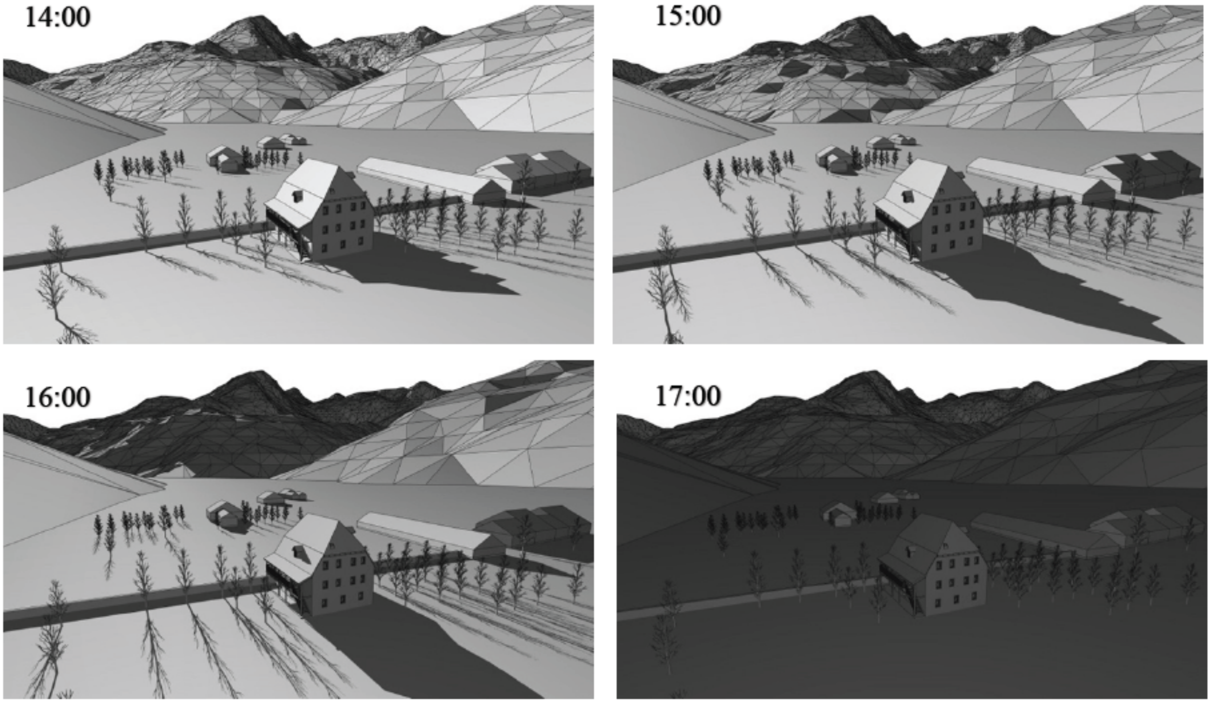


Fig. 148 Sun study of Kulla’s context on the 3rd of February 2021, every hour from 06:00 until 17:00 o’clock

12.3. KULLA OF DELI GJONBALAJ, VUTHAJ

This building is surrounded by one to two story houses and other auxiliary buildings. The analysis below shows the impact that these buildings might have in kulla, in terms of sunlight exposure and shadowing.

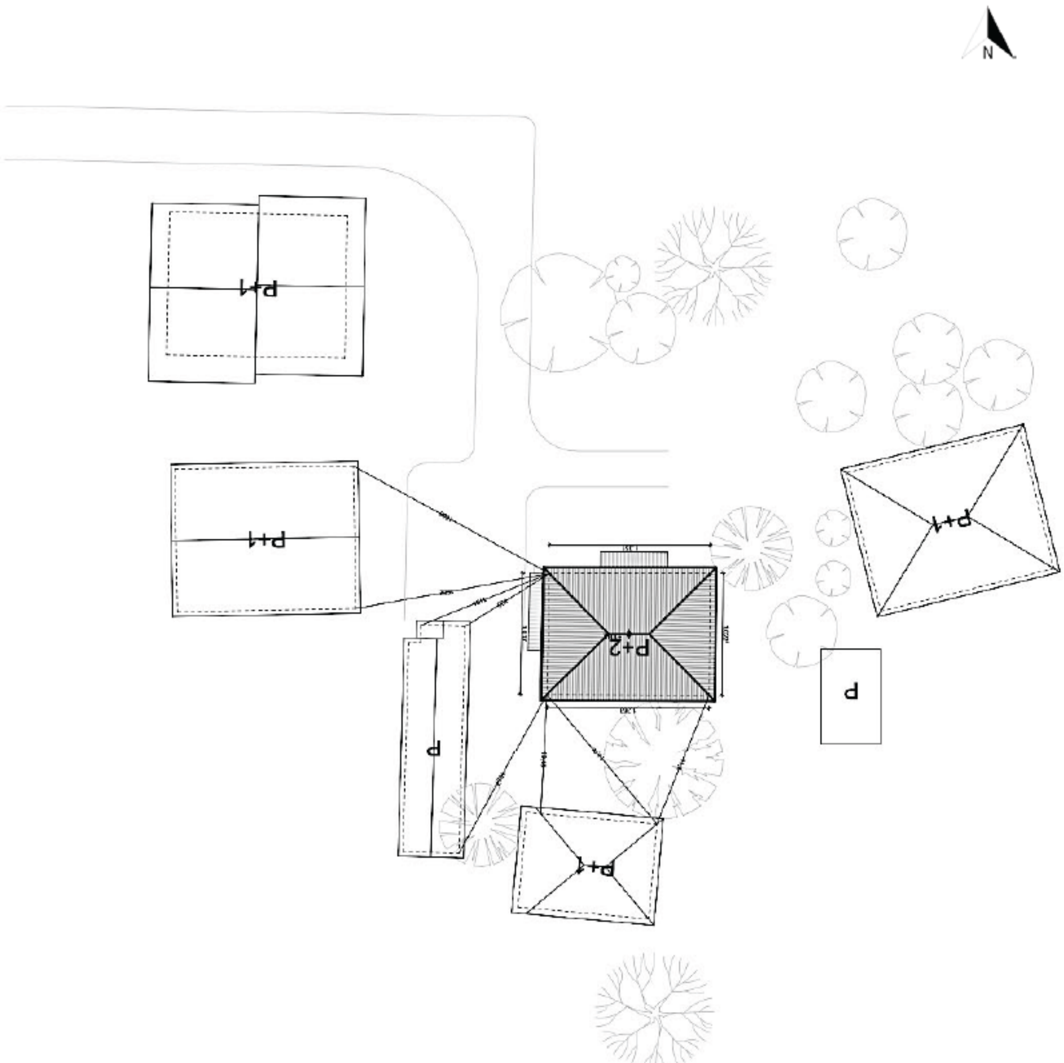
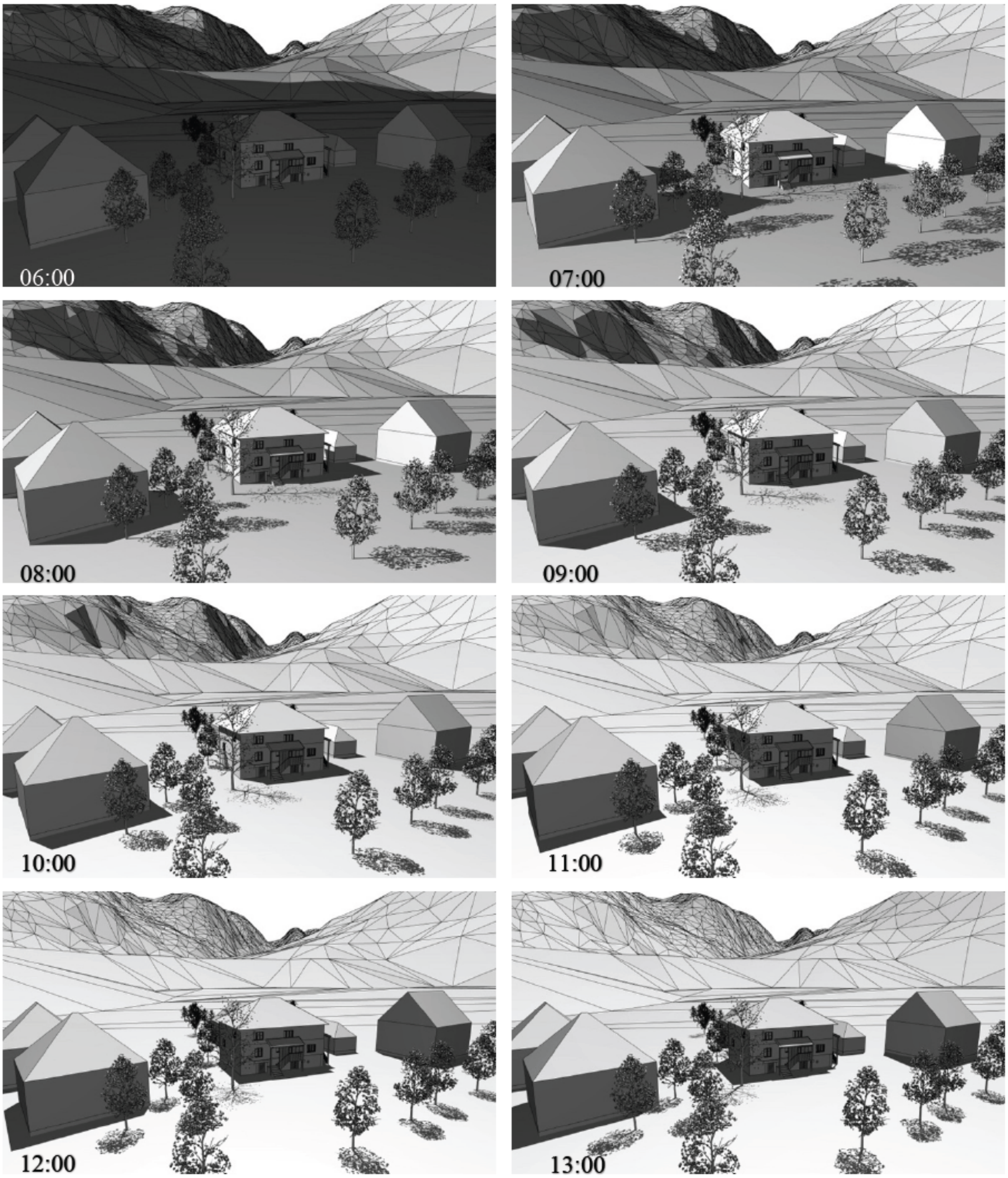


Fig. 149 Site plan of the kulla of Deli Gjonbalaj in Vuthaj (Labeatet, 2021, edited by the author)

12.3.1. Sun study during mid-Spring

The sun study of the setting of Kulla during mid-Spring, shows that the building is shadowed from sunrise until 07:00 o'clock and then from 17:00 o'clock onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 5th of May 2021, Kulla is under sunlight for about 10 hours.



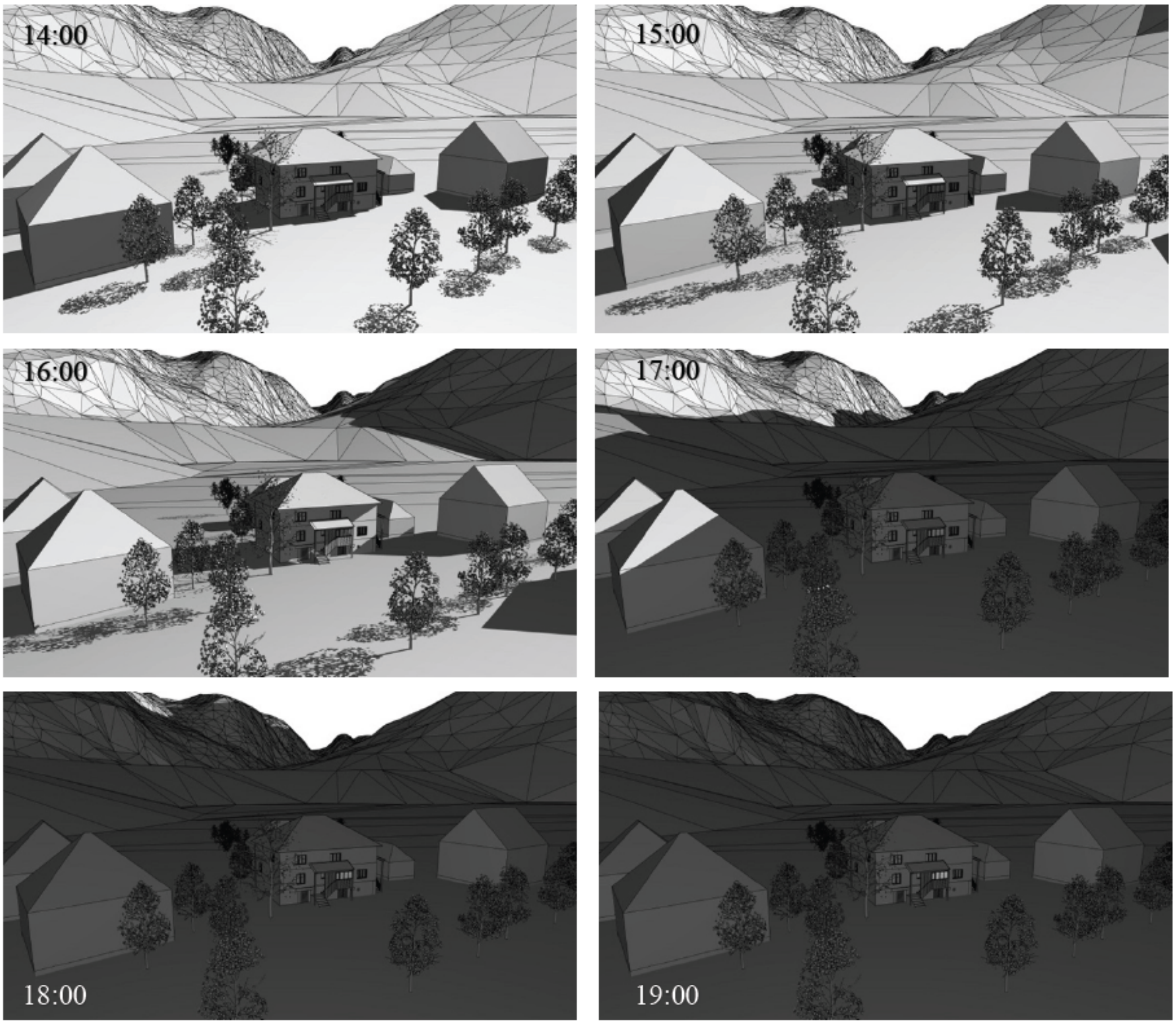
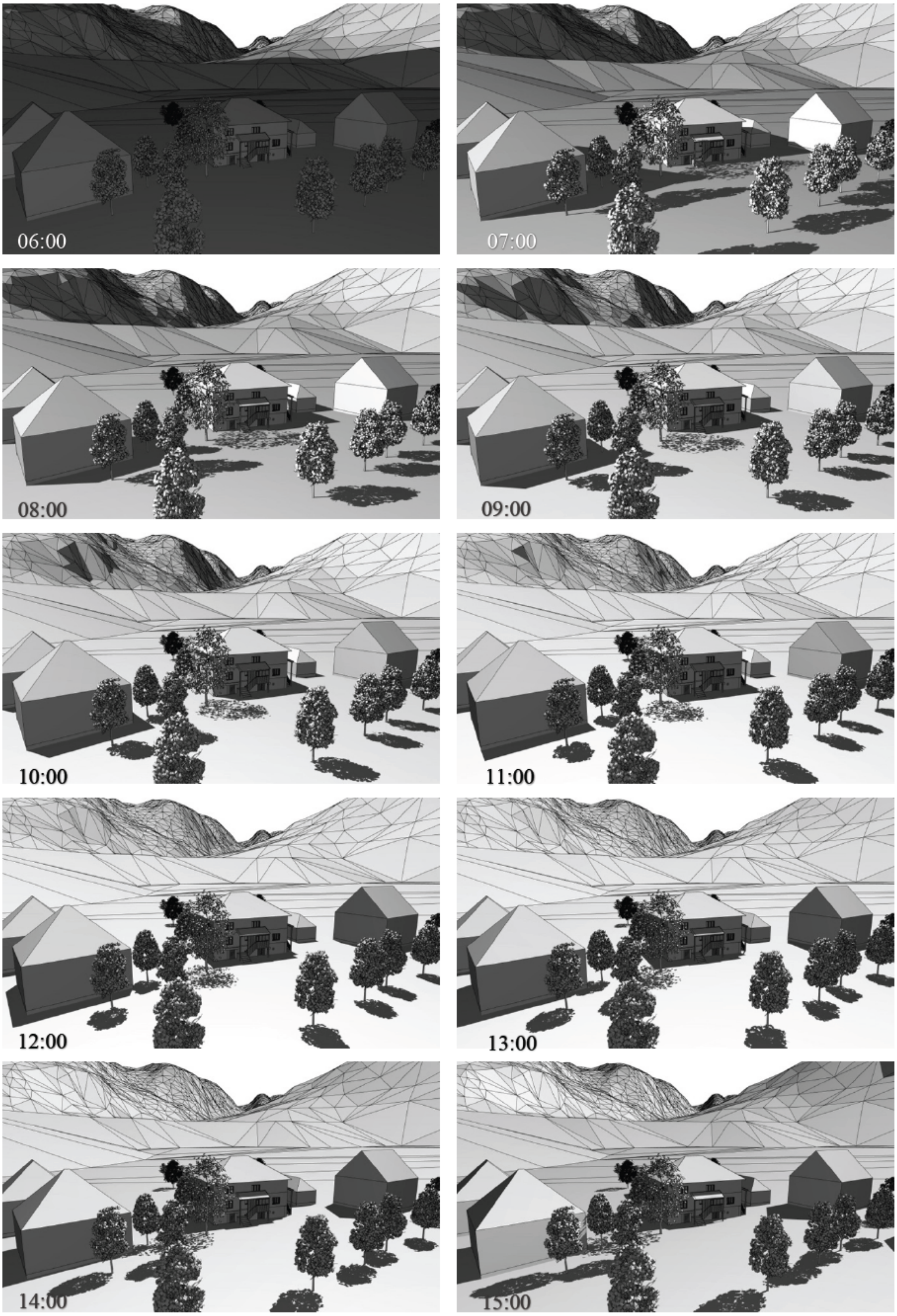


Fig. 150 Sun study of Kulla's context on the 5th of May 2021, every hour from 06:00 until 19:00 o'clock

12.3.2. Sun study during mid-Summer

The sun study of the setting of Kulla during mid-Summer, shows that the building is shadowed from sunrise until 07:00 o'clock and before 18:00 o'clock onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 5th of August 2021, Kulla is under sunlight for about 11 hours.


06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00

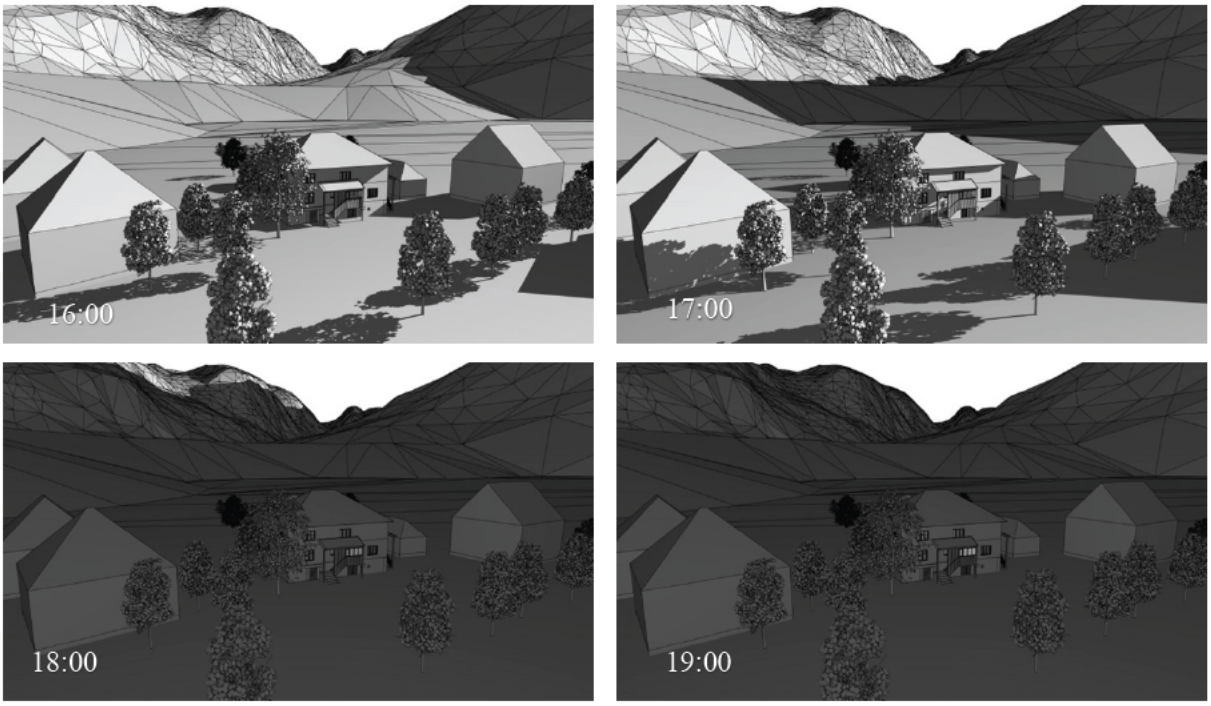
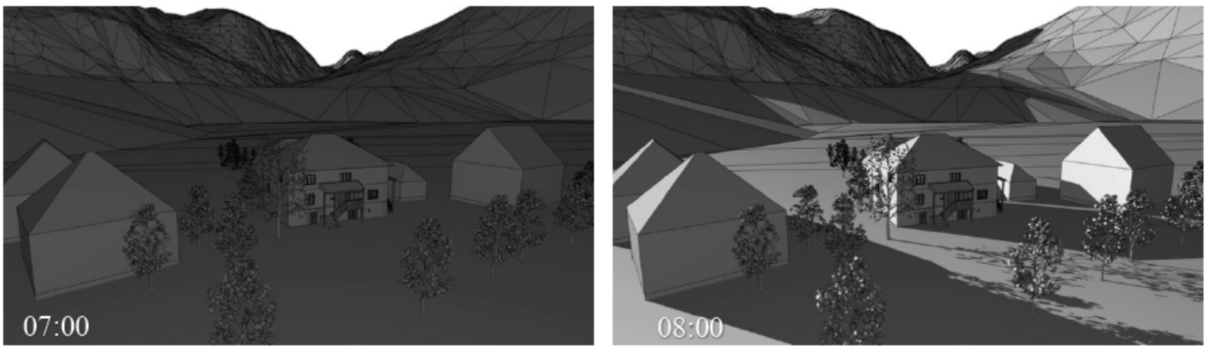


Fig. 151 Sun study of Kulla's context on the 5th of August 2021, every hour from 06:00 until 19:00 o'clock

12.3.3. Sun study during mid-Autumn

The sun study of the setting of Kulla during mid-Autumn, shows that the building is shadowed from sunrise until 08:00 o'clock and then from 15:00 o'clock onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 5th of November 2021, Kulla is under sunlight for about 7 hours.



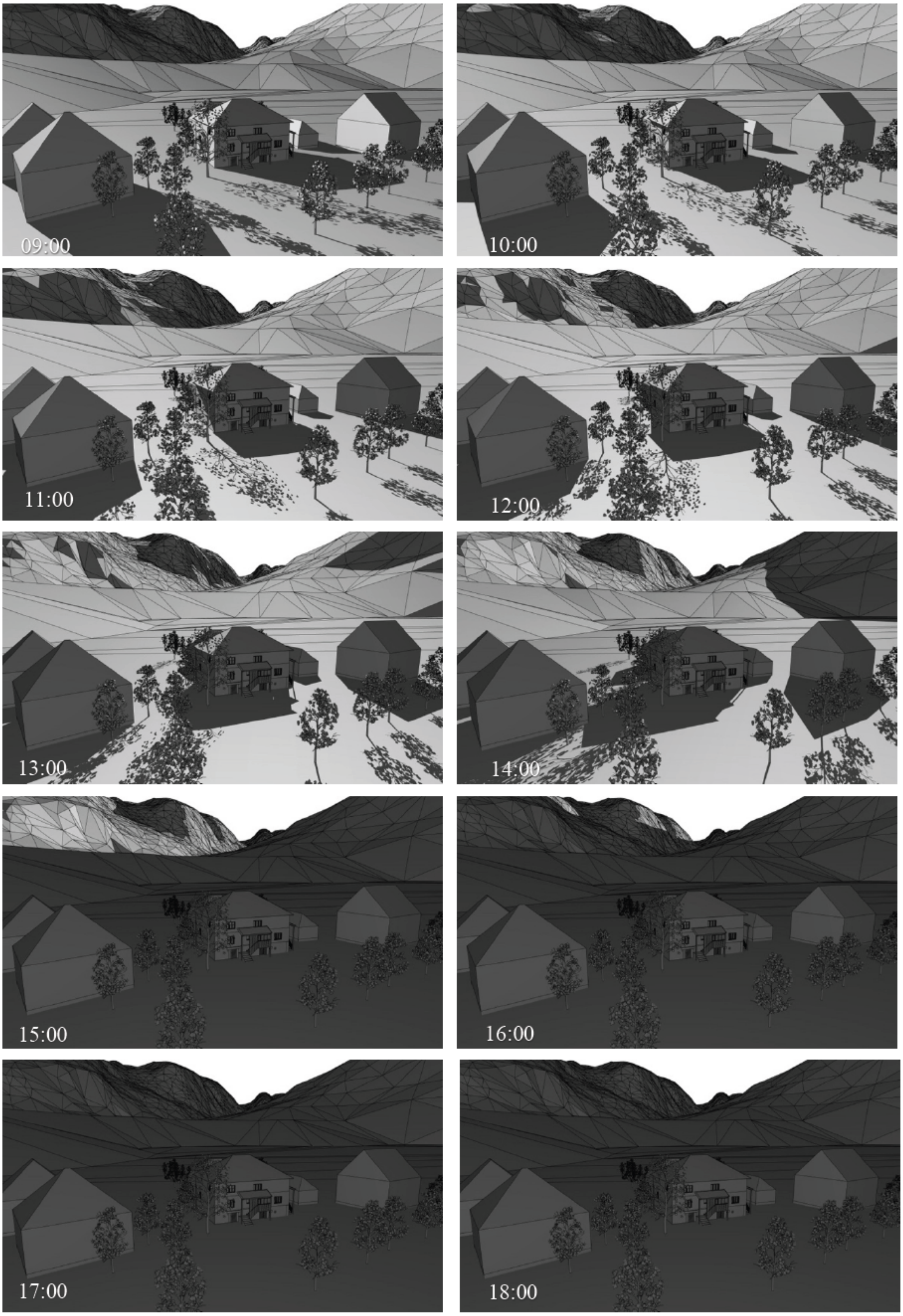
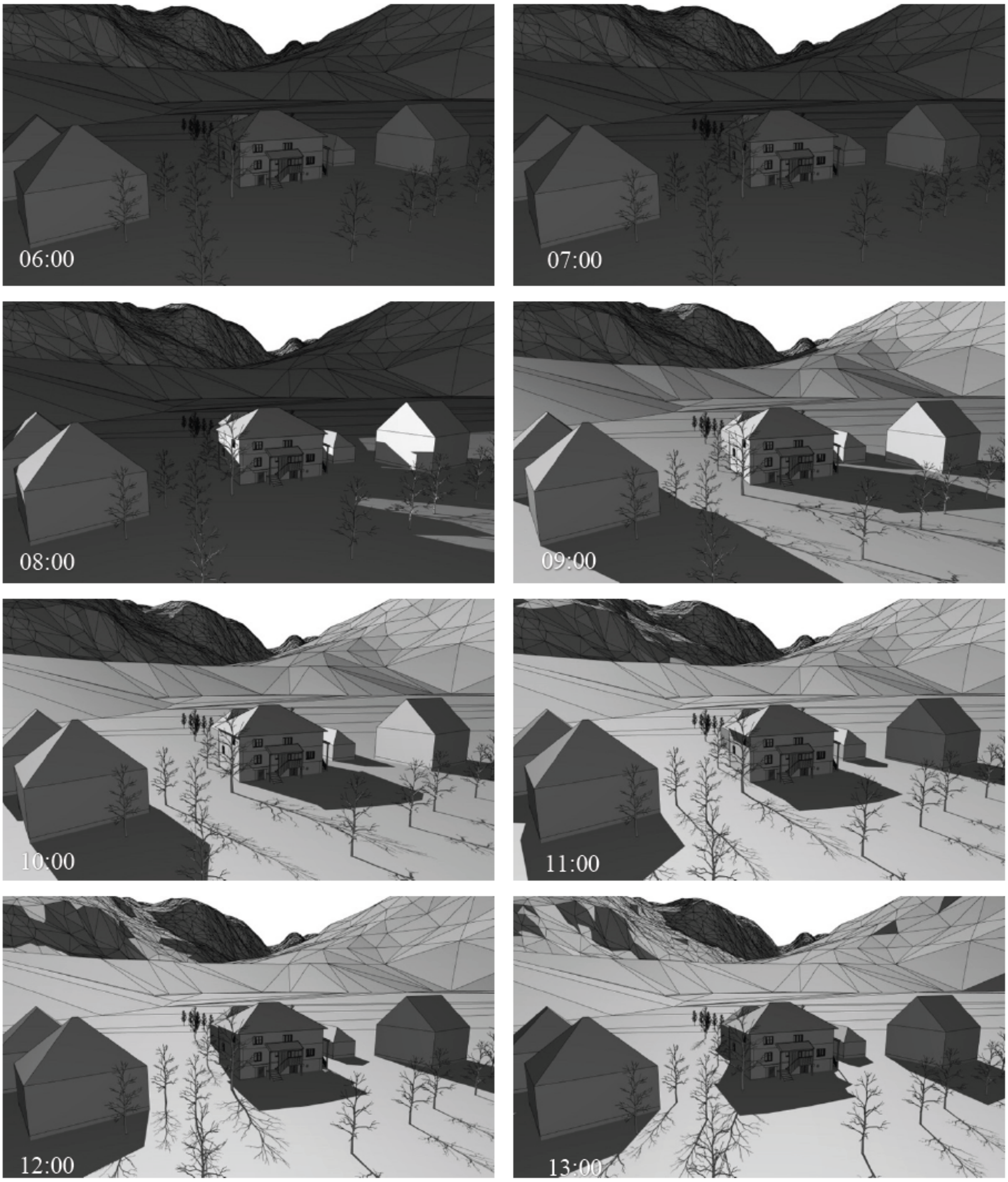


Fig. 152 Sun study of Kulla's context on the 5th of November 2021, every hour from 07:00 until 18:00 o'clock

12.3.4. Sun study during mid-Winter

The sun study of the setting of Kulla during mid-Winter, shows that the building is shadowed from sunrise until 09:00 o'clock and then from 14:00 o'clock onwards. The shadows come from the mountains and there is little to no impact from the surrounding buildings. So, during 3rd of February 2021, Kulla is under sunlight for about 5 hours.



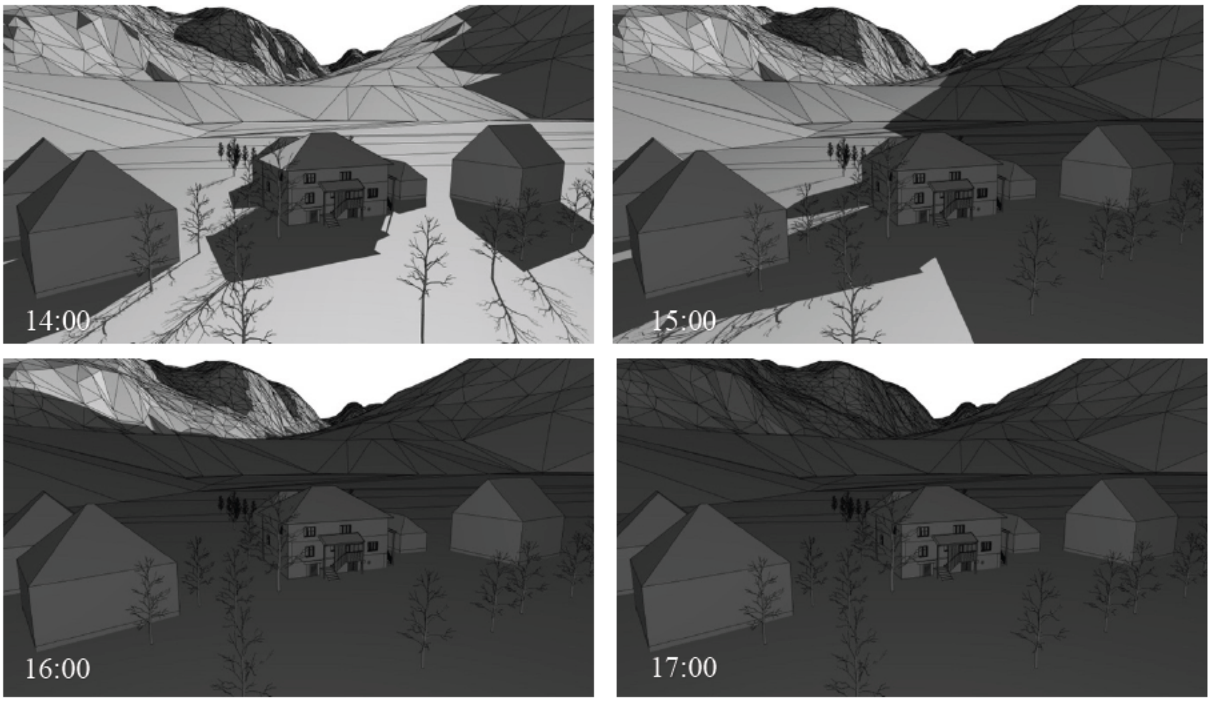


Fig. 153 Sun study of Kulla's context on the 3rd of February 2021, every hour from 06:00 until 17:00 o'clock

To recap, the table below shows the impact of the buildings and vegetation in the setting of three kullas, and the hours of full and partial sunlight exposure of the facades. According to the data, it can be seen that the Kulla of Isuf Mazrekaj has an average of 4 hours of sun exposure in the North- East façade, 6,13 hours in the South- East façade, 5,5 hours of in the South- West façade, and only 2,5 hours in the North- West façade. On the other hand, the Kulla of Selimaj family has an average of 2,38 hours of sun exposure in the North- East façade, 4,5 hours in the South-East, 5,75 hours in the South-West and only 1,88 in the North- West. Finally, the Kulla of Deli Gjonbalaj in Vuthaj has no sun exposure at all in the North façade, an average of 3,88 hours in the East façade, 6, 38 hours in the South façade and 3,63 hours in the West façade. This analysis is one of the man indications, that the buildings need thermal insulation in the external walls with low sun exposure.

SUN STUDY ANALYSIS				
DRANOC	SUN EXPOSURE IN THE FACADES OF KULLA OF ISUF MAZREKAJ (hrs)			
SEASON	NE	SE	SW	NW
SPRING	4	7	5,5	2,5
SUMMER	4	7	5,5	3
AUTUMN	1	5,5	5	0,5
WINTER	1,5	5	6	0
AVERAGE	2,63	6,13	5,50	1,50
VALBONA	SUN EXPOSURE IN THE FACADES OF KULLA OF SELIMAJ FAMILY (hrs)			
SEASON	NE	SE	SW	NW
SPRING	4,5	4,5	6,5	3
SUMMER	5	5	7	4,5
AUTUMN	0	4,5	5	0
WINTER	0	4	4,5	0
AVERAGE	2,38	4,50	5,75	1,88
VUTHAJ	SUN EXPOSURE IN THE FACADES OF KULLA OF DELI GJONBALAJ (hrs)			
SEASON	N	E	S	W
SPRING	0	4,5	6,5	4,5
SUMMER	0	5	7	5
AUTUMN	0	3	6	3
WINTER	0	3	6	2
AVERAGE	0,00	3,88	6,38	3,63

Table 4 Sun exposure length in the facades of kullas

12.3.5. Light exposure and daylighting (verification of results from subchapters 12.3.1-12.3.4)

Due to the lack of architectural laboratories in Kosovo, the computation for one of the study cases, the kulla in Vuthaj, was performed in a laboratory in Krems University. The results of the laboratory tests corroborate the results of archicad sun study.

This analysis was part of the project for the rehabilitation of Kulla of Deli Gjonbalaj in Vuthaj in Montenegro with the aim of comfort-optimizing the living spaces, and analyzing the light exposure and daylighting. This project was part of Ilucidare and was drafted by DI Dr.techn. Gregor Radinger, MSc from Danube University Krems, Kaltrina Thaci from CHwB Kosovo and DI Dr.techn. Tobias Steiner from IBO, Vienna.

The project was implemented during Ilucidare Capacity Building in October 2021. The solar exposure of the Kulla of Deli Gjonbalaj in Vuthaj was analyzed in the light laboratory of the Danube University Krems using a physical working model and different sun settings at the earth's location 42° 31'N; 19°50'E. The building model was then exposed to simulated direct light-situations for different times of the day and year. The simulated direct light input on the building structure was documented photographically. The following table lists the selected times of exposure to sunlight at different times of the day and year, as well as the prevailing solar heights and directions.

42° 31´N; 19°50´E			
Date	Time	Sunheight γ	Azimut α
21.6.	10:00	51	107
	13:00	71	192
	16:00	45	261
21.3.	10:00	14	142
	12:00	48	185
	16:00	20	251
21.12.	10:00	20	156
	12:00	24	185
	16:00	1	236

Table 5 Sun positions at different times of the day and year

The sun exposure of the building structure at different times of the day and year is documented in the following photo series- building view from southwest.

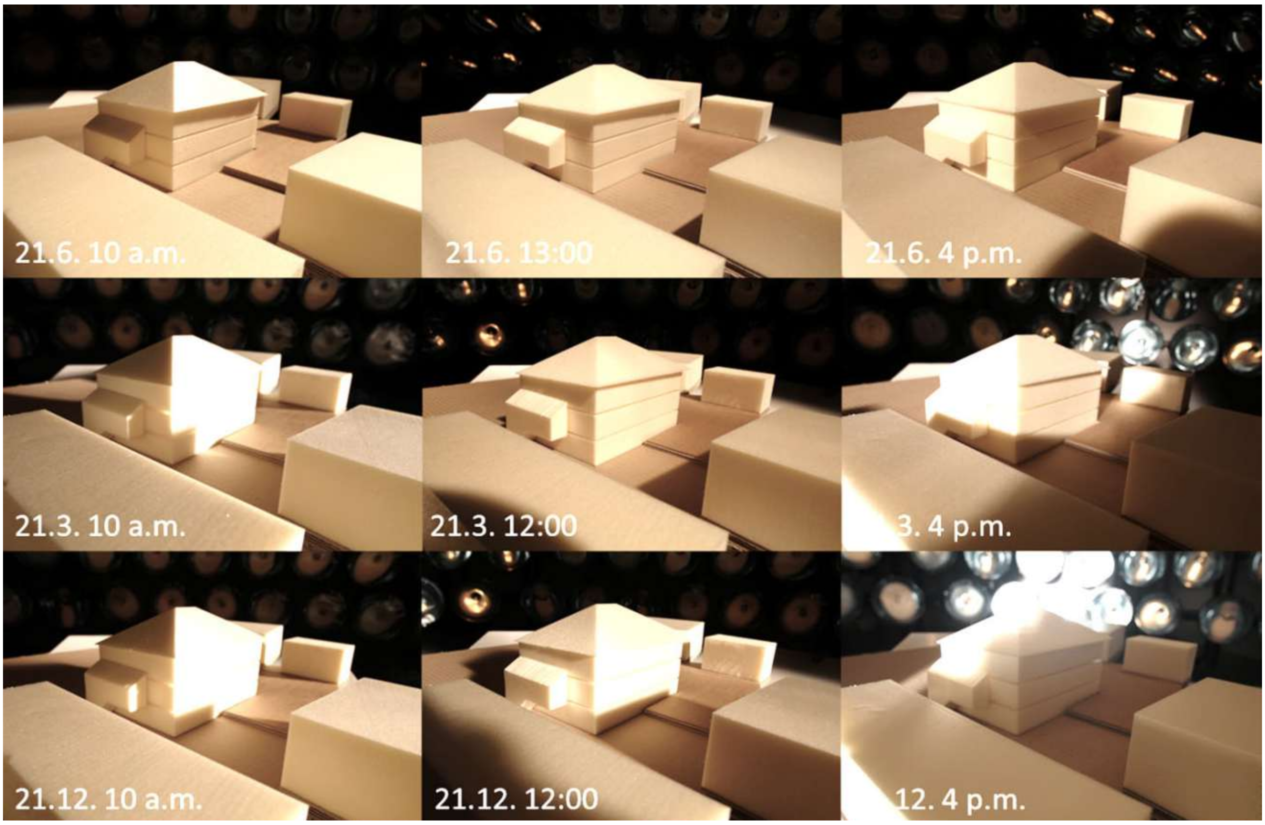


Fig. 154 Sun exposure of the building on 21st of July, 21st of March and 21st of December

The west-orientated windows of the living area are exposed to direct sunlight from the middle of the day throughout the year. The surrounding landscape and vegetation shade the building and shorten the sunlight hours, especially in the winter months.

13. TEMPERATURE AND RELATIVE HUMIDITY

Temperature and relative humidity data in the indoor and outdoor areas of three kullas were recorded by data loggers (Testo mini data loggers) in the period of June until September 2021 at intervals of 15 minutes. In Dranoc, the same period was also measured in 2020. In each kulla were installed three data loggers (2 indoors and 1 outdoor), whereas in the kulla in Dranoc four data loggers were put (3 indoor and 1 outdoor). The position of data loggers was in the heated areas, in the cold (unheated areas) and outside the building (under the canopy), in order to see the temperature and relative humidity variations. Data loggers were not put in places with direct sunlight, heat, wind and rain. The exact location of data loggers was measured and drawn in building plans. The measured data was then processed in ComSoft Basic Software and was further processed in excel. The data results are presented in the following sub chapters.

13.1. KULLA OF ISUF MAZREKAJ, DRANOC

Temperature and relative humidity data in the indoor and outdoor areas were recorded by four data loggers between 29.07.2020 and 19.10.2020, as well as between 26.06.2021 and 17.09.2021 at measurement intervals of 15 minutes. One measuring device (MP_A) was located under the canopy of the terrace, in the setting of the kulla, one was located in the bedroom in the first floor, facing south-west (MP_4), one in the *oda,* facing also south-west (MP_2) and the last one in the loft area of the kulla (MP_3). The exact location of the data loggers is presented in the drawing below.

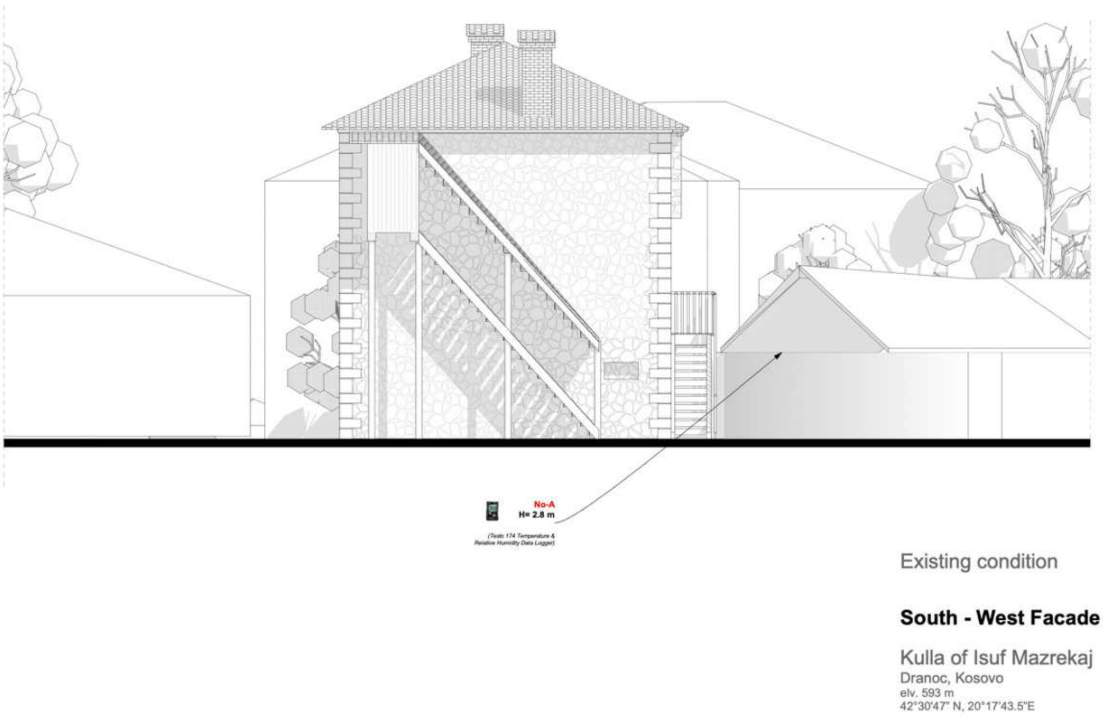


Fig. 155 The location of the data logger no. A under the canopy outside the kulla

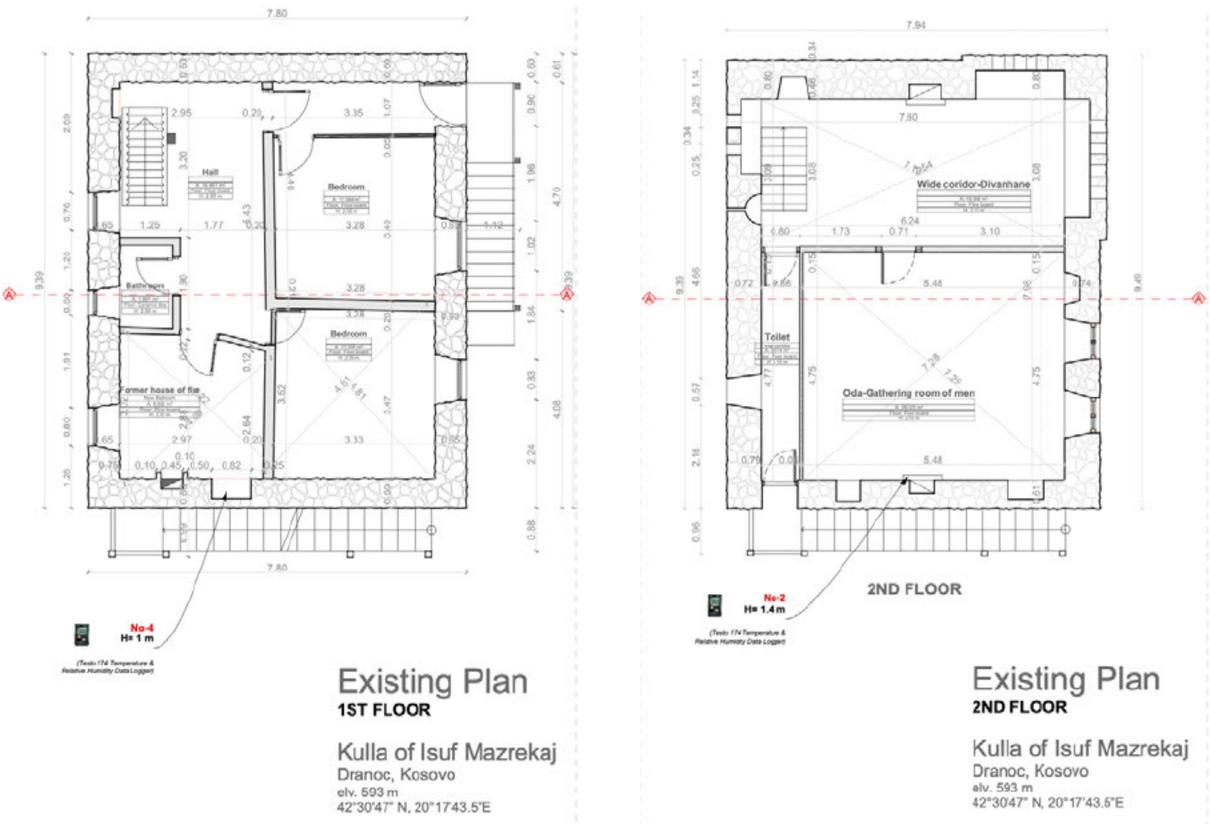


Fig. 156 The location of the data logger no. 4 in the 1st floor and no.2 in the 2nd floor

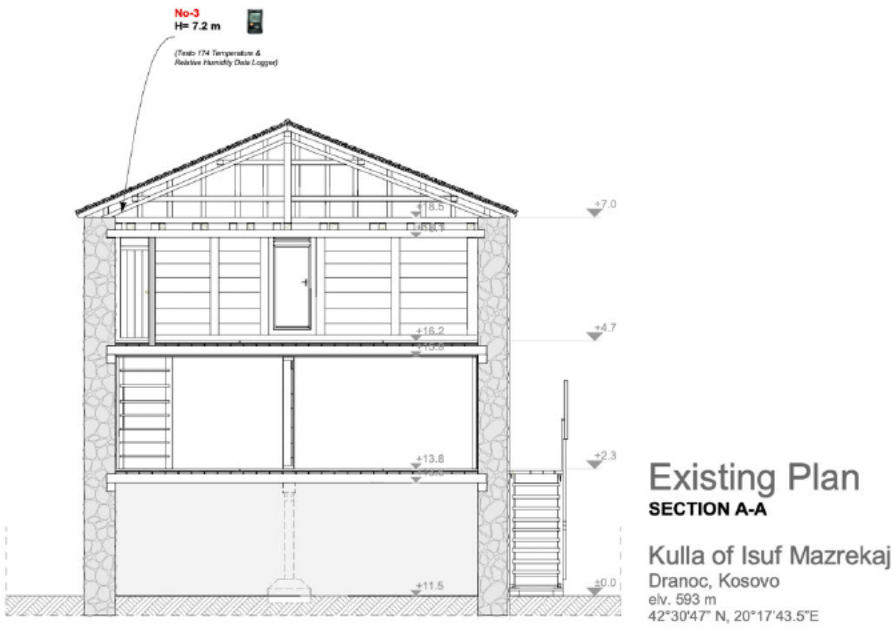


Fig. 157 The location of the data logger no. 3 in the loft area

The following tables summarize the results of the temperature analyses by indicating average temperatures, maximum and minimum values as well as temperature differences during the entire observation period and on hot and cool days. On the other hand, the following graphs show the outdoor and indoor temperature and relative humidity curves over the measured period in 2020 and 2021.

Period	Point	ØT (°C)	T_max (°C)	T_min (°C)	ΔT (°C)
Overall period:	MP_2	21,9	28,4	13,0	15,4
29.06.2020- 19.10.2020	MP_3	20,8	33,7	7,5	26,2
	MP_4	20,6	26,8	11,8	15,0
	MP_A	19,4	32,3	8,6	23,7
Hot days period:	MP_2	24,2	28,4	26,7	1,7
29.07.2020- 31.07.2020	MP_3	23,9	33,7	27,8	5,9
	MP_4	22,7	26,8	25,2	1,6
	MP_A	22,5	32,1	28,6	3,5
Cold days period:	MP_2	14,8	18,3	13,0	5,3
17.10.2020-19.10.2020	MP_3	11,0	15,3	7,5	7,8
	MP_4	13,9	17,9	11,8	6,1
	MP_A	9,9	11,0	8,8	2,2

Fig. 158 Temperature peaks, differences and averages during June-October 2020

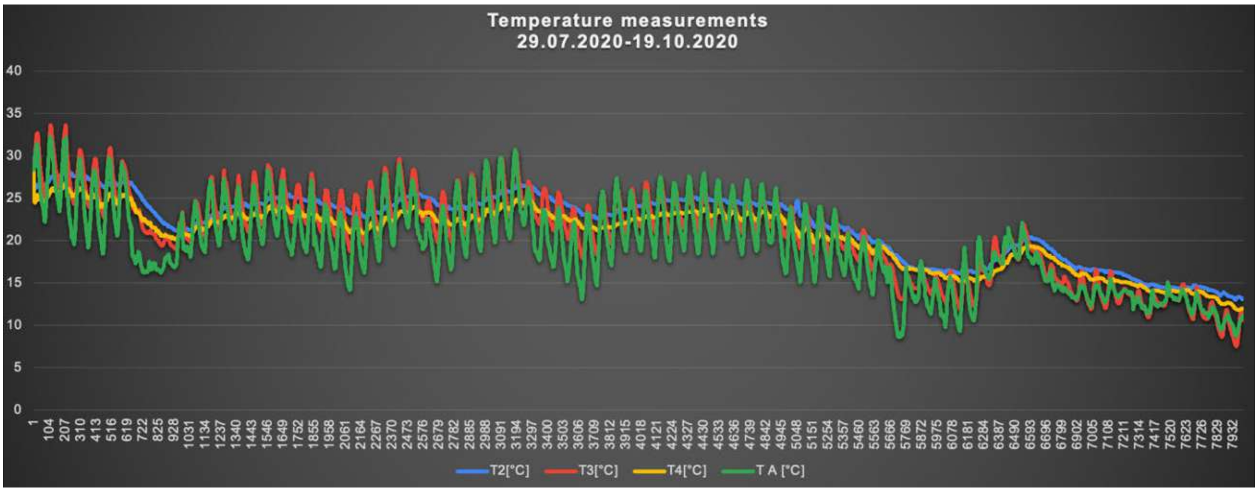


Fig. 159 Temperature curves over the entire observation period in 2020

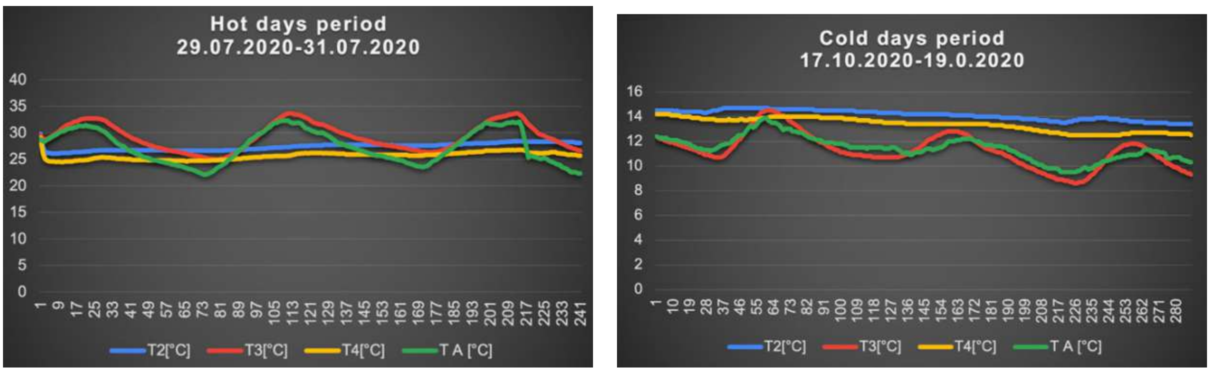


Fig. 160 Left: Temperature curves during hot days period in 2020, right: Temperature curves during cold days period in 2020

Period	Point	Ø RH (%)	RH_max (%)	RH_min (%)	ΔRH (%)
Overall period:	MP_2	56,0	72,0	39,0	33,0
29.06.2020- 19.10.2020	MP_3	62,4	82,2	42,4	39,8
	MP_4	61,8	78,0	42,4	35,6
	MP_A	67,8	98,0	30,6	67,4

Table 6 Relative humidity peaks, differences and averages during June-October 2020

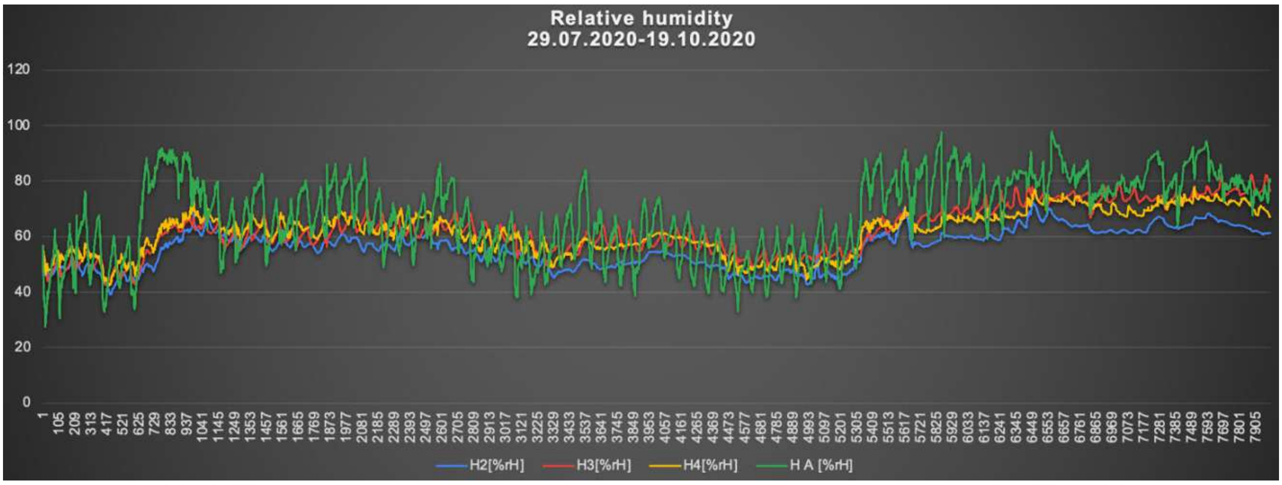


Fig. 161 Relative humidity curves over the entire observation period in 2020

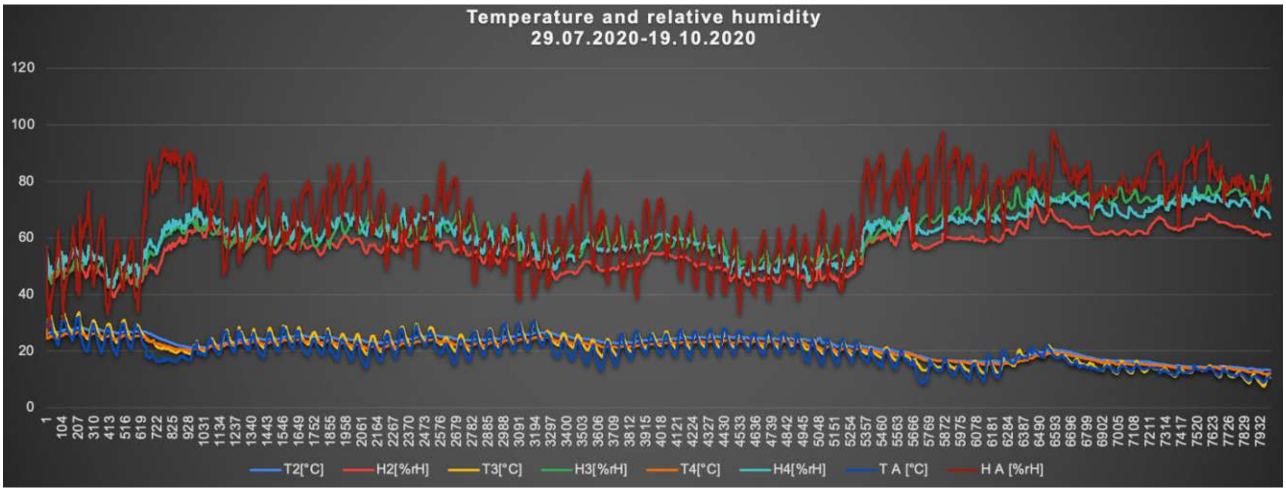


Fig. 162 Temperature and Relative humidity curves over the entire observation period in 2020

The following summarizing statements can be made after evaluating the collected data during 2020:

- The outdoor temperatures are characterized by high temperature peaks and large temperature fluctuations. During the summer observation period, the outdoor temperature peaks reach up to 32,3 °C and drop to 8,6 °C. The temperature difference during the observation period is thus 23,7 °C, with an average temperature of 19,4 °C.
- In contrast, the temperature curves in the interior are constant and show only slight fluctuations on hot and cool days. The average temperatures during the entire observation period are 21.9 °C (MP_2), 20,8 °C (MP_3), 20,6 °C (MP_4). On several consecutive hot days (29.07.2020-31.07.2020) the temperature averages are 24.2 °C (MP_2), 23,9 °C (MP_3), 22,7 °C (MP_4), the temperature fluctuations are 1.7, 5.9, and 1.6 °C. On cooler days (17.10.2020 - 19.10.2020) the temperature averages are 14,8 °C (MP_2), 11 °C (MP_3), 13,9 °C (MP_4), the temperature fluctuations are 5.3, 7.8, and 6.1 °C.
- The temperature peaks and fluctuation ranges are slightly higher on the loft area (MP_3) than on the first and second floor.
- **The interior temperatures are predominantly in a thermally very comfortable range of values.**
- The outdoor RH is characterized by high values and large fluctuations. During the summer observation period, the outdoor RH peaks reach up to 98 %, and drops to 30,6 %. The RH difference during the observation period is thus 67,4 %, with an average RH of 67,8 %.
- In contrast, the values of RH in the interior have lower fluctuations. The average RH during the entire observation period is 56 % (MP_2) and 62,4 % (MP_3) and 61.8 (MP_4). The highest RH is 73 % (MP_2), 82,2 % (MP_3) and 78 (MP_4). On the other hand, the lowest RH is 33 % (MP_2), 39,8 % (MP_3) and 35,6 (MP_4).
- In a historic structure, the most essential climatic characteristic is relative humidity (RH), which should ideally be between 40 and 65 percent. When the relative humidity (RH) is too low, organic materials might crack and furniture joints can loosen. Mold growth, dry rot, and insect infestation are all more likely when RH is too high.
- **So, if we take the average values, then it means that the building is in the safe side. But taking into consideration the high peaks, then during some periods, the relative humidity is high in this building.**

Period	Point	ØT (°C)	T_max (°C)	T_min (°C)	ΔT (°C)
Overall period: **26.06.2021 - 17.09.2021**	MP_2	25,6	32,0	19,7	12,3
	MP_3	25,7	35,0	16,6	18,4
	MP_4	23,8	32,8	18,2	14,6
	MP_A	23,8	34,8	12,7	22,1
Hot days period: **29.07.2021- 31.07.2021**	MP_2	27,5	29,9	20,3	9,6
	MP_3	24,5	34,9	16,9	18,0
	MP_4	25,4	27,5	18,9	8,6
	MP_A	25,5	34,6	23,7	10,9
Cold days period: **08.09.2021- 10.09.2021**	MP_2	20,0	20,4	19,7	0,7
	MP_3	19,2	23,5	16,9	6,6
	MP_4	18,8	19,3	18,3	1,0
	MP_A	18,9	24,5	14,6	9,9

Table 7 Temperature peaks, differences and averages during June-September 2021

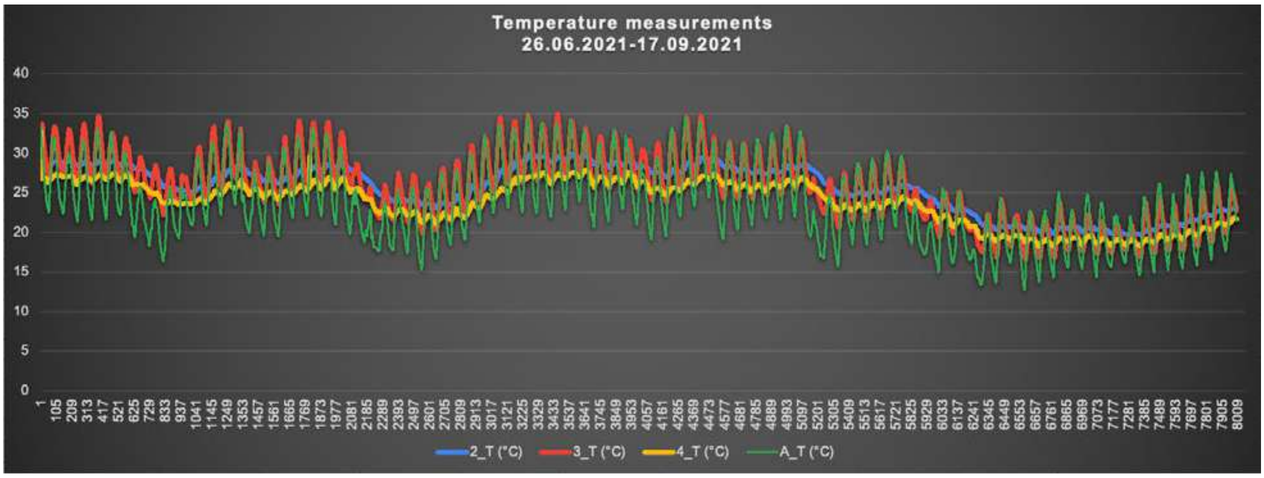


Fig. 163 Temperature curves over the entire observation period in 2021

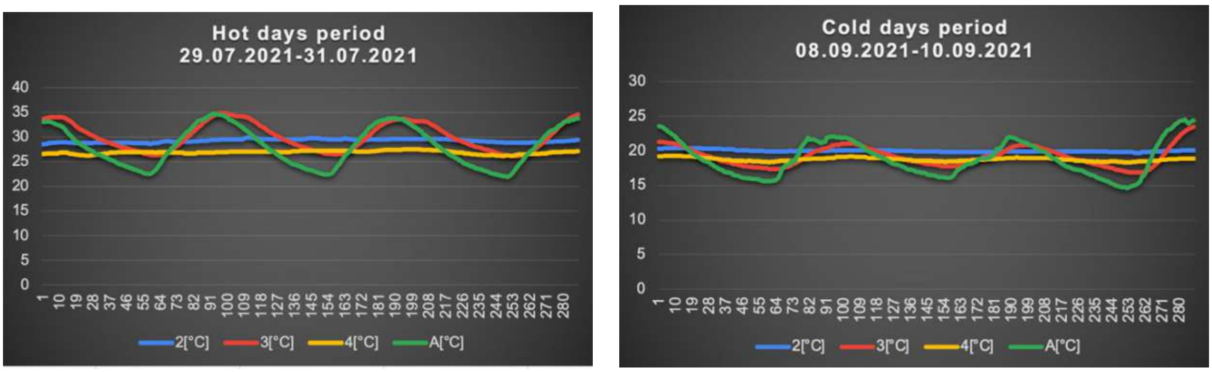


Fig. 164 Left: Temperature curves during hot days period in 2021, right: Temperature curves during cold days period in 2021

Period	Point	Ø RH (%)	RH_max (%)	RH_min (%)	ΔRH (%)
Overall period: **26.6.2021 - 17.09.2021**	MP_2	46,1	61,1	30,2	30,9
	MP_3	48,1	63,0	31,5	31,5
	MP_4	53,4	69,6	31,7	37,9
	MP_5	50,4	85,9	23,4	62,5

Table 8 Relative humidity peaks, differences and averages during June-September 2021

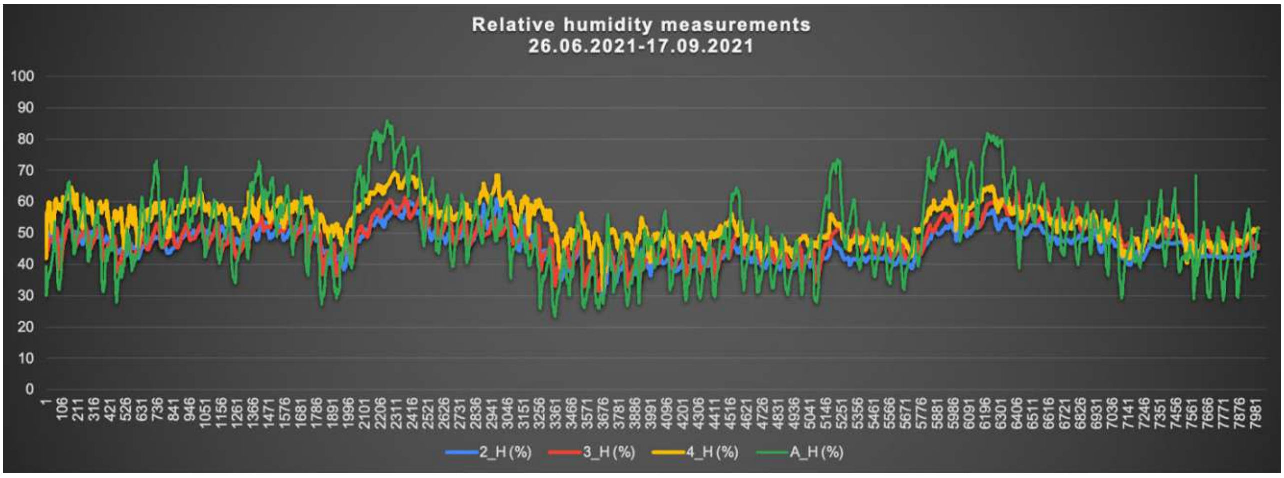


Fig. 165 Relative humidity curves over the entire observation period in 2021

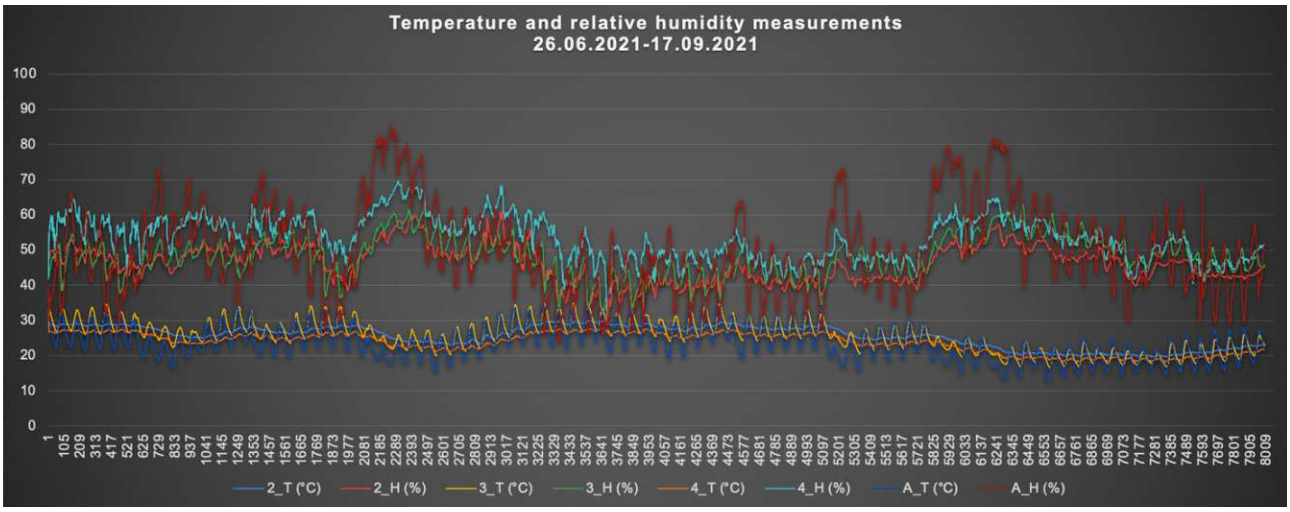


Fig. 166 Temperature and Relative humidity curves over the entire observation period in 2021

The following summarizing statements can be made after evaluating the collected data during 2021:

- The outdoor temperatures are characterized by high temperature peaks and large temperature fluctuations. During the summer observation period, the outdoor temperature peaks reach up to 34,8 °C and drop to 12,7 °C. The temperature difference during the observation period is thus 22,1 °C, with an average temperature of 23,8 °C.

- In contrast, the temperature curves in the interior are constant and show slight fluctuations, some of them noticeable ones on hot and cool days. The average temperatures during the entire observation period are 25.6 °C (MP_2), 25.7 °C (MP_3), 23.8 °C (MP_4). On several consecutive hot days (29.07.2021-31.07.2021) the temperature averages are 27.5 °C (MP_2), 24.5 °C (MP_3), 25.4 °C (MP_4), the temperature fluctuations are 9.6, 18 and 8.6 °C. On cooler days (08.09.2021 - 10.09.2021) the temperature averages are 20 °C (MP_2), 19.2 °C (MP_3), 18.8 °C (MP_4), the temperature fluctuations are 0.7, 6.6 and 1 °C.
- The temperature peaks and fluctuation ranges are slightly higher on the loft area (MP_3) than on the first and second floor.
- **The interior temperatures are predominantly in a thermally very comfortable range of values.**
- The outdoor RH is characterized by high values and large fluctuations. During the summer observation period, the outdoor RH peaks reach up to 85.9 %, and drops to 23.4 %. The RH difference during the observation period is thus 62.5 %, with an average RH of 50.4 %.
- In contrast, the values of RH in the interior have lower fluctuations. The average RH during the entire observation period is 46.1 % (MP_2), 48.1 % (MP_3) and 53.4 (MP_4). The highest RH is 61.1 % (MP_2), 63 % (MP_3) and 69.7 (MP_4). On the other hand, the lowest RH is 30.2 % (MP_2), 31.5 % (MP_3) and 31.7 (MP_4).
- In a historic structure, the most essential climatic characteristic is relative humidity (RH), which should ideally be between 40 and 65 percent. When the relative humidity (RH) is too low, organic materials might crack and furniture joints can loosen. Mold growth, dry rot, and insect infestation are all more likely when RH is too high.
- **According to the above data, the Kulla of Isuf Mazrekaj is in a safe side, as far as the relative humidity is concerned.**

13.2. KULLA OF SELIMAJ FAMILY, VALBONA

Temperature and relative humidity data in the indoor and outdoor areas were recorded by three data loggers between 15.06.2021 and 05.09.2021 at measurement intervals of 15 minutes. One measuring device (MP_2) was located in the kitchen- living room, facing east, one was located under the canopy of the staircase outside the building, facing south (MP_1), and the last one in the loft area of the kulla (MP_3). The exact location of the data loggers is presented in the drawing below.

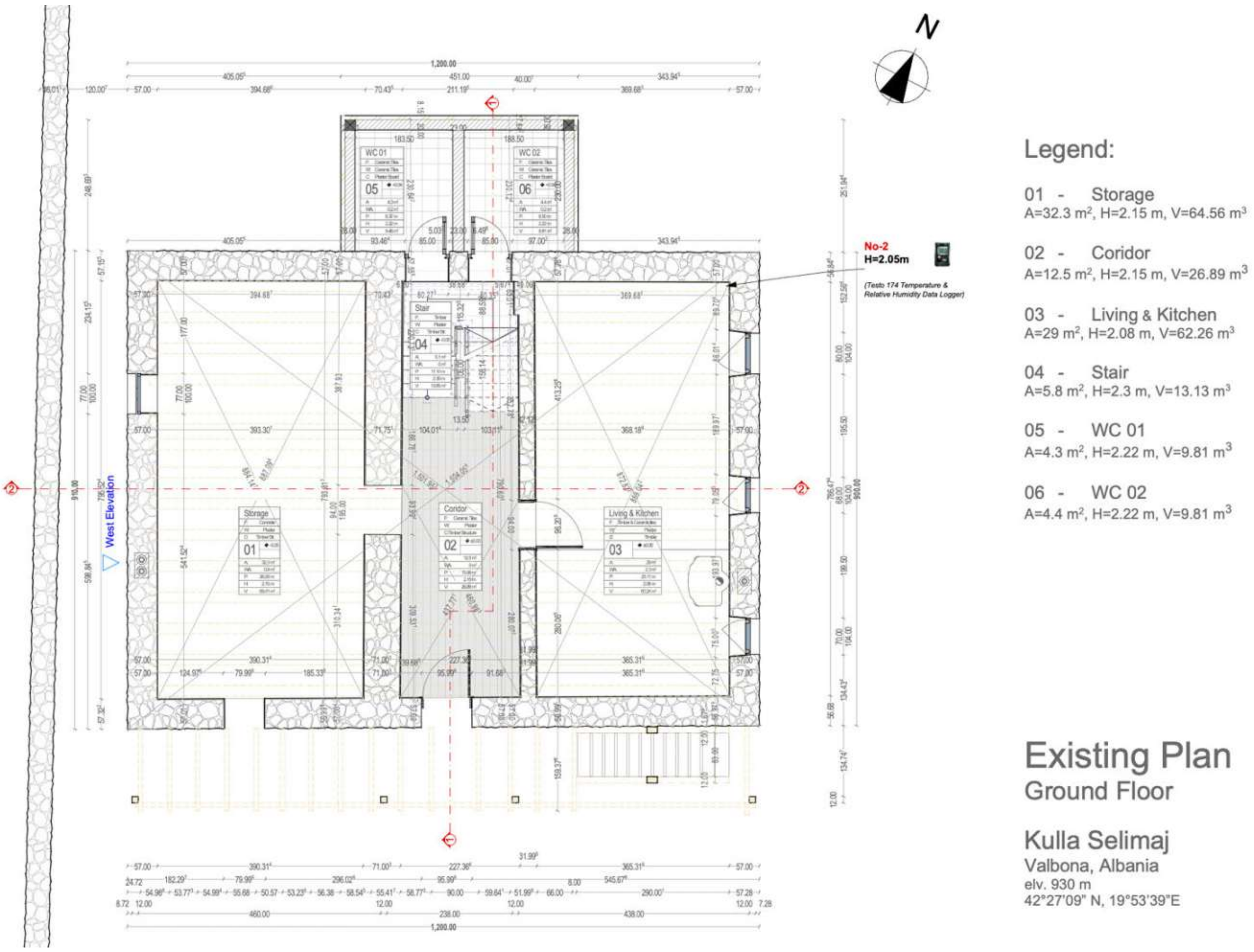


Fig. 167 The location of data logger no.2 in the ground floor

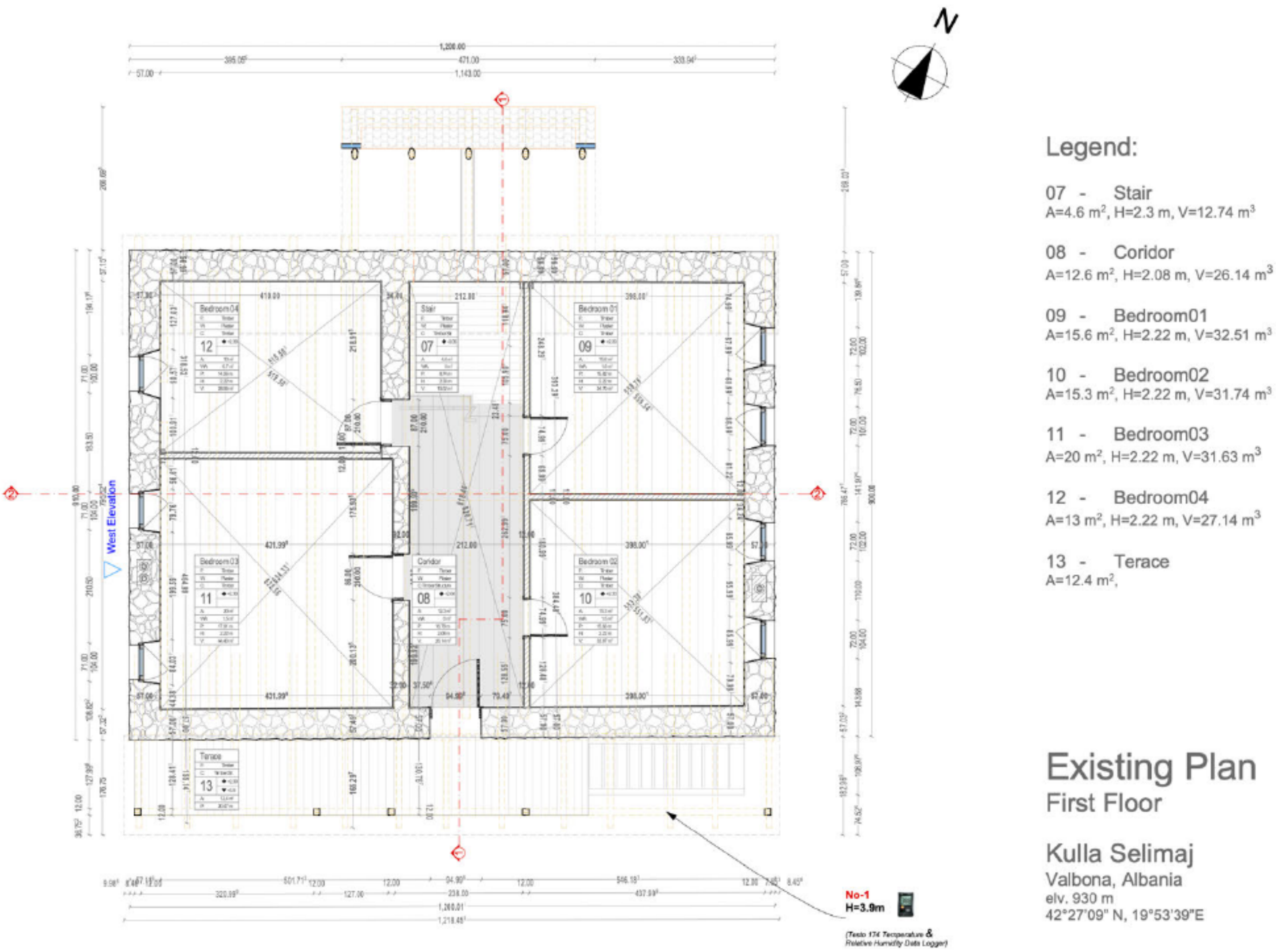


Fig. 168 The location of data logger no.1 in the first floor

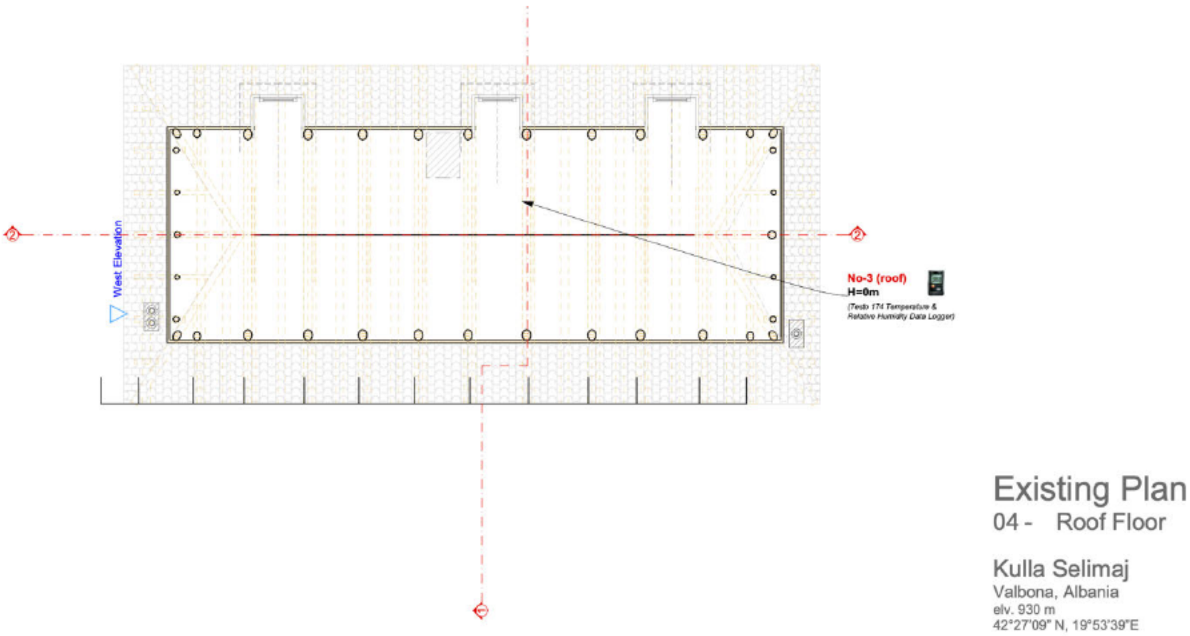


Fig. 169 The location of data logger no.3 in the roof

The following table summarizes the results of the temperature analyses by indicating average temperatures, maximum and minimum values as well as temperature differences during the entire observation period and on hot and cool days.

Period	Point	Ø T (°C)	T_max (°C)	T_min (°C)	ΔT (°C)
Overall period: 15.06.2021- 05.09.2021	MP_1	22,7	37,7	7,5	30,2
	MP_2	22,3	37,5	14,9	22,6
	MP_3	22,8	38,6	11,9	26,7
Hot days period: 28.07.2021- 30.07.2021	MP_1	22,7	37	36,6	0,4
	MP_2	22,9	27,2	25,2	2
	MP_3	23,7	31,2	30,2	1
Cool days period: 02.09.2021- 04.09.2021	MP_1	**20,4**	**8,8**	**7,5**	**1,3**
	MP_2	**20,4**	**20,1**	**16,0**	4,1
	MP_3	**22,0**	**14,2**	**13,3**	0,9

Table 9 Temperature peaks, differences and averages during June-September 2021

The following graphs show the outdoor and indoor temperature and relative humidity curves over the measured period in 2021.

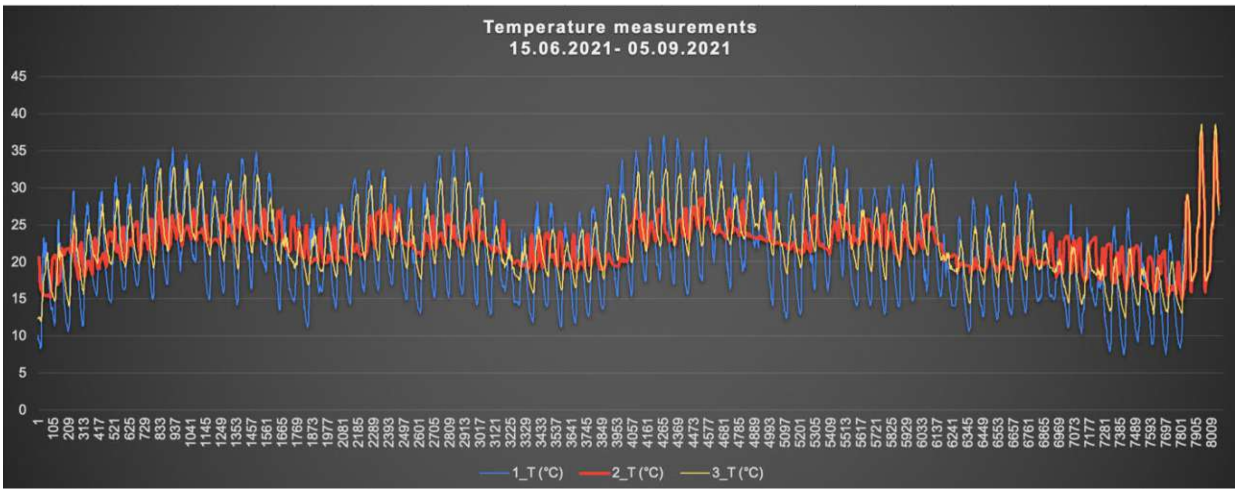


Fig. 170 Temperature curves over the entire observation period in 2021

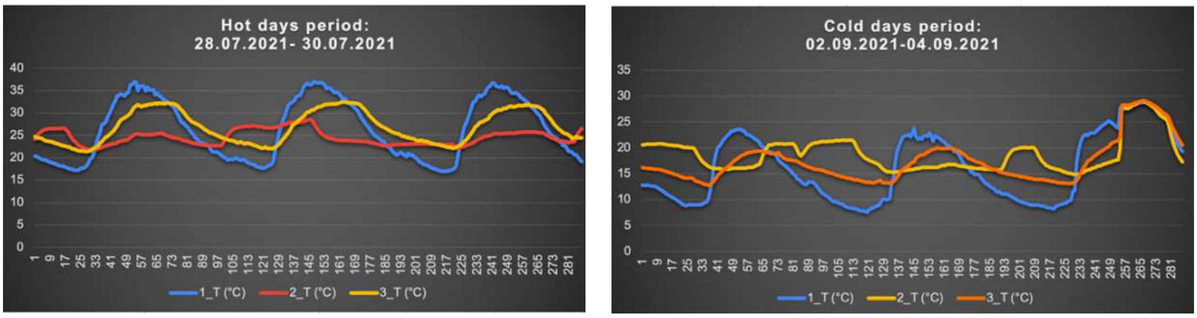


Fig. 171 Left: Temperature curves during hot days period in 2021, right: Temperature curves during cold days period in 2021

Period	Point	Ø RH (%)	RH_max (%)	RH_min (%)	ΔRH (%)
Overall period: 15.06.2021- 05.09.2021	MP_1	55,5	96,5	10,5	86,0
	MP_2	58,5	81,9	31,2	50,7
	MP_3	51,6	79,6	16,6	63,0

Table 10 Relative humidity peaks, differences and averages during June-September 2021

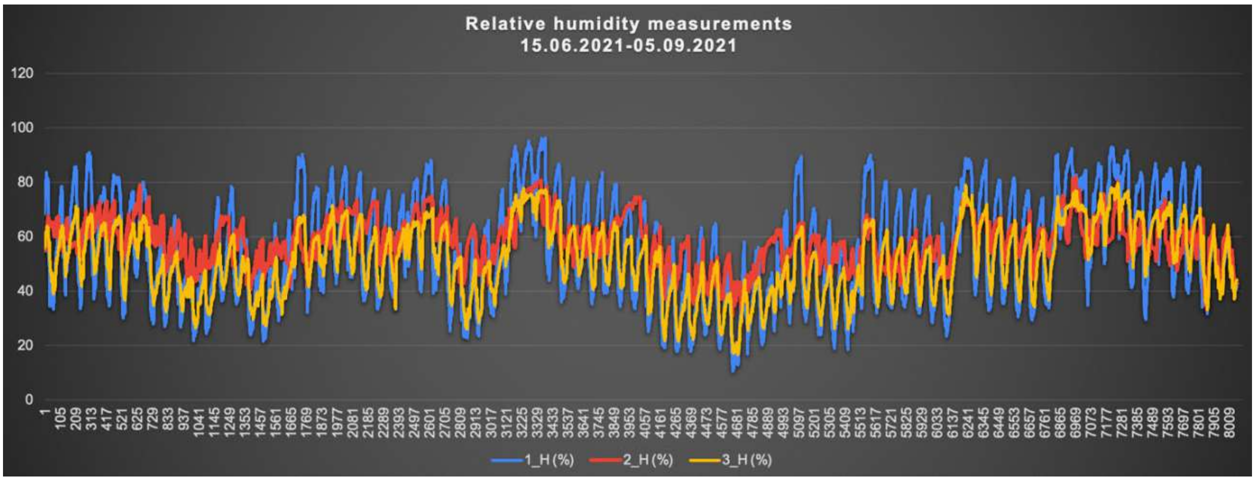


Fig. 172 Relative humidity curves over the entire observation period in 2021

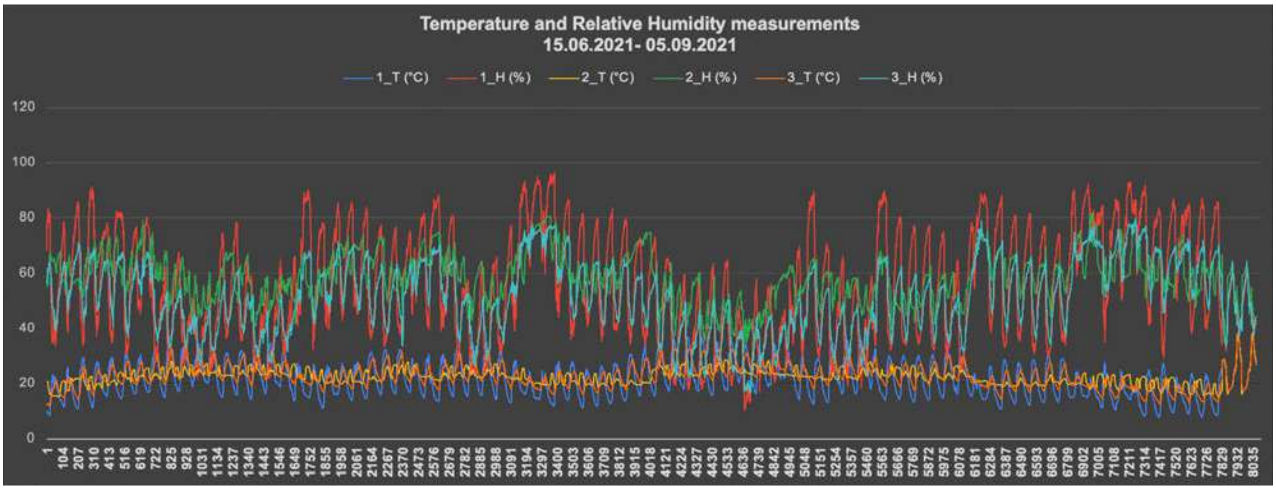


Fig. 173 Temperature and Relative humidity curves over the entire observation period in 2021

The following summarizing statements can be made after evaluating the collected data:

- The outdoor temperatures are characterized by high temperature peaks and large temperature fluctuations. During the summer observation period, the outdoor temperature peaks reach up to 37.7 °C and drop to 7.5 °C. The temperature difference during the observation period is thus 30.2 °C, with an average temperature of 22.7 °C.
- In contrast, the temperature curves in the interior are constant and show only slight fluctuations on hot and cool days. The average temperatures during the entire observation period are 22,3 °C (MP_2) and 22.8 °C (MP_3). On several consecutive hot days (28.07.2021-30.07.2021) the temperature averages are 22.9 °C (MP_2) and 23.7 °C (MP_3), the temperature fluctuations are 2 °C and 1 °C. On cooler days (02.09.2021 - 04.09.2021) the temperature averages are 20.4 °C (MP_2) and 22.0 °C (MP_3), the temperature fluctuations are 4.1 °C and 0.9 °C.
- The temperature peaks and fluctuation ranges are slightly higher on the loft area or (MP_4) than on the ground floor (MP_2).
- **The interior temperatures are predominantly in a thermally very comfortable range of values.**
- The outdoor RH is characterized by high values and large fluctuations. During the summer observation period, the outdoor RH peaks reach up to 96,5 %, and drops to 10,5 %. The RH difference during the observation period is thus 86 %, with an average RH of 55 %.
- In contrast, the values of RH in the interior have lower fluctuations. The average RH during the entire observation period is 58,5 % (MP_2) and 51,6 % (MP_3). In (MP_2) the

maximum RH is 81,9 %, whereas the lowest is 31,2 %. In (MP_3) the maximum RH is 79,6 %, whereas the lowest is 16,6 %.

- In a historic structure, the most essential climatic characteristic is relative humidity (RH), which should ideally be between 40 and 65 percent. When the relative humidity (RH) is too low, organic materials might crack and furniture joints can loosen. Mold growth, dry rot, and insect infestation are all more likely when RH is too high.
- **So, if we take the average values, then it means that the building is in the safe side. But taking into consideration the high peaks, then during some periods, the relative humidity is high in this building.**

13.3. KULLA OF DELI GJONBALAJ, VUTHAJ

Temperature and relative humidity data in the indoor and outdoor areas were recorded by three data loggers between 15.06.2021 and 04.09.2021 at measurement intervals of 15 minutes. One measuring device (MP_4) was located in the area of the external staircase on the west side of the building, one in the southwest-facing storage room in the ground floor (MP_5) and another one in the living room on the first floor (MP_6), which is also southwest-facing. The exact location of the data loggers is presented in the drawing below.

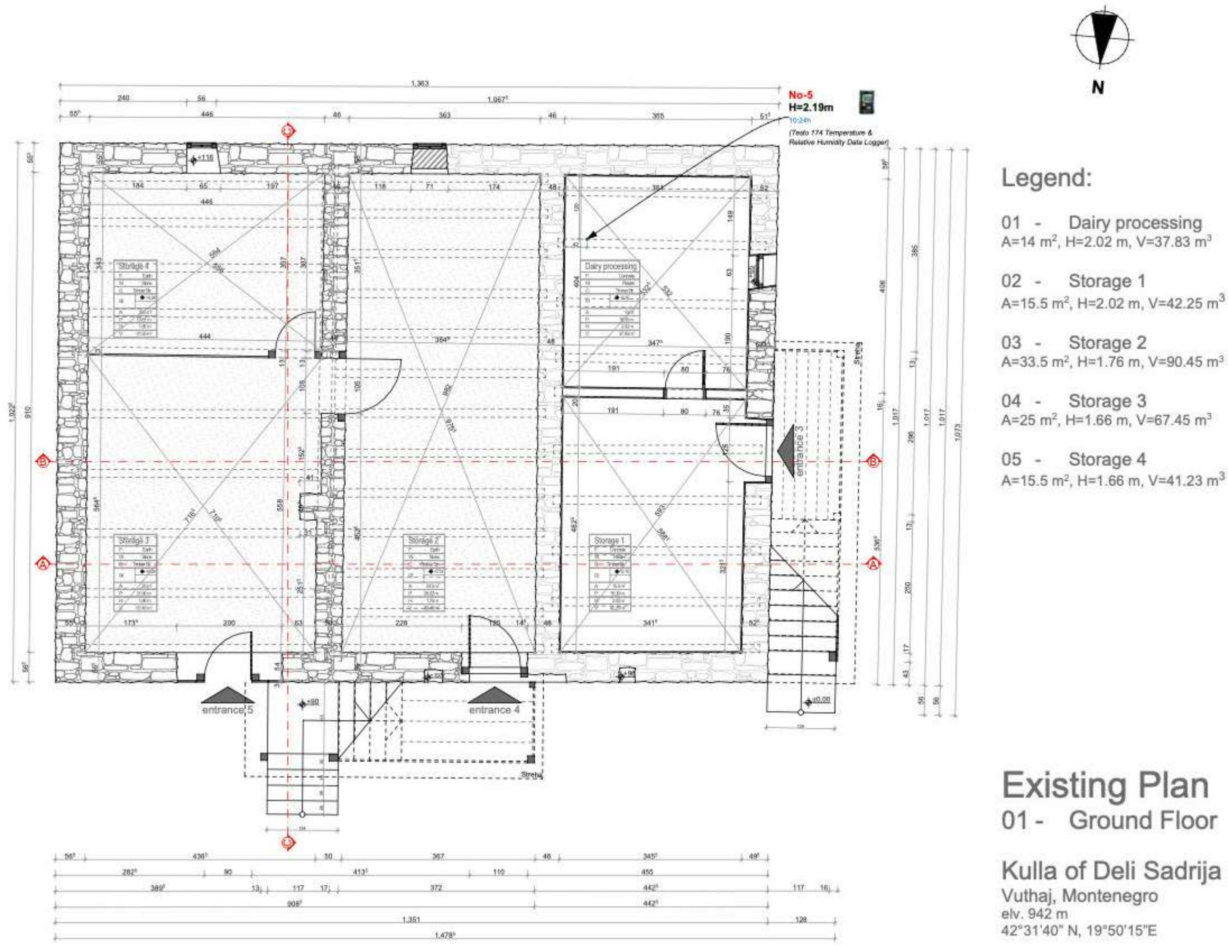


Fig. 174 The position of the data logger no.5, in the southwest storage room. (Drawing by Labeatët, 2021, edited by the author)

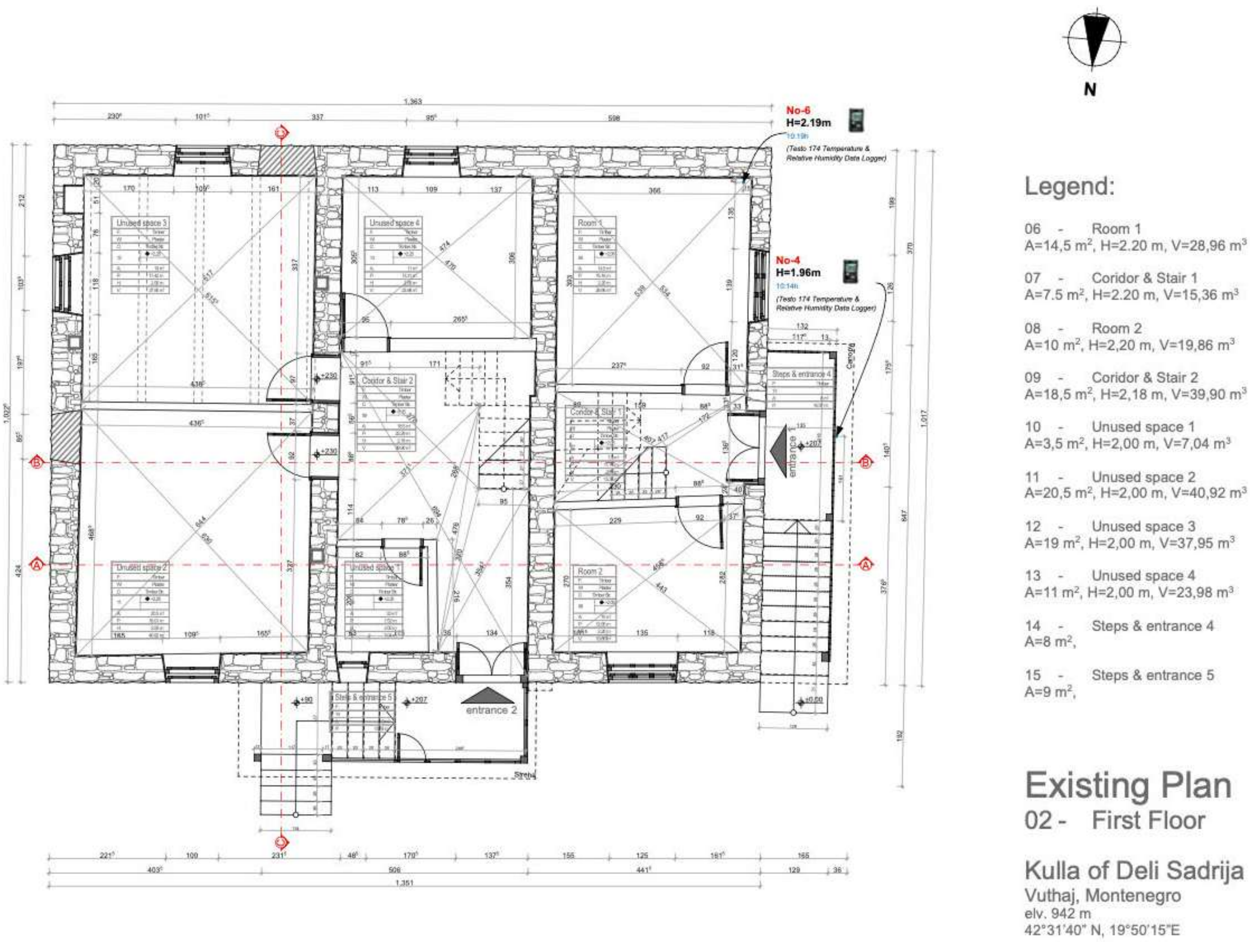


Fig. 175 The position of the data logger no.6, in the southwest living room and data logger no. 4 in the west façade, under the stairs canopy (Drawing by Labeatët, 2021, edited by the author)

The following table summarizes the results of the temperature analyses by indicating average temperatures, maximum and minimum values as well as temperature differences during the entire observation period and on hot and cool days.

Period	Point	Ø T (°C)	T_max (°C)	T_min (°C)	ΔT (°C)
Overall period: **15.6.2021 - 04.09.2021**	MP_4	20,3	39,3	5,5	33,8
	MP_5	20,6	24,2	14,1	10,1
	MP_6	22,8	27,2	15,6	11,6
Hot days period: **22.06.2021-24.6.2021**	MP_4	23,7	39,3	11,9	27,4
	MP_5	20,4	21,8	19,4	2,4
	MP_6	23,5	25	22,3	2,7
Cool days period: **17.07.2021-20.7.2021**	MP_4	18,5	31,7	9,8	21,9
	MP_5	20,7	21,7	20	1,7
	MP_6	22,6	24,4	20,9	3,5

Table 11 Temperature peaks, differences and averages during June-September 2021

The following graphs show the outdoor and indoor temperature and relative humidity curves over the measured period in 2021.

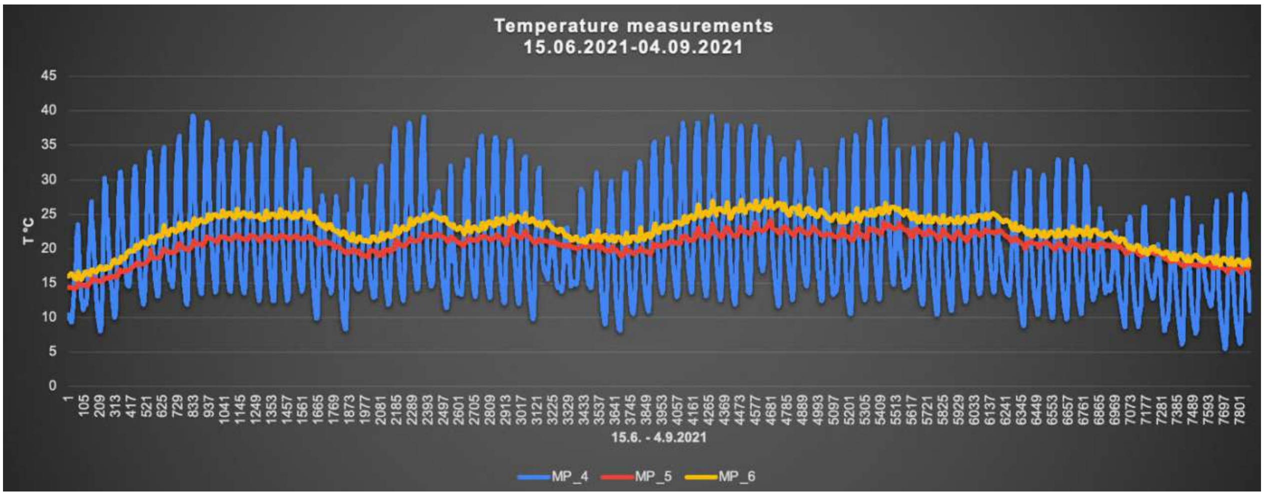


Fig. 176 Temperature curves over the entire observation period in 2021

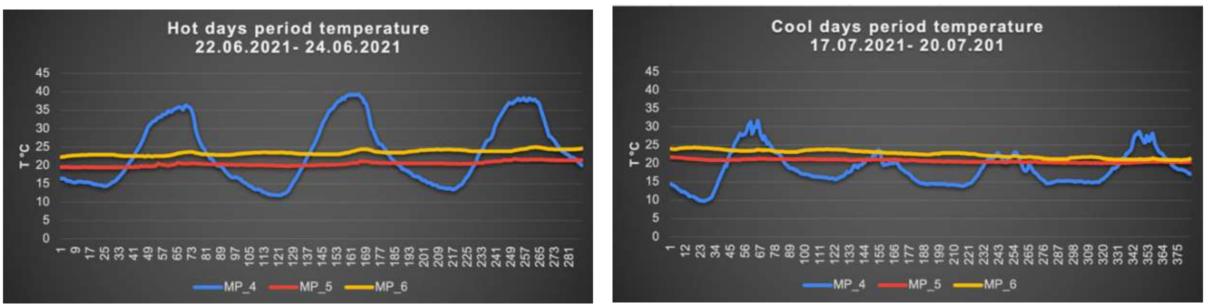


Fig. 177 Left: Temperature curves during hot days period in 2021, right: Temperature curves during cold days period in 2021

Period	Point	Ø RH (%)	RH_max (%)	RH_min (%)	ΔRH (%)
Overall period: **15.6.2021 - 04.09.2021**	MP_4	60,7	98,6	12,9	85,7
	MP_5	62,5	78,8	37,8	41,0
	MP_6	55,8	69,2	37,5	31,7

Table 12 Relative humidity peaks, differences and averages during June-September 2021

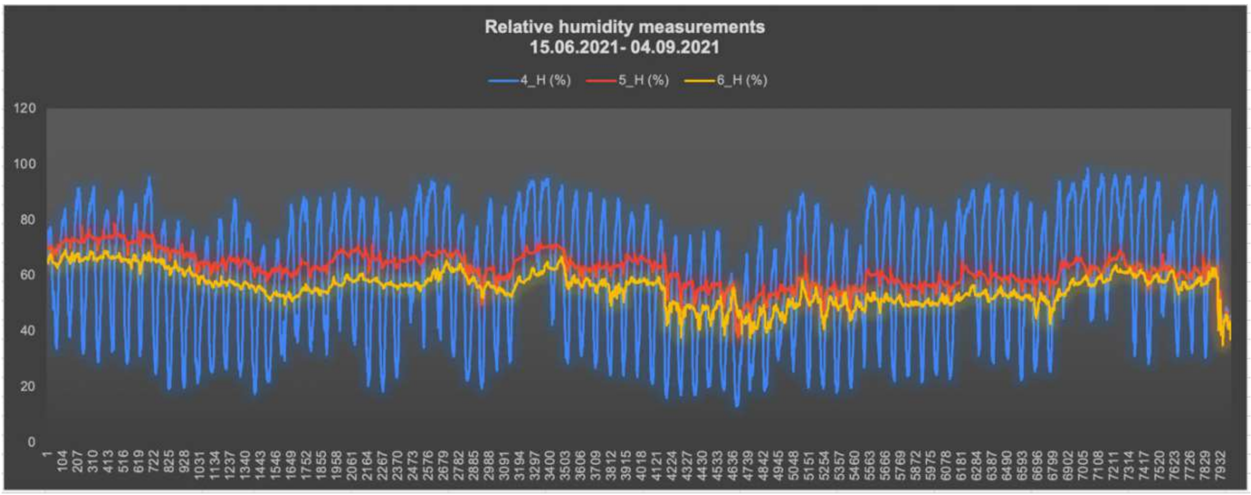


Fig. 178 Relative humidity curves over the entire observation period in 2021

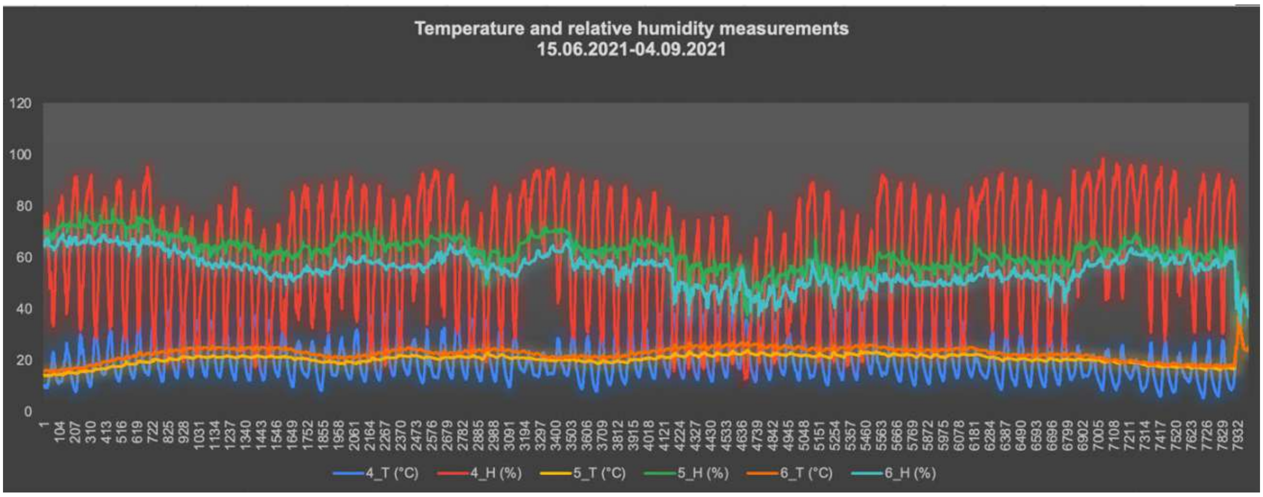


Fig. 179 Temperature and Relative humidity curves over the entire observation period in 2021

The following summarizing statements can be made after evaluating the collected data:

- The outdoor temperatures are characterized by high temperature peaks and large temperature fluctuations. During the summer observation period, the outdoor temperature peaks reach up to 39.3 °C and drop to 5.5 °C. The temperature difference during the observation period is thus 33.8 °C, with an average temperature of 20.3 °C.

- In contrast, the temperature curves in the interior are constant and show only slight fluctuations on hot and cool days. The average temperatures during the entire observation period are 20.6 °C (MP_5) and 22.8 °C. On several consecutive hot days (22.6.2021-24.6.2021) the temperature averages are 20.4 °C (MP_5) and 23.5 °C (MP_6), the temperature fluctuations are 2.4 °C and 2.7 °C. On cooler days (17.7.2021 - 20.7.2021) the temperature averages are 20.7 °C (MP_5) and 22.6 °C (MP_6), the temperature fluctuations are 1.7 °C and 3.5 °C.
- The temperature peaks and fluctuation ranges are slightly higher on the first floor (MP_6) than on the ground floor (MP_5).
- **The interior temperatures are predominantly in a thermally very comfortable range of values.**
- The outdoor RH is characterized by high values and large fluctuations. During the summer observation period, the outdoor RH peaks reach up to 98,6 %, and drops to 12,9 %. The RH difference during the observation period is thus 85,7 %, with an average RH of 60,7 %.
- In contrast, the values of RH in the interior have lower fluctuations. The average RH during the entire observation period is 62,5 % (MP_5) and 55,8 % (MP_6). In (MP_5) the maximum RH is 78,8 %, whereas the lowest is 37,8 %. In (MP_6) the maximum RH is 69,2 %, whereas the lowest is 37,5 %.
- In a historic structure, the most essential climatic characteristic is relative humidity (RH), which should ideally be between 40 and 65 percent. When the relative humidity (RH) is too low, organic materials might crack and furniture joints can loosen. Mold growth, dry rot, and insect infestation are all more likely when RH is too high.
- **So, if we take the average values, then it means that the building is in the safe side. But taking into consideration the high peaks, then during some periods, the relative humidity is high in this building.**

14. OTHER ASPECTS OF THERMAL COMFORT ANALYSIS

14.1. METHODS AND MEANS OF HEATING AND VENTILATION

Albanian kullas used natural heating and ventilation methods in addition to natural building materials and construction techniques. During cold months, wood-burning fireplaces were used for heating; some kullas had only one fireplace, while larger ones had one fireplace per level. The largest kullas, on the other hand, had their open fireplaces in the center of the room at first, then afterwards in the form of a chimney in each room. Iron stoves replaced fireplaces in the period between the two world wars, and they are still used today. Moreover, the cattle in barn located in the ground floor, were also an indirect method of heating these buildings; especially the first floor.

Dairy cows are homoeothermic animals that must maintain a body temperature of 38.8°C +/- 0.5°C at all times. They are sensitive to environmental conditions that affect their thermal exchange. Air temperature, radiant temperature, air velocity, and relative humidity are all factors to take into account. [219] Recent studies show that a single cow gives off 3,500-4,000 BTU an hour [220] or about 1.4 kW of electric heater. [221] If converted to SI unit of energy- Joule, that would be 3692695-4220223J (4.22 Megajoule) per hour and 101 MJ per day.

Usually, the family owners of kullas kept about 4 cows in the ground floor barns, thus the energy released by four cows per days is 404 MJ (112.22 kilowatt). If the average household consumption is about 30 kW per day, it means that the amount of energy released by four cows in a day could be used for 4 days' electricity needs including heat.

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[219] NADIS Animal Health Skills (2022) *Managing heat stress in dairy cows*. Available at: https://www.nadis.org.uk/disease-a-z/cattle/managing-heat-stress-in-dairy-cows/.

[220] Leifa Riis-Carstensen (2020) Mother Earth News. *Using Cow Thermal Energy to Heat Homes in Winter*. Available at: https://www.motherearthnews.com/homesteading-and-livestock/cow-thermal-energy-to-heat-homes-zmaz82ndzgoe/.

[221] NADIS Animal Health Skills (2022) *Managing heat stress in dairy cows*. Available at: https://www.nadis.org.uk/disease-a-z/cattle/managing-heat-stress-in-dairy-cows/.

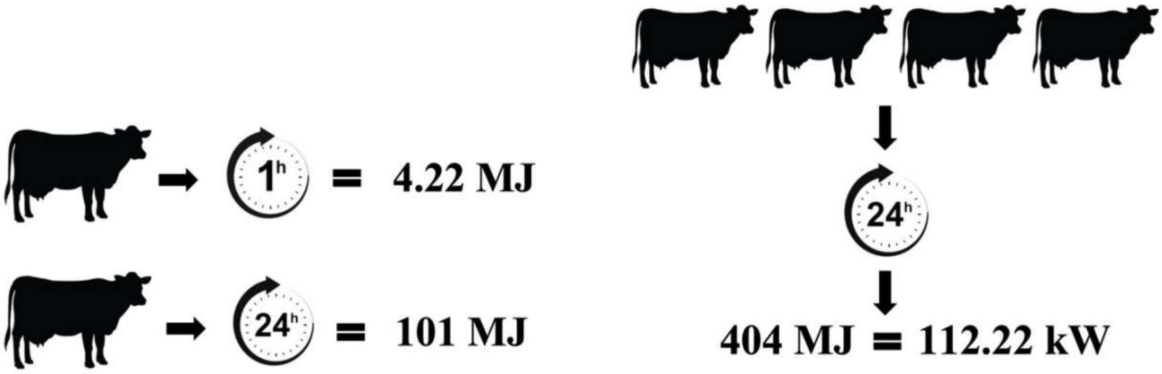


Fig. 180 Heat emission of cows for 1h and 1 day

Heat is constantly produced by metabolic activities in the human body and transferred with the environment and among internal organs via conduction, convection, evaporation, and radiation. The heat created by the inner body tissues flows to the vasodilated skin surface capillaries, and the temperature difference between the limbs and the surrounding air causes heat transmission, primarily through radiation. Radiation is the most significant form of heat loss, accounting for roughly 60% of total heat loss. Core body tissues lose heat by radiation by transferring heat through subcutaneous blood vessels, which emit infrared rays from the skin surface. The second main form of heat loss is evaporation, which accounts for around 22% of total heat loss. Water vaporization consumes heat and demands energy, allowing for heat loss. Even when the body is not sweating, this process occurs. [222] If we compare the energy output of cows, with those of humans, we can conclude that the resting human releases much less heat energy, with about 0.12 kW per hour. [223]

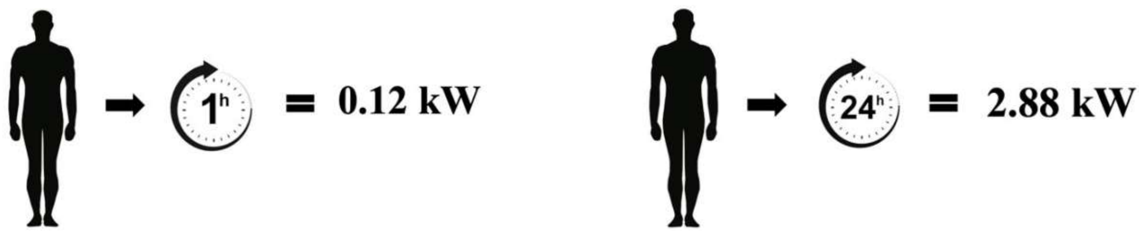


Fig. 181 Human emission of heat for 1h and 1 day

[222] Lindsey K. Koop and Prasanna Tad (2021) *Physiology, Heat Loss*. Available at: https://www.ncbi.nlm.nih.gov/books/NBK541107/.
[223] Matthew Stevens (2016) *Human Body Heat as a Source for Thermoelectric Energy Generation*. Stanford University. Available at: http://large.stanford.edu/courses/2016/ph240/stevens1/.

Intelligent machines in the film "The Matrix" use humans as a source of energy by harvesting their thermal energy and converting it to electricity. In the film, the collected energy is sufficient to power the post-apocalyptic machine world as well as a massive simulation that convinces humans that it is still in the late twentieth century. Although, obviously the cattle and human energy is not sufficient to power the whole planet, it has however, quite a high impact in heating buildings.

To control the temperature, humidity and air quality in kullas, windows have traditionally been the only way to get fresh air inside, and they are still the only approach used nowadays. Apart from building surveys, three similar interviews were conducted to three owners of the case study kullas in Dranoc, Valbona and Vuthaj to gain more insight into the methods and means of heating before and presently. And the results are presented below. The interviews contained about ten open-ended questions and were conducted and audio-recorded live.

14.1.1. KULLA OF ISUF MAZREKAJ, DRANOC

During the interview with Isuf Mazrekaj, the owner of the Kulla in Dranoc, holding his name conducted on the 29th of July 2020 in Dranoc, it was understood that the kulla is used as Bed and Breakfast for tourists, whereas the family uses it only when they have guests or feasts. The building is heated with wood-burning stoves only when there are guests (during 2019 because of Covid-19, there were only four guests throughout the whole year), since it used as a bed and breakfast only. Each room has its own chimney, and when needed the stoves can be installed there. During winter, Oda is always heated, whereas other rooms are heated with electric heaters only when there are guests. Oda is heated from mid-November until March, from 18:00 until 23:00, whereas if there are guests, then all living and sleeping environments are heated even during the daytime. The family spends about 7 m^3 of wood for heating this building; and they use beech wood, as according to the owner it has good lighting properties. However, the provided heating is not enough as it is lost through draughts. According to the owner, when the cattle was removed from the barn about 4 years ago, it directly affected in lowing the temperatures indoors and increasing the need for more heating. As far as the ventilation is concerned, during the hot seasons, the windows are always left open, whereas during the cold seasons they are opened only when needed.

14.1.2. KULLA OF SELIMAJ FAMILY, VALBONA

During the interview with Kelmend Selimaj, the owner of the Kulla in Valbona, conducted on the 30th of October 2020 in Valbona, it was understood that the kulla is used as Bed and Breakfast for tourists. The building is occupied about seven months during the year by guests and family, the latter use the kitchen and storage place. The building is heated with wood-burning stoves and electric heaters, only the guest rooms and kitchen. Each room has its own chimney, and when needed the stoves can be installed there, but more often electric heaters are used. The building is heated during cold seasons, usually from November to Mid-April, for approximately 12 hours, from 06:00 in the morning until late afternoon. The family spends about 8 m^3 of beech wood for heating the building. However, the provided heating is not enough as it is lost through draughts. According to the owner, when the cattle was removed from the barn, it directly affected in lowing the temperatures indoors and increasing the need for more heating. As far as the ventilation is concerned, during the hot seasons, the windows are always left open, whereas during the cold seasons they are opened only when needed.

14.1.3. KULLA OF DELI GJONBALAJ, VUTHAJ

During the interview with the owners of the Kulla of Deli Sadri Gjonbalaj, conducted on the 06th of June 2021 in Vuthaj, it was understood that only 1/3 of the building is used by the family, whereas the rest is abandoned. The building is heated with wood-burning stoves. The building used to be heated with fireplaces and iron stoves until 1999. The building is heated during cold seasons, usually from mid-October to Mid-May, from 06:00 o'clock in the morning until late afternoon. The family spends about 15 m^3 of beech wood for heating the building. However, the provided heating is not enough as it is lost through draughts. According to the owner, when the cattle was removed from the barn during 1993-1994 with the sanitation activism, it directly affected in lowing the temperatures indoors and increasing the need for more heating. As far as the ventilation is concerned, during the hot seasons, the windows are always left open, whereas during the cold seasons they are opened only when needed.

15. BUILDING DEFECTS AND PATHOLOGY

According to visual surveying of case study kullas, it was understood that apart from the Kulla of Deli Gjonbalaj in Vuthaj, the other kullas are in a good condition, despite some minor building defects. However, the main problem of these buildings is the inappropriate interventions by owners, which is especially obvious in the Kulla of Selimaj family in Valbona. These interventions with "modern materials" affect not only the building structure by potentially causing damage to it in the future, but they also affect the building authenticity. On the other hand, the Kulla of Isuf Mazrekaj in Dranoc has preserved its authenticity the most (apart from enlarged windows during the Young Turks period, and some minor interventions by the owners). It has also undergone sporadic restoration and adaptive reuse processes, and as such it is in a good condition. The subchapters below present the defects and pathology of the above mentioned kullas, as well as their history of interventions. The analysis of this point is a crucial part towards achieving a full thermal comfort upgrade.

15.1. KULLA OF ISUF MAZREKAJ, DRANOC

The Kulla of Isuf Mazrekaj, together with other kullas in the Mazrekaj neighborhood were restored from the organization CHwB Kosovo, since 2001. The latest project on this kulla was in autumn 2017, which focused on analyzing the challenges of adaptive reuse in the local context. Professionals and students of different fields along with the community gathered, analyzed and proposed interventions in this building. The resourceful group worked for twelve days at site and adapted the kulla into the guesthouse. The intervention focus lay on the improvement of the environmental performance of the kulla including the adaption of its interior and yard, and the introduction of the concept of slow food and storytelling. These sporadic interventions have drastically improved the condition of this building, and as such nowadays it is in a good state and is being used as a bed and breakfast from locals, but especially international tourists. The only area that needs treatment, is the ground floor, which used to be a barn until recently. The owner wishes to convert this space into a small dining area for the tourists who visit the kulla.

Fig. 182 The view of the kulla of Isuf Mazrekaj and its setting, 2021

Fig. 183 Left: Oda e burrave, 2021, right: Divanhane, 2021

Fig. 184 Left: Bedroom, 2021, right: Ground floor, former barn, 2021

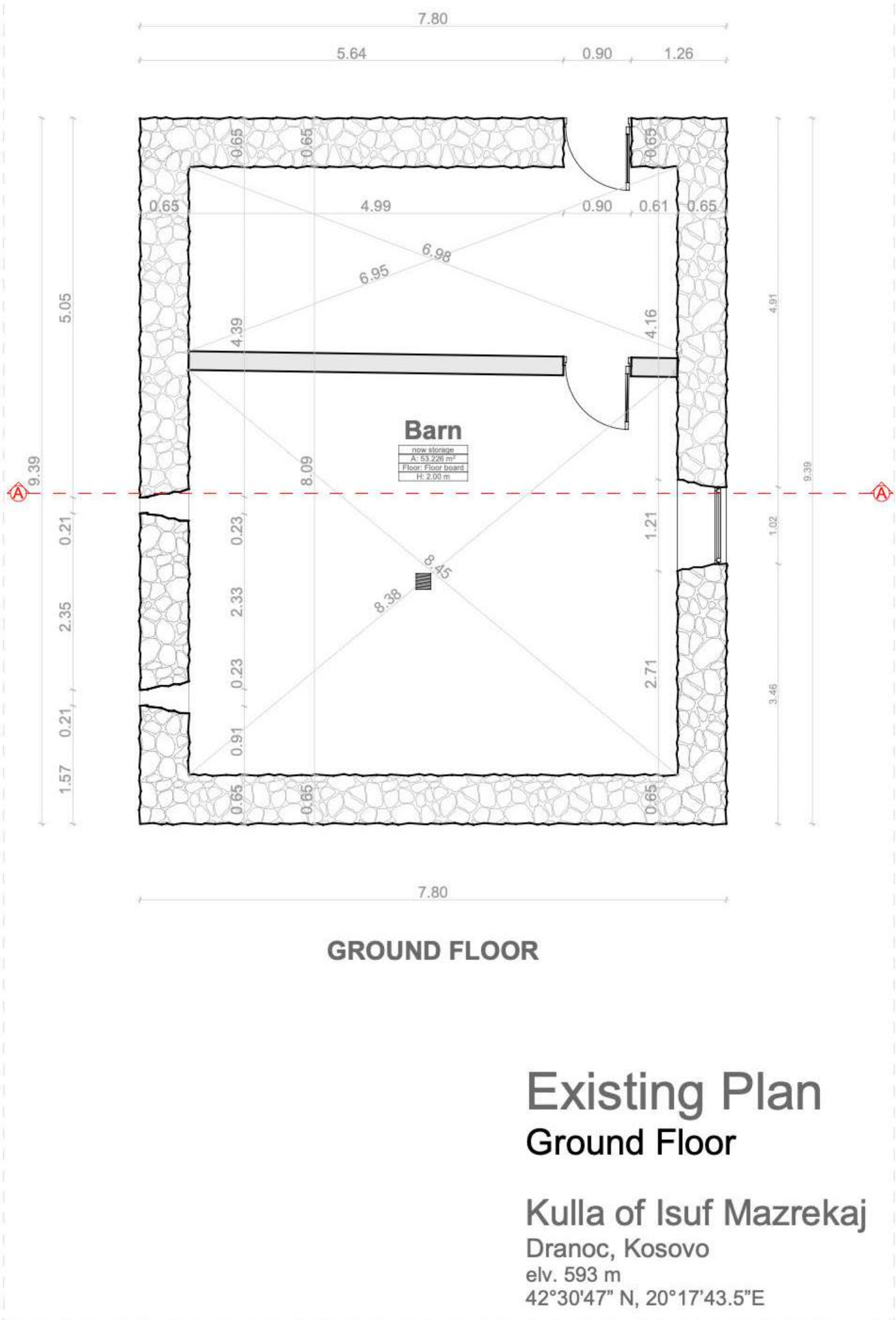


Fig. 185 The ground floor of the building, former barn- now storage

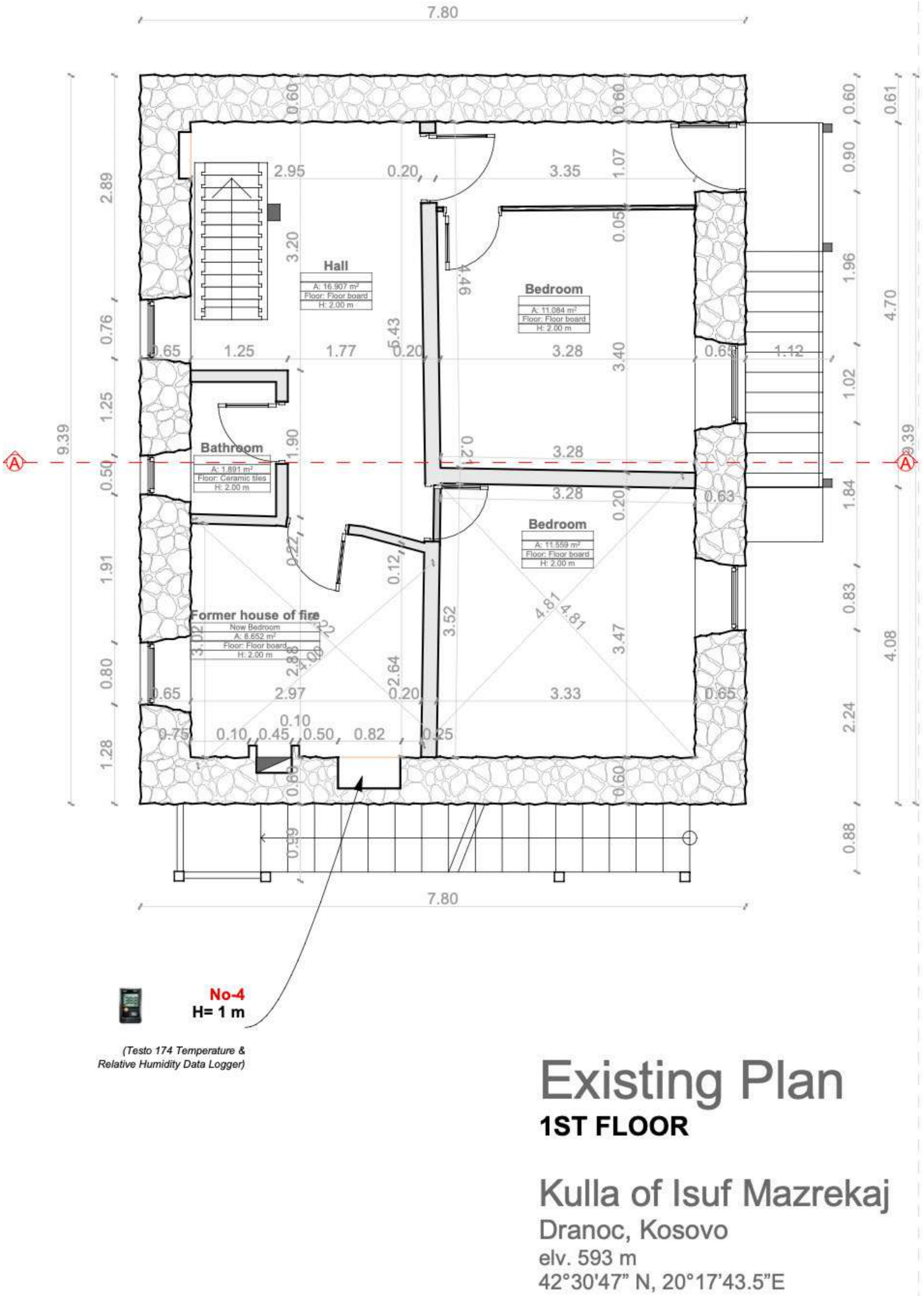


Fig. 186 The first floor of the building

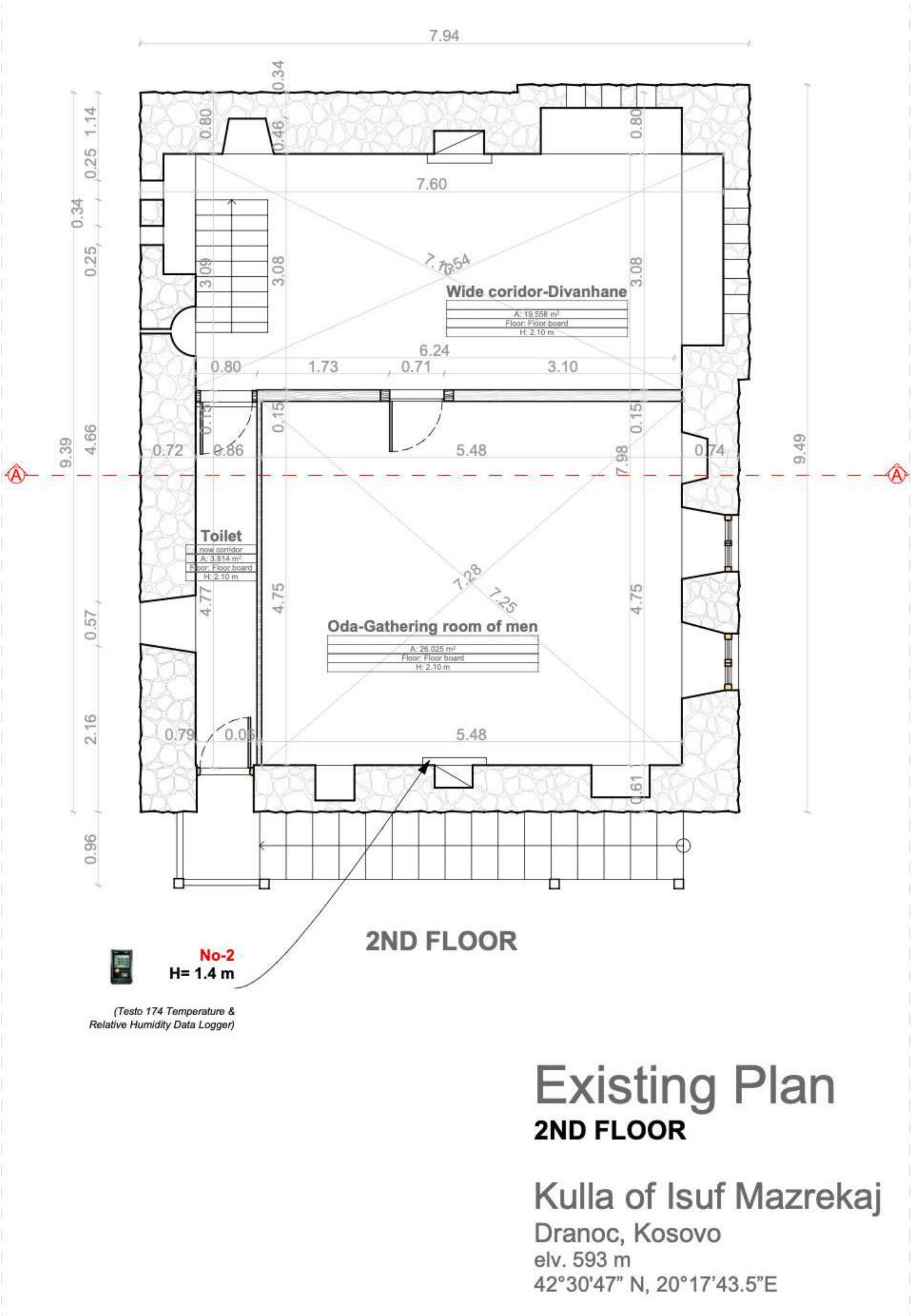
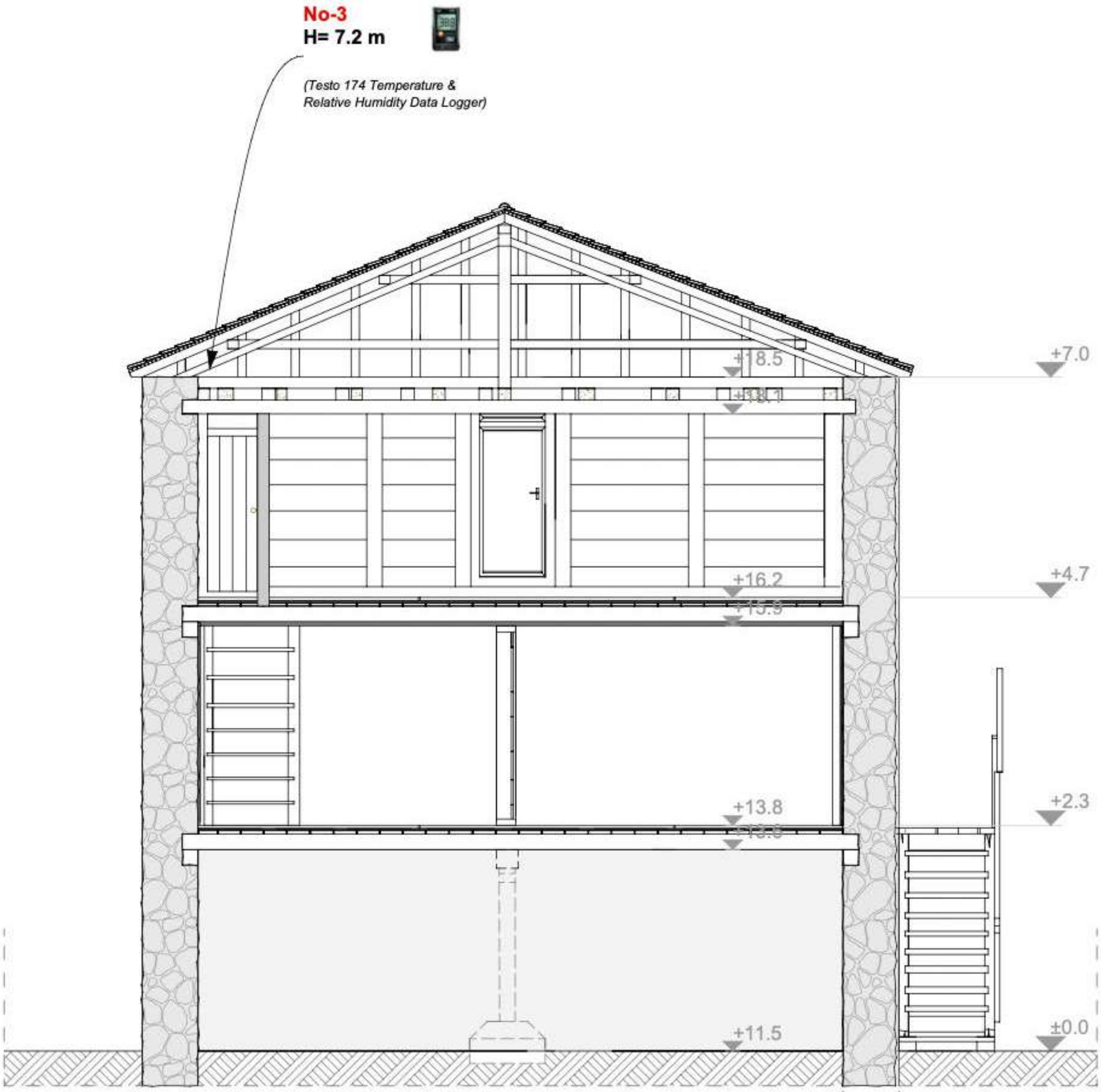


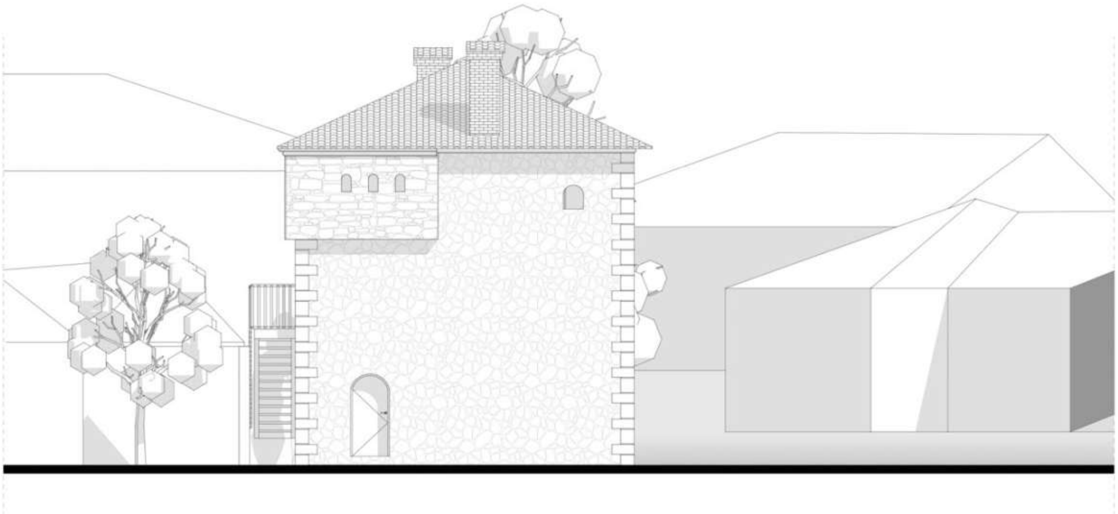
Fig. 187 The second floor of the building



Existing Plan
SECTION A-A

Kulla of Isuf Mazrekaj
Dranoc, Kosovo
elv. 593 m
42°30'47" N, 20°17'43.5"E

Fig. 188 The section of the building

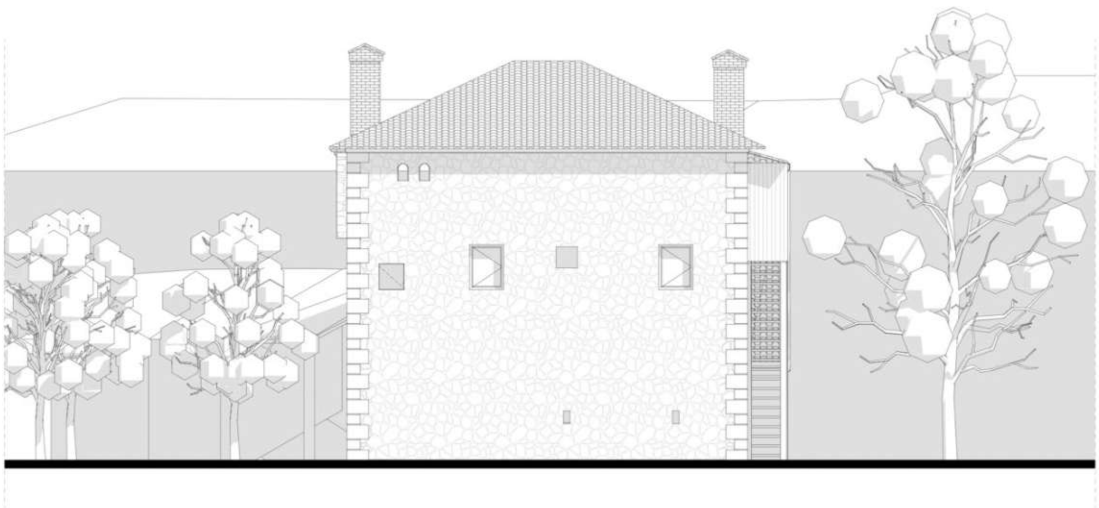


Existing condition

North- East Facade

Kulla of Isuf Mazrekaj
Dranoc, Kosovo
elv. 593 m
42°30'47" N, 20°17'43.5"E

Fig. 189 The North-East façade of the building



Existing condition

North- West Facade

Kulla of Isuf Mazrekaj
Dranoc, Kosovo
elv. 593 m
42°30'47" N, 20°17'43.5"E

Fig. 190 The North-West façade of the building

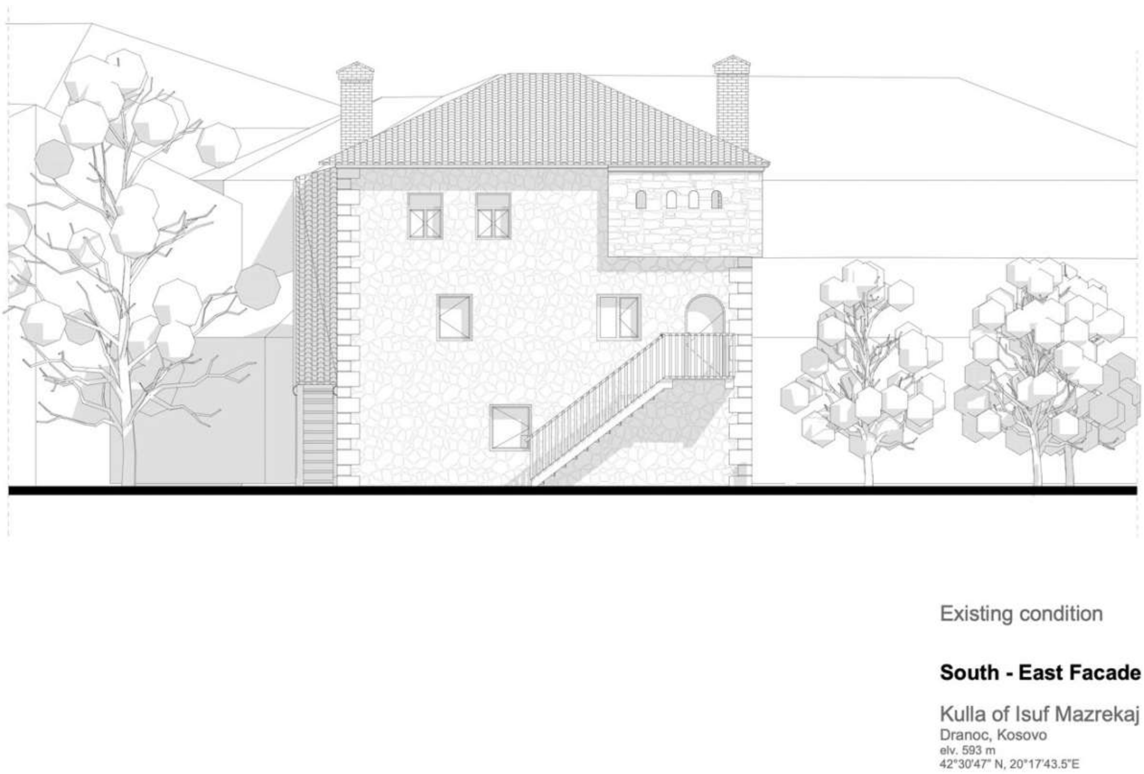


Fig. 191 The North-West façade of the building

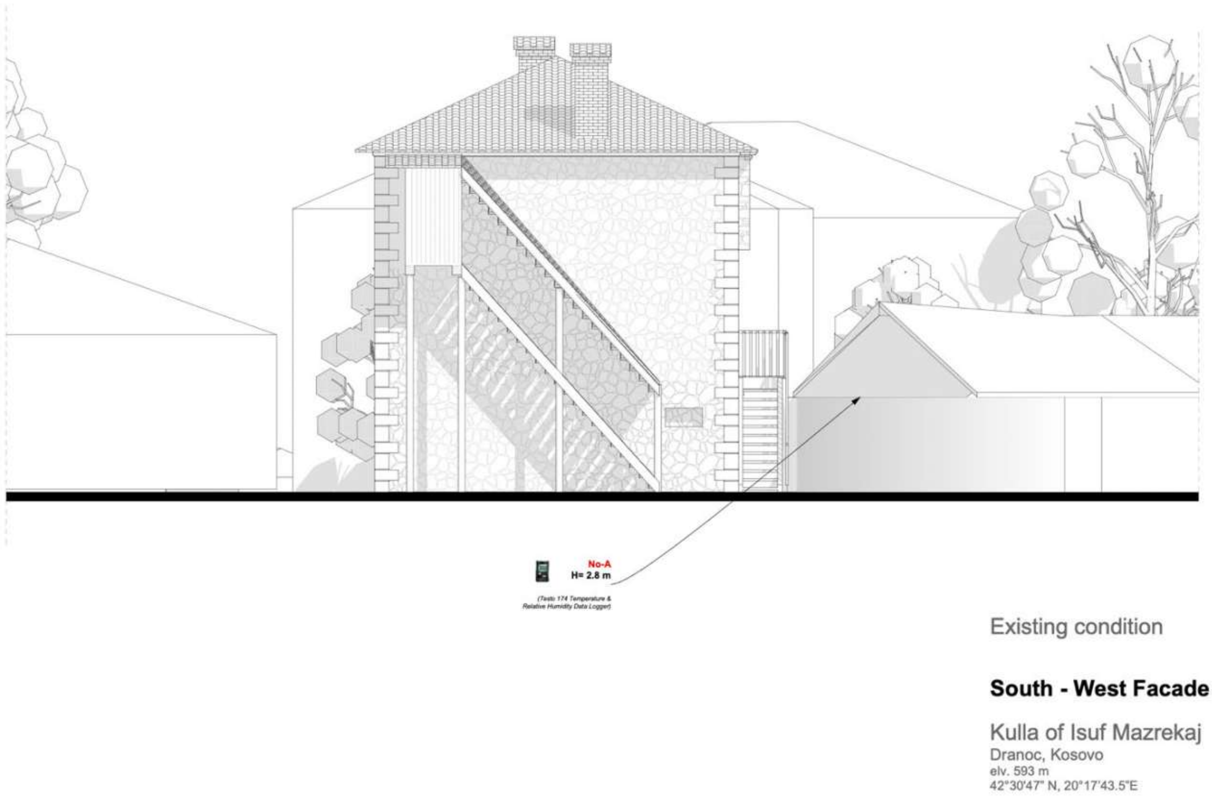


Fig. 192 The North-West façade of the building

15.2. KULLA OF SELIMAJ FAMILY, VALBONA

Kulla of Selimaj family in Valbona, built in the 19th century (according to the owner) underwent various interventions by the owner, 80 years ago, when windows were first put in the roof. Afterwards, about 30 years ago the roof cover was changed from timber boards- *furde*, to aluminum sheet. Moreover, the owners have also enlarged the windows in the first floor, and opened new ones in the ground floor. In addition, the doors were totally changed as they used to have arches on top. Apart from these interventions, the owner stated that due to rising damp, he had also furnished the adobe and straw walls with new timber material. The kulla also underwent various other inappropriate interventions throughout the years, such as restoration of external walls with cement mortar, a new annex added to the original structure used for toilets, and new interior and exterior doors. The building was used as a residential house from the family until about 7 years ago, when it started to be used as a bed and breakfast for tourists.

Fig. 193 The Kulla of Selimaj family in Valbona, 2021

Fig. 194 Left: Bedroom in the first floor, 2021, right: Bedroom in the top floor, 2021

Fig. 195 Left: New annex added in the north facade, 2021, right: Rising damp in the west facade, 2021

Fig. 196 Left: A closed opening and a crack in south facade, 2021, right: Cement mortar and new windows, 2021

Fig. 197 Building defects and history of interventions in the ground floor of the building

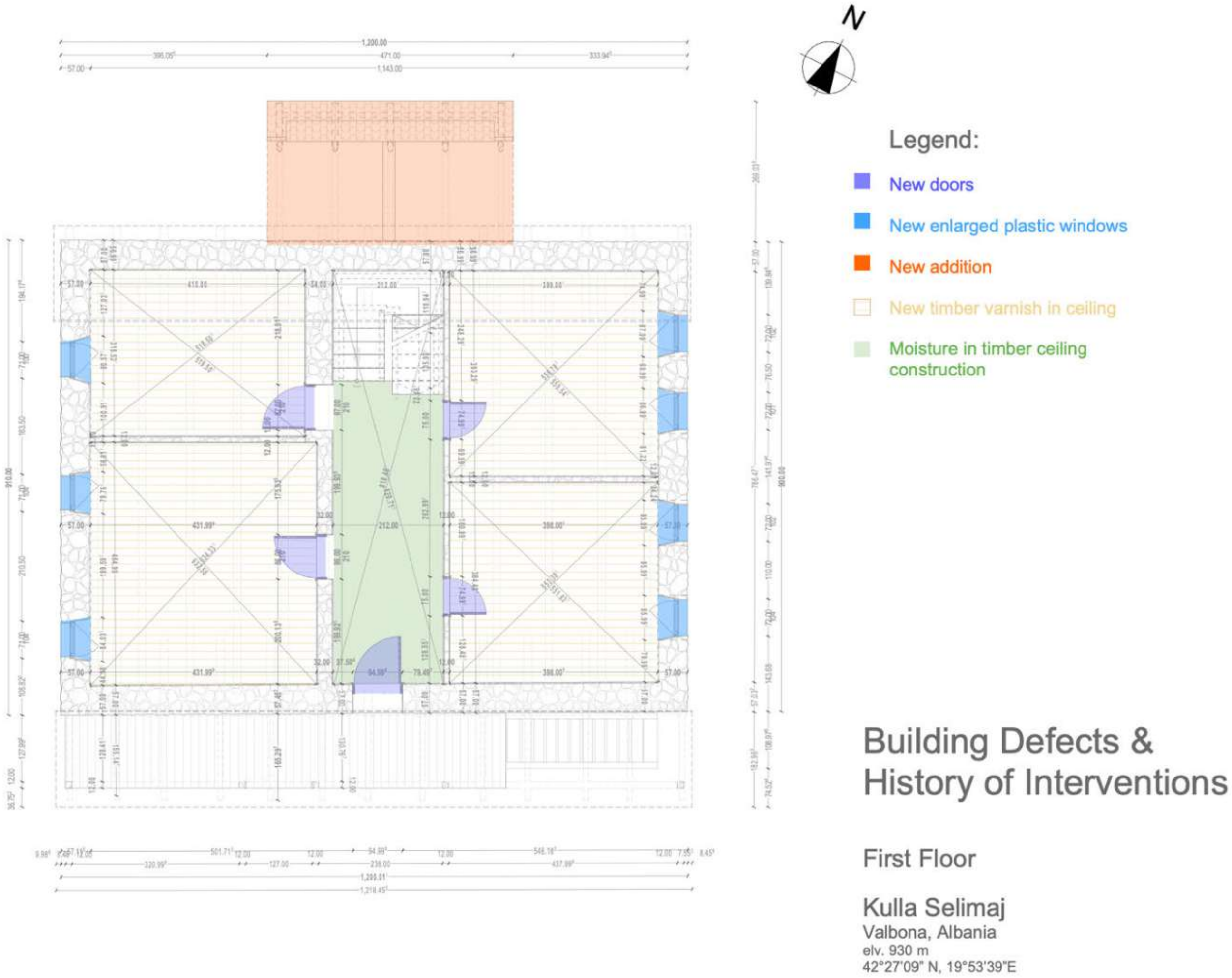


Fig. 198 Building defects and history of interventions in the first floor of the building

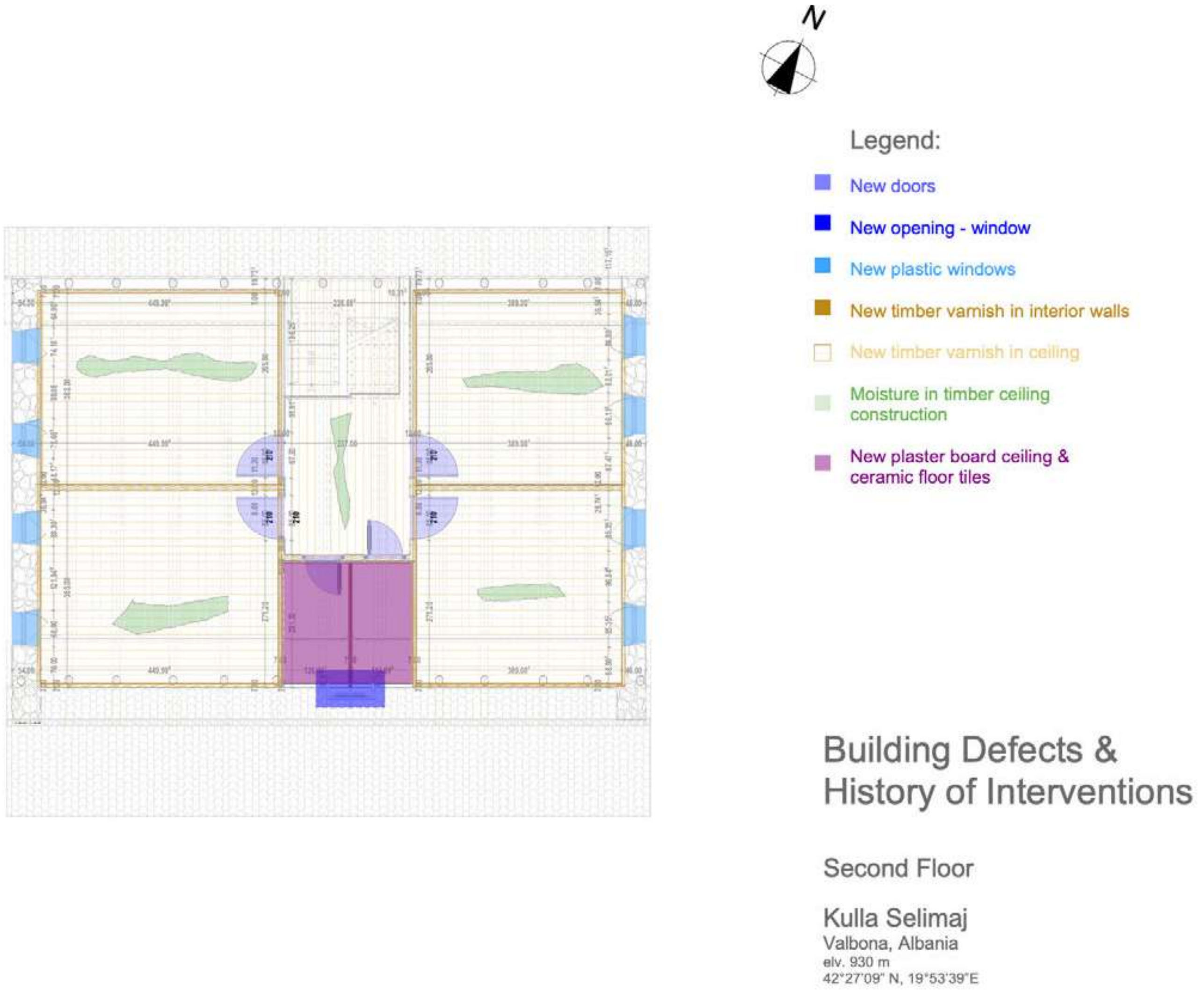


Fig. 199 Building defects and history of interventions in the second floor of the building

Fig. 200 Building defects and history of interventions in the East façade of the building

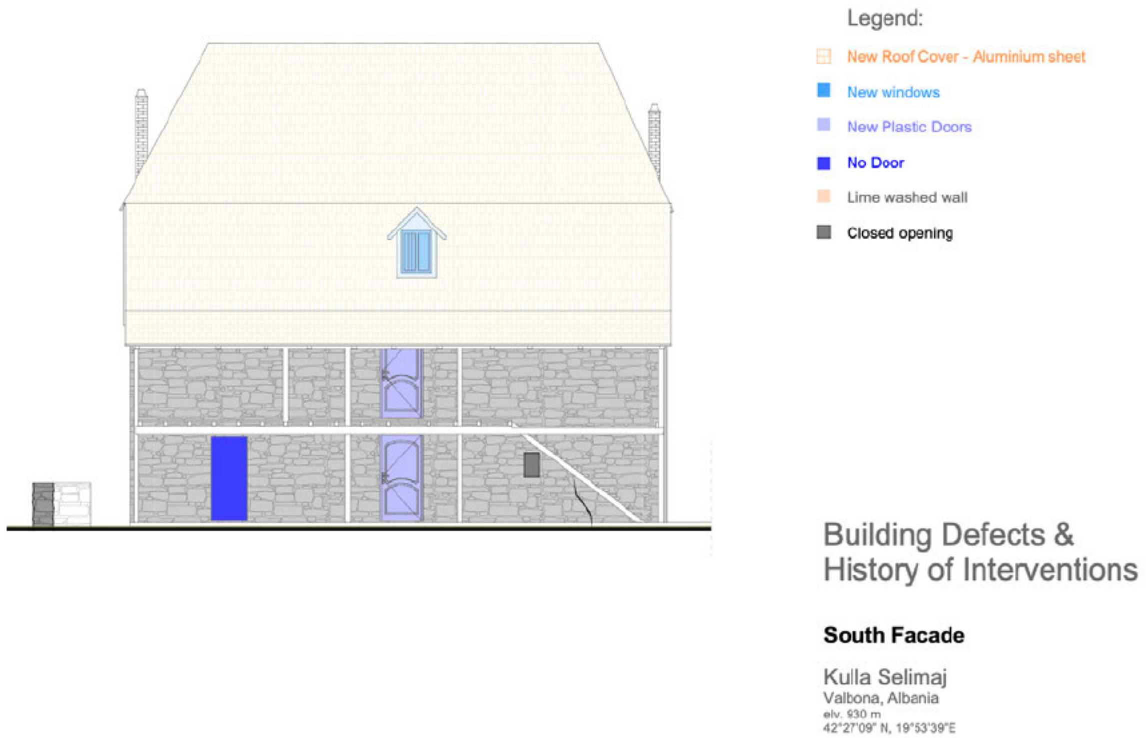


Fig. 201 Building defects and history of interventions in the South façade of the building

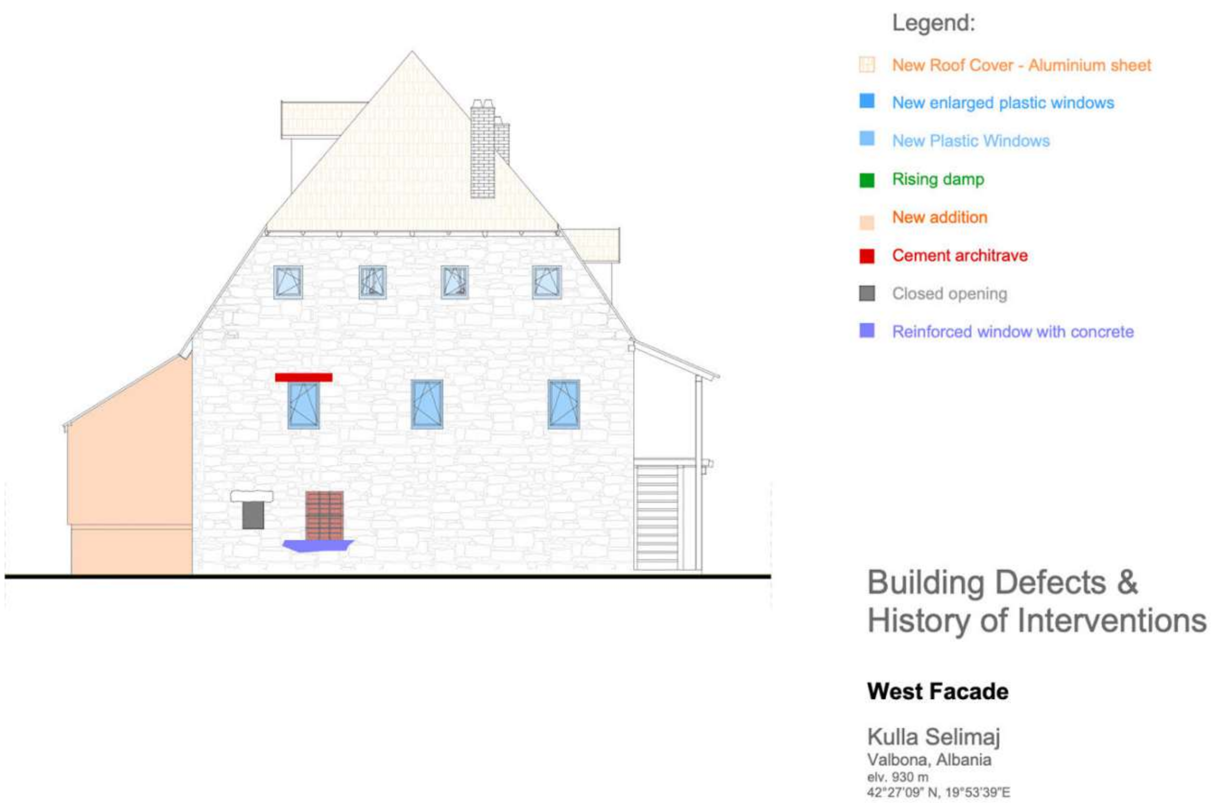


Fig. 202 Building defects and history of interventions in the West façade of the building

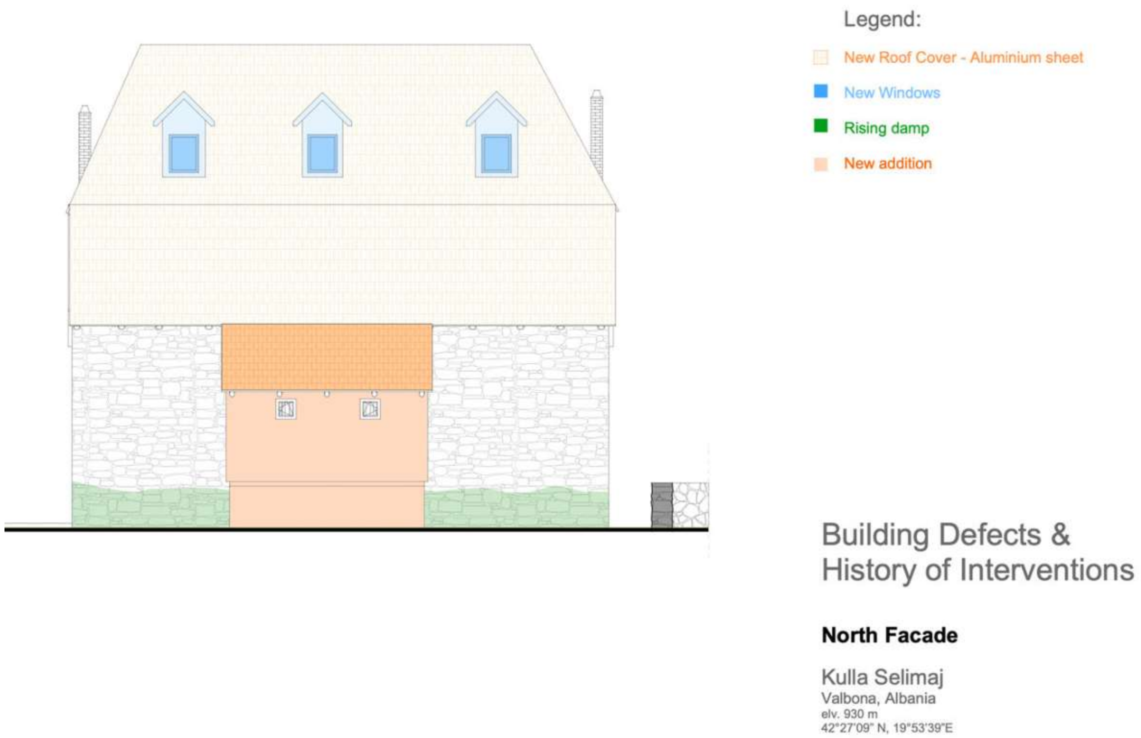
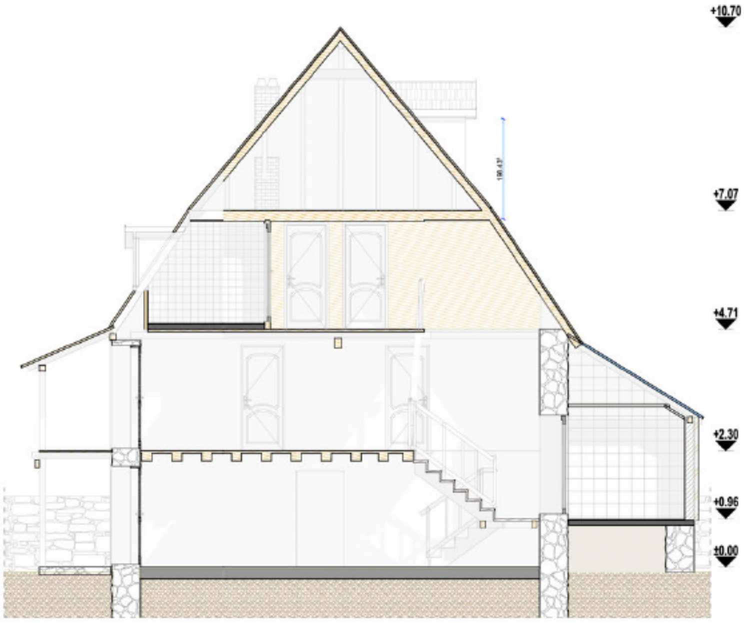


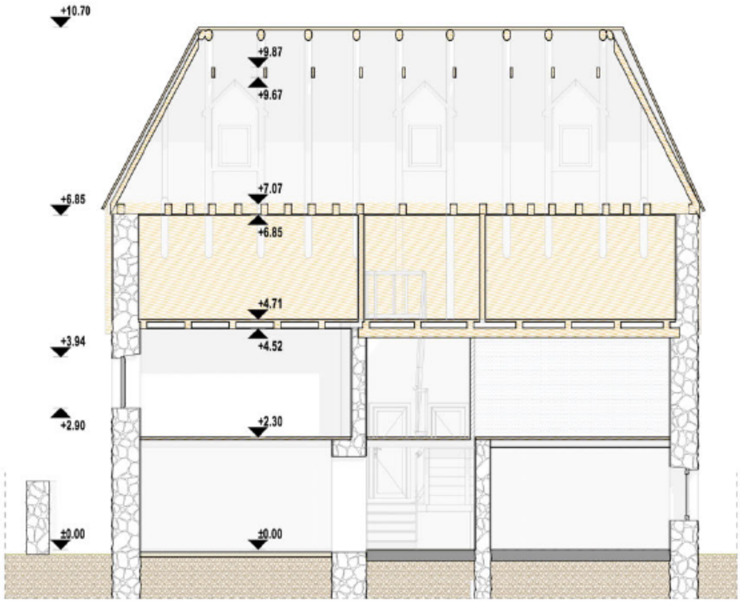
Fig. 203 Building defects and history of interventions in the North façade of the building



Existing Plan
Section 1-1

Kulla Selimaj
Valbona, Albania
elv. 930 m
42°27'09" N, 19°53'39"E

Fig. 204 Section 1-1 of the building



Existing Plan
Section 2-2

Kulla Selimaj
Valbona, Albania
elv. 930 m
42°27'09" N, 19°53'39"E

Fig. 205 Section 2-2 of the building

15.3. KULLA OF DELI GJONBALAJ, VUTHAJ

This old structure has undergone several rounds of interventions. This Kulla, according to the owner, was built in 1900 by Deli Sadria of the Gjonbalaj family. The building was burned down three times, in 1903, 1906, and 1912, and the family reconstructed/ repaired it. Because the family's needs altered as a result of these substantial disasters, the structure underwent a transformation as well. Because the original timber planks of the roof cover, known as *furde* or *shiklla*, were difficult to keep and the family lacked expertise of how to restore/maintain that material, they were replaced with aluminum sheet. Because of the need for extra light, the family enlarged most of the windows throughout time, closed some original windows and doors, and opened new ones. In addition, the building received some new partition walls made of modern material, and cement mortar was put to a dozen areas of the facades. Only 1/3 of the building is currently used by the family as a living space, with the remainder abandoned.

In terms of the building's condition, it was determined during the field survey that the structure is in poor condition. First, water has invaded the building due to the damaged new roof cover, causing damage to the ceiling. Then there are indicators of rising damp inside the structure due to the lack of guttering and French pipes. Finally, the structure has been substantially distorted by bulges developed in the external walls and constructive cracks forming in the building fabric as a result of multiple "inappropriate" transformations and a lack of maintenance and repair.

Fig. 206 The view of the Kulla of Deli Gjonbalaj in Vuthaj, 2021

Fig. 207 Left: The damaged roof cover of the building, 2021, right: Cement mortar and enlarged windows, 2021

Fig. 208 Left: Constructive cracks in the abandoned part, 2021, right: Damaged plaster and window, 2021

Fig. 209 Left: Damp in the ceiling of a used bedroom, 2021, right: Holes in the roof and baskets for water, 2021

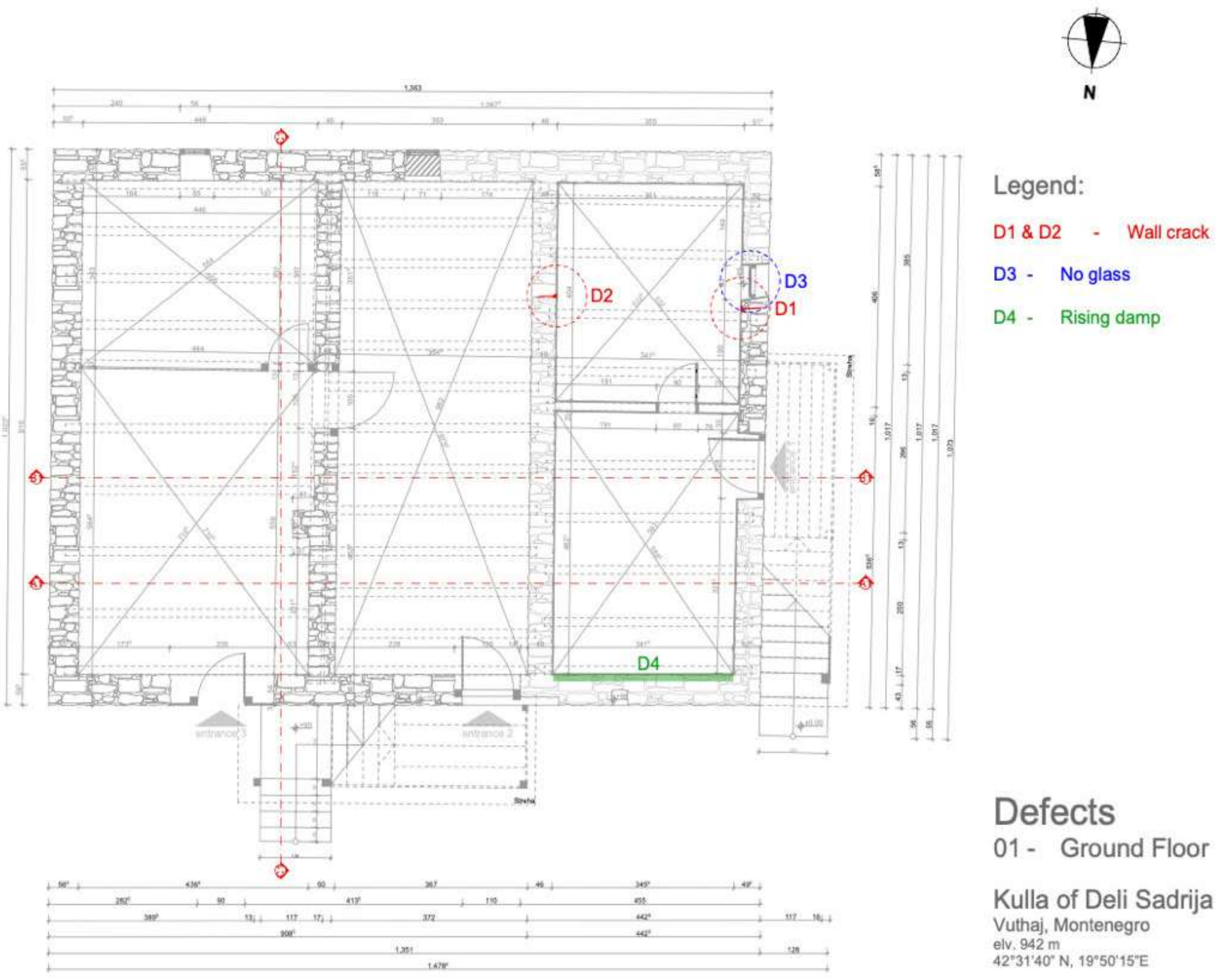


Fig. 210 Defects in the ground floor (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

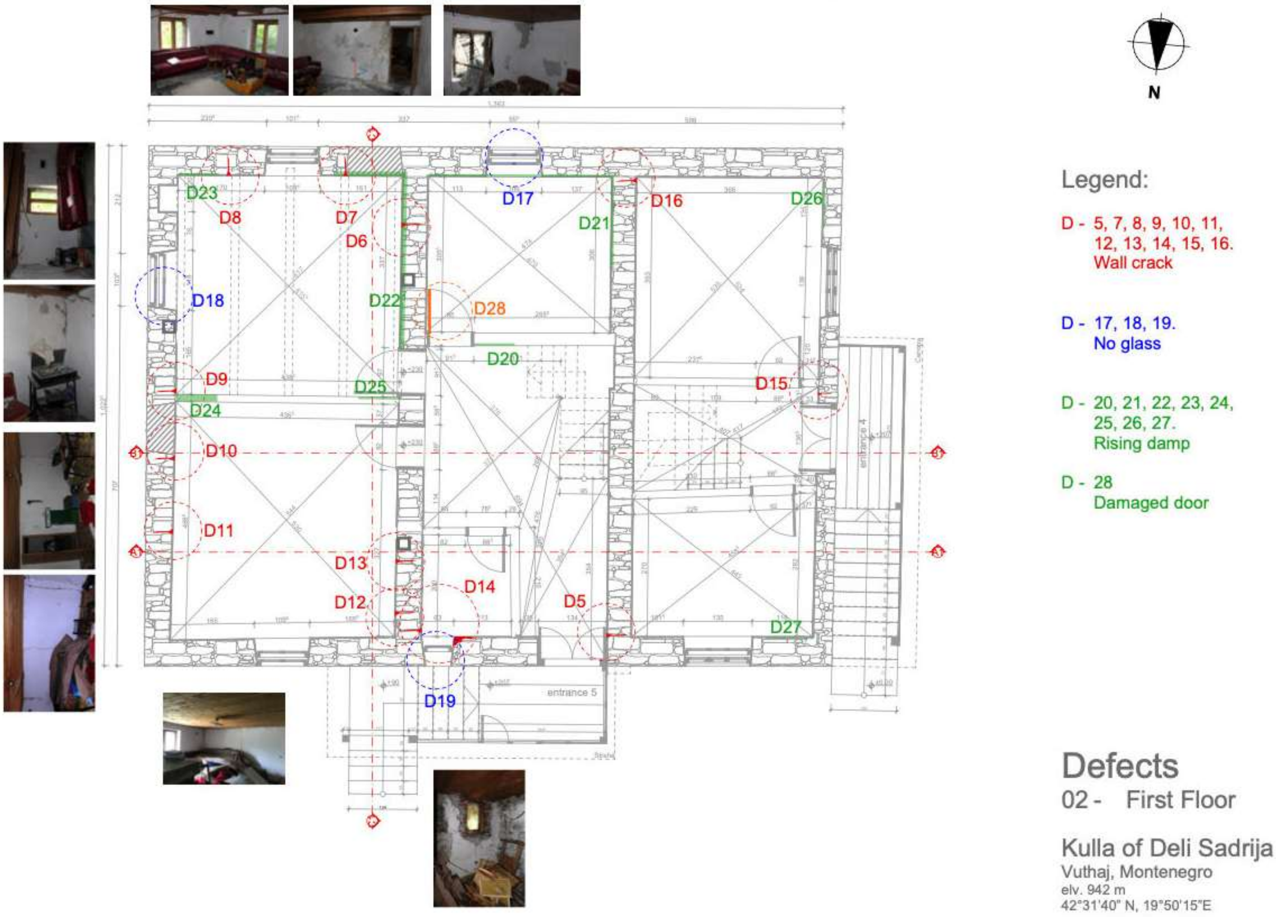


Fig. 211 Defects in the first floor (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

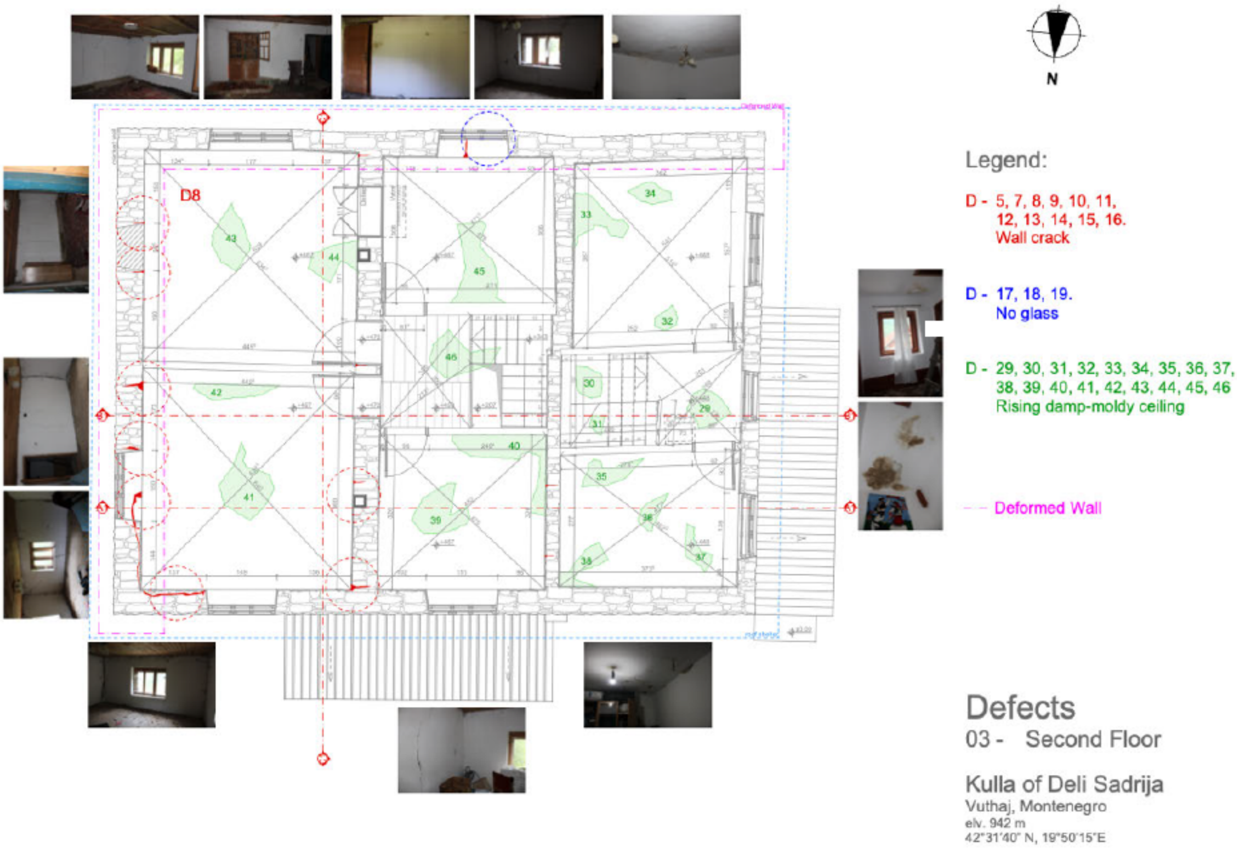


Fig. 212 Defects in the third floor (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

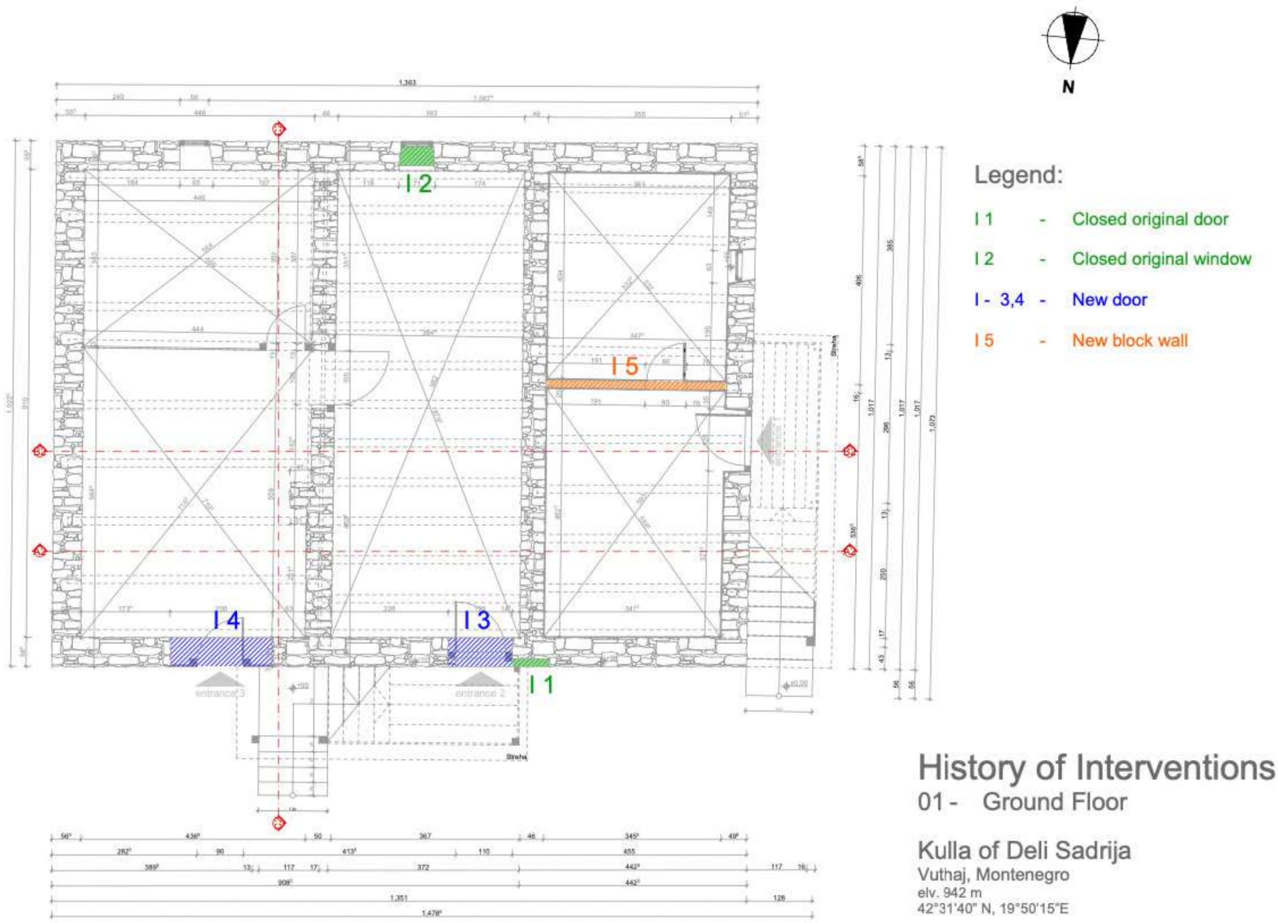


Fig. 213 History of interventions in the ground floor (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

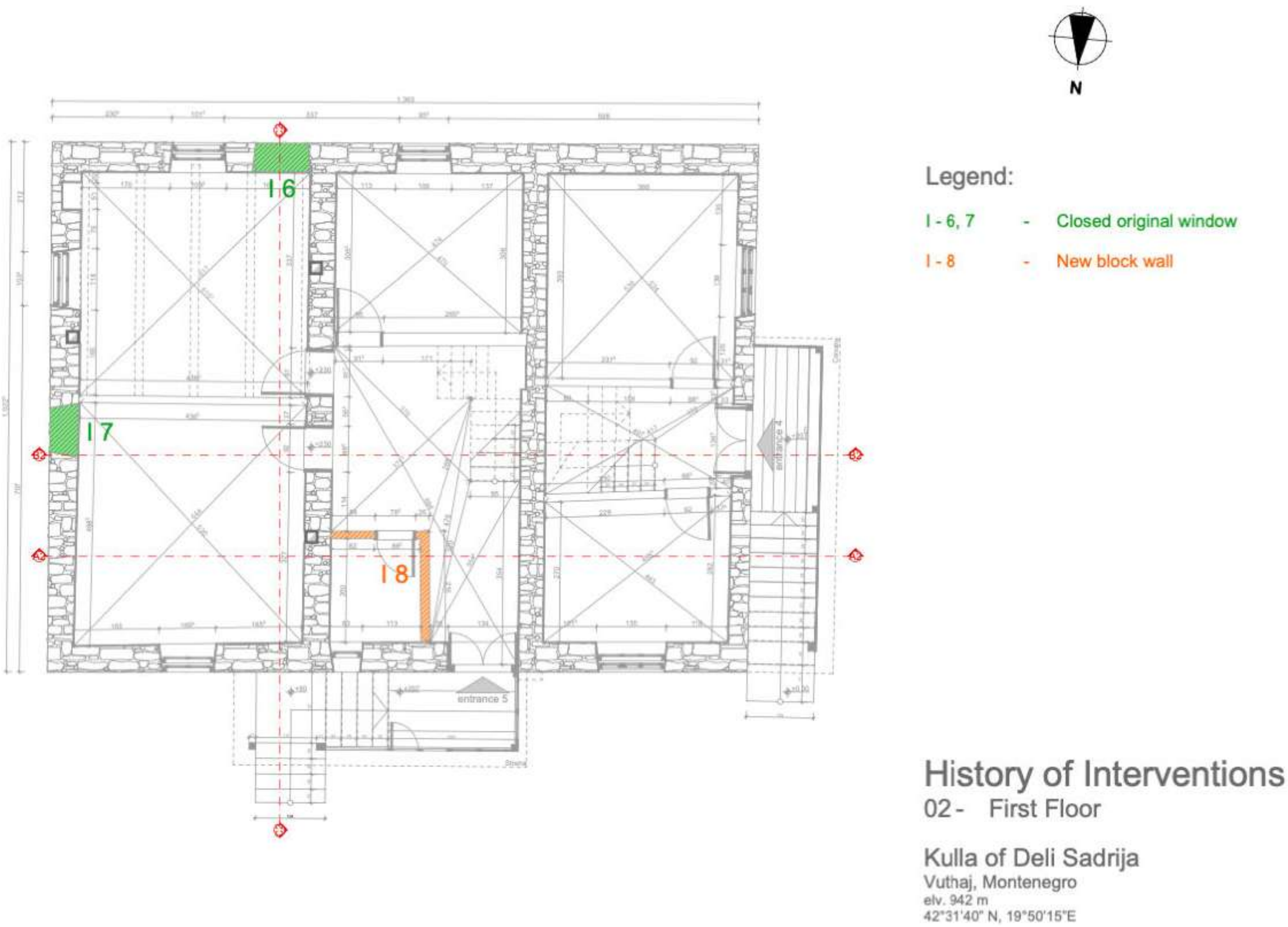


Fig. 214 History of interventions in the first floor (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

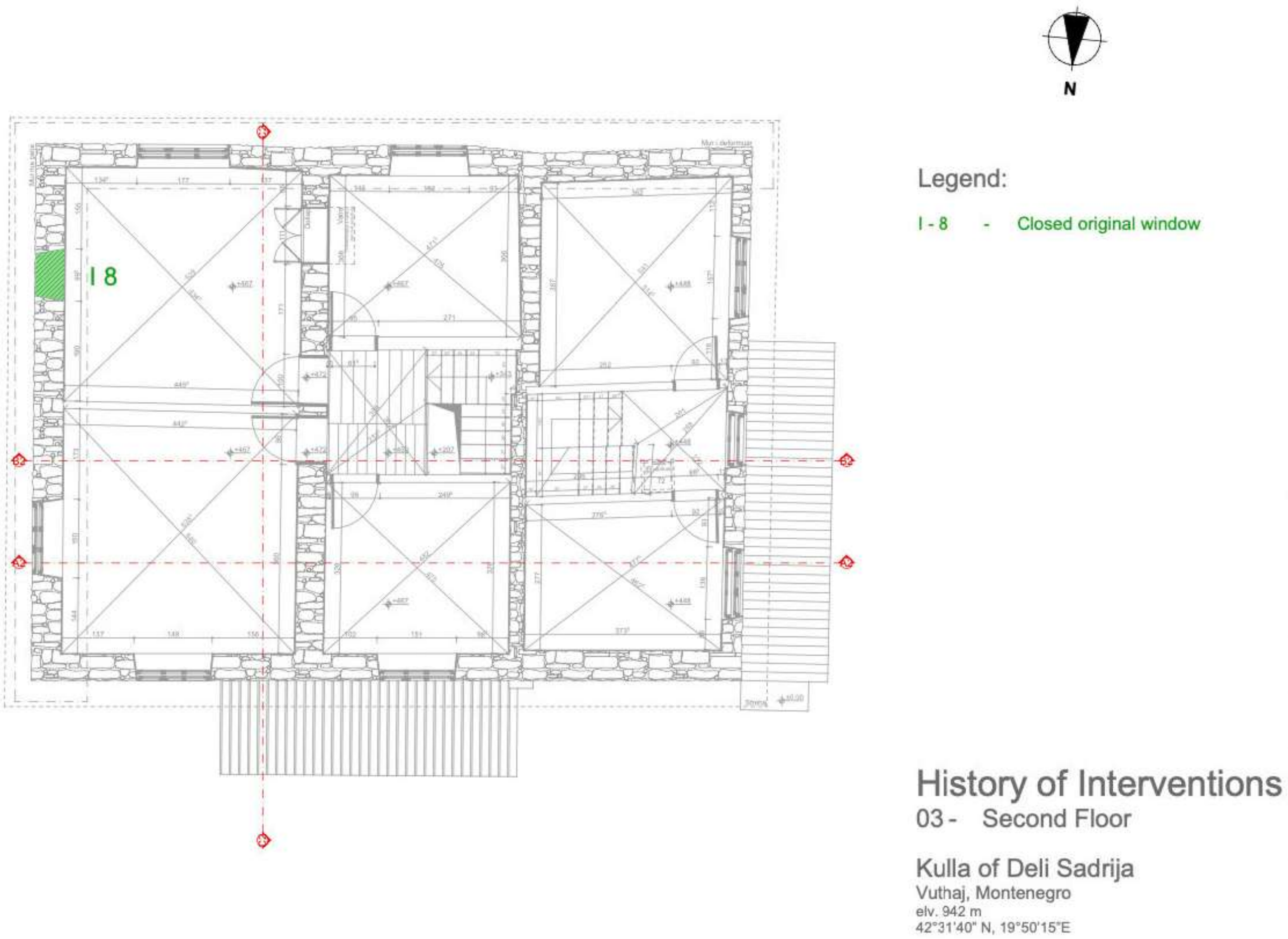


Fig. 215 History of interventions in the second floor (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

Fig. 216 Defects and history of interventions in section A-A (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

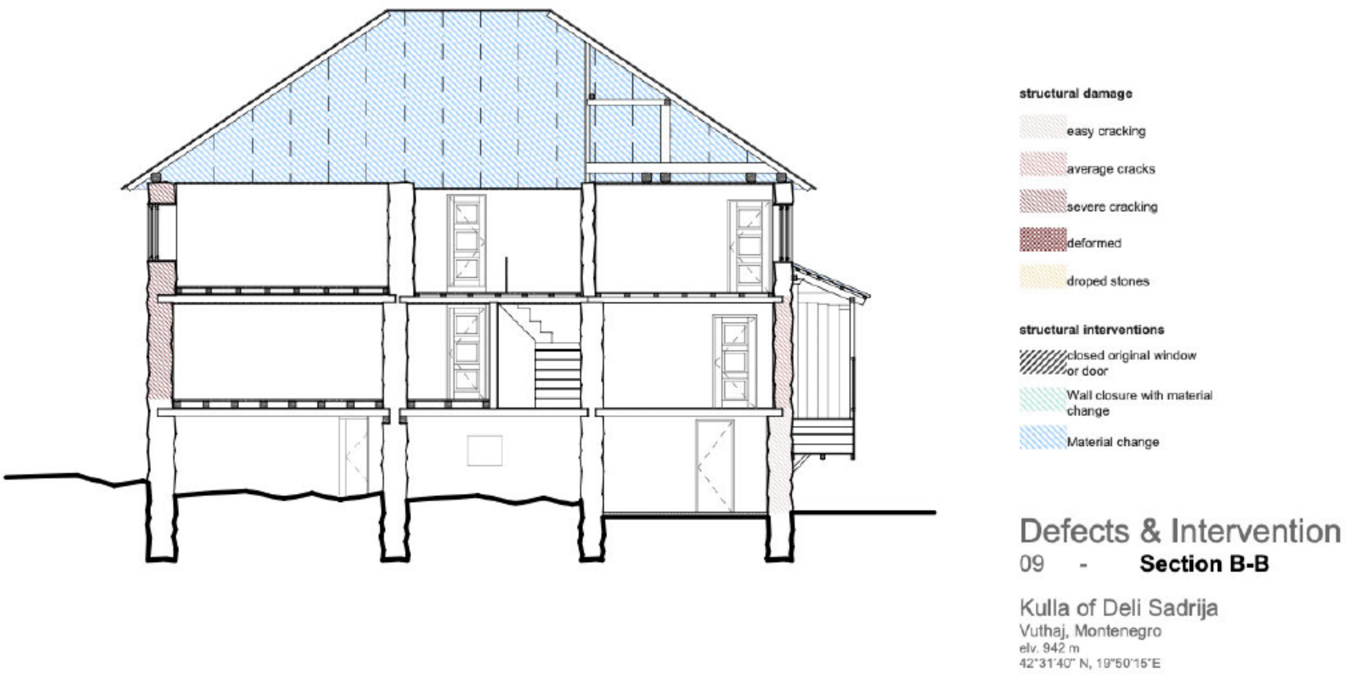


Fig. 217 Defects and history of interventions in section B-B (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

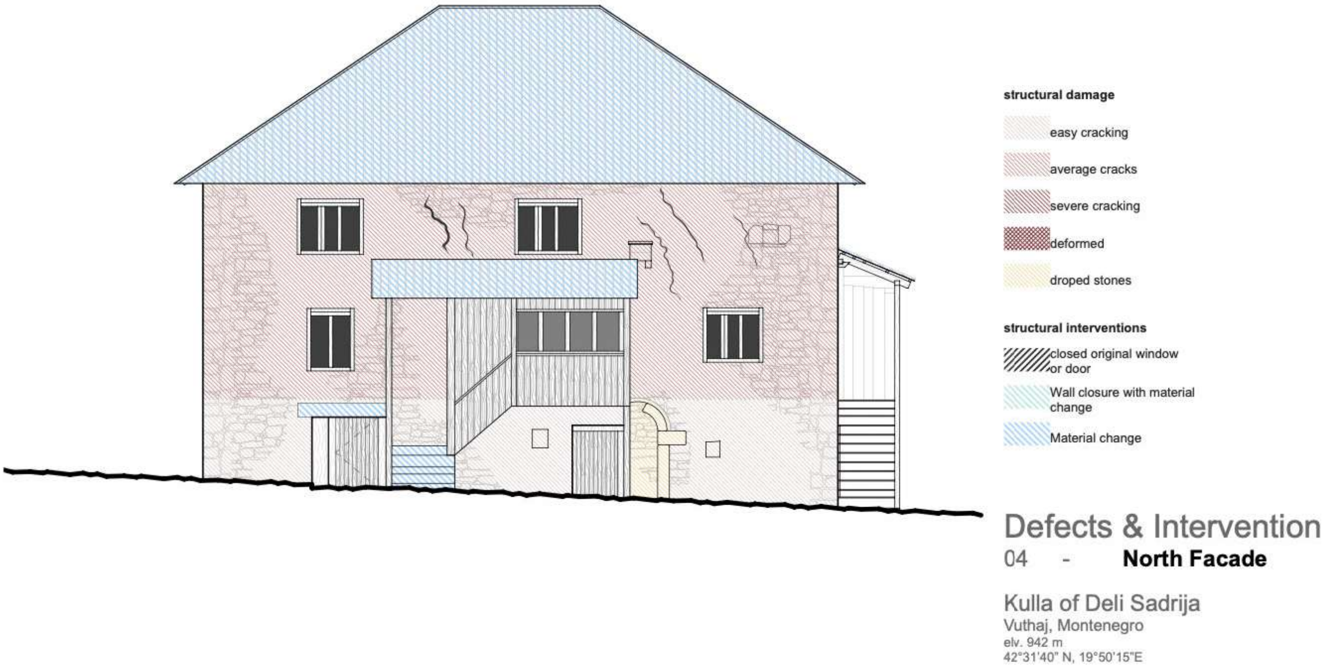


Fig. 218 Defects and history of interventions in the north façade (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

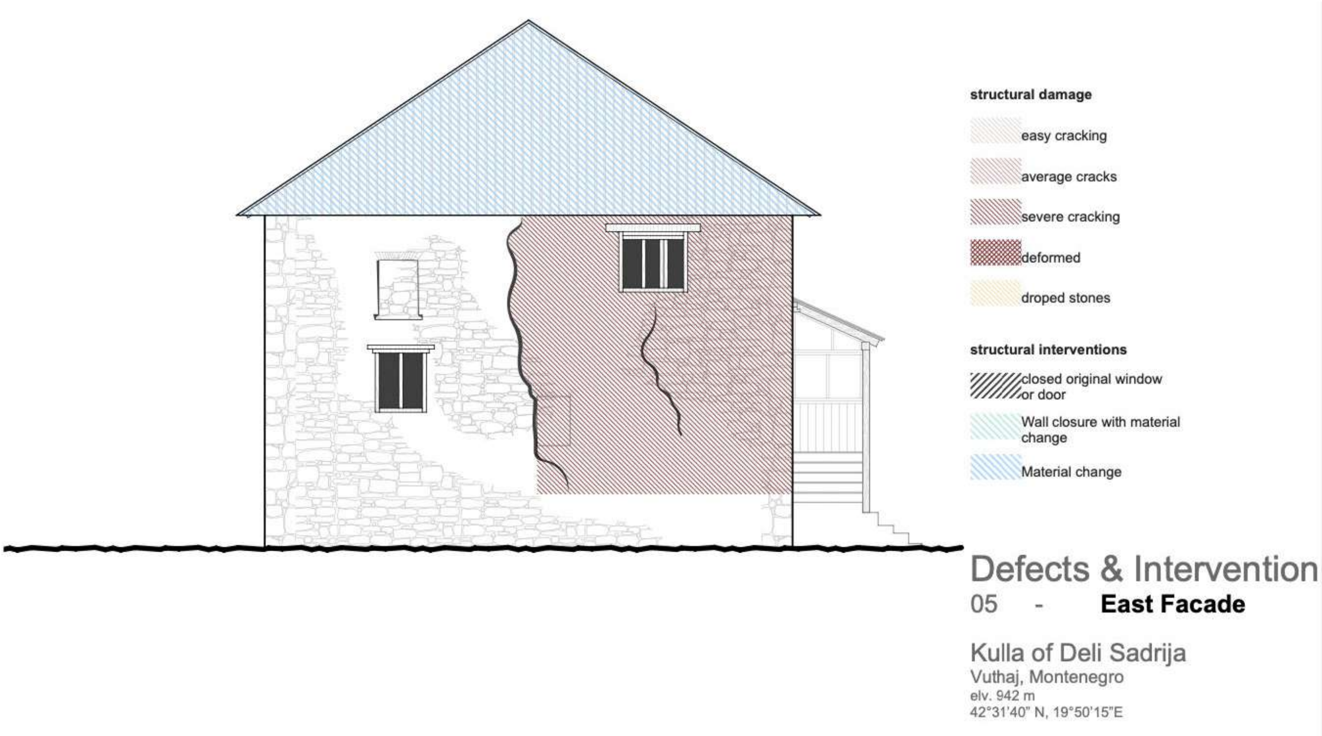


Fig. 219 Defects and history of interventions in the east façade (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

Fig. 220 Defects and history of interventions in the south façade (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

Fig. 221 Defects and history of interventions in the west façade (Drawings by Labeatët, 2021; Defects and history of interventions analysis and graphic presentation by the author)

PART IV

CONCLUSIONS AND RECOMMENDATIONS

PART IV

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16. CONCLUSIONS

Kullas are multidimensional heritage assets that symbolize the identity, traditions, and historical-social image of Albanian people in the cross-border region of Kosovo, North Albania, and Montenegro. Since their inception, kullas have not only served as fortified residential structures, but also as institutions that have organized different gatherings and assemblies aimed at resolving social and historic concerns that occurred during their existence. Kullas were places where people would have sporadic celebrations and mourning. They crystallize the daily lives of those who live there, who infused the spirit of place, which may still be seen in the remaining artifacts and structures, as well as in collective recollections and narratives. Kullas are still one of the most popular nostalgic stories, and their tales continue to be told. Kulla is inextricably related to history, which is the focal point of Albanian social life. These relics, which were over 200 years old, were a testament to historical occurrences in Albanian territory. Their emergence is inextricably related to the political environment in which they found themselves, which persisted throughout their existence. In terms of social structure, kullas arose from the living system derived from the Code of Conduct (Kanun of Lek Dukagjini). This means that these structures are not typical residential structures, since their purpose was determined by patriarchalism, hospitality, Albanian political situation, family structure, local material availability, and context adaptation.

Kulla's location was carefully chosen to provide a good view of the surroundings. Its primary purpose was to give refuge and protection for the Albanian families who resided there, but it also acted as a venue for hosting visitors (Albanians were well known for hospitality). As a result, these dwellings feature a compact structure, a high level of fortification, and small windows and shooting holes (Albanian: *frëngji*). They have a rectangular floor plan, usually 10 x 10 meters, with strong stone defended walls that reach 70-80 meters in thickness, sometimes even higher, and a height of 7-8 meters, with no or very small apertures or riffle loopholes. They are mostly three-story buildings; however four-story versions do occasionally emerge. The ground floor was solely used as a cattle barn, the first floor had bedrooms and the firehouse-kitchen, and the second floor had the so-called Guest Chamber (Albanian: *Oda e Burrave*), which served as a meeting place for men who discussed a variety of social and political issues of the time, thus giving it the status of an institution.

Kullas started to be erected at the end of the 17th century, during a period characterized by insecurity, upheaval, and constant fighting. The majority of the extant Kullas come from the 18th and 19th centuries, with a few built in the 20th century. Kullas were originally built for the family's safety, but they subsequently became a habit and even trendy. All wealthy families erected kullas because owning one signified respect and honor. The construction of kullas, on the other hand, was not exclusive to wealthy households. They were also constructed by middle-class families, owing to the villagers' willingness to assist one another with building and materials. Kullas were erected in practically all areas where natural circumstances existed, but primarily in the Region of Dukagjini, Has, and Gjakova Mountains (Alb: Malësia e Gjakovs), in western Macedonia, Montenegro, Mat, Lume, and Mirditë, and even in the vicinity of Vlora.

The construction of kullas took very little time because all of the building materials were given by the villagers and stored at the construction site for 8-10 months before they began, and the arrangement with the craftsmen was established over a year earlier. Kullas were constructed using local resources. Given the abundance of stones in the hilly areas of the cross-border region of Kosovo, Albania, and Montenegro, the structure of these buildings was always made of locally sourced stones. The majority of the wall is made up of round stones that were most likely obtained from surrounding riverbeds. Timber, mud, and bricks were also available locally for these structures. On the other hand, lime mortar was utilized as a stone binding medium as well as a plaster for interior walls. As per the builders of kullas, masters from Dibra were the most well-known for building these constructions in the Balkans. Decorations on the other hand, usually on timber, were usually crafted by locals.

In terms of volumetric appearance and layout, all kullas, regardless of where they are erected, are similar. To the untrained eye, they appear to be relatively similar, but when examined closely, each province has its own unique characteristics, particularly in terms of exterior architectural elements, functional design, and building materials, all of which were chosen based on what the region had to offer. The inner areas, as well as the outside architecture of kullas in various places, share typological characteristics. Variances in composition, functional scheme, construction style, and so on are likely to have arisen as a result of differences in way of life, economics, and circumstantial material found in the location.

The similarity of kulla building is related to the same way of life of Albanians in these territories, not only in terms of socio-cultural, but also in terms of economic characteristics. The Albanian family is structured as a large patriarchal family, which implies that at least three generations of blood relatives live in the same residence, meaning a family consisting of parents, their married sons, and their nephews. In a patriarchal society, the family is also characterised by an organized organization with emphasized rule and hierarchy, which in the case of Albanians is based on customary law known as "*Kanun (Code) of Lekë Dukagjini"*. The construction of Kulla as a residential building reflects this structuring and organizing of households. The pure and mostly intact rural environment of kullas reflects ancient economic life, which is largely preserved today. Albanian villagers continue to maintain agriculture and animals, despite the fact that kullas are no longer the fundamental socio-cultural and economic foundation. These relics, on the other hand, shape the rural fabric and are still the most important living artefacts.

Kullas are nearly always part of a larger architectural ensemble, rather than standing alone. This ensemble is a key component of rural landscape composition, and it changes depending on the tribe's location: plains or mountains, the family economy: agricultural or livestock, and the number of family members or families. This ensemble consists of a confined land area with a kulla in the center and ancillary facilities such as restrooms, agricultural spaces, and processing areas for agricultural and livestock goods surrounding it. The terrain and the property boundaries determine the shape of the architectural ensemble.

Despite their multifaceted values, Kullas have been subjected to a variety of degradations as a result of a variety of socio-political and economic reasons. However, a common issue that contributed to their disregard is that communities are less and less seeing kullas as their primary living place, as they do not meet modern necessities, and as a result, only low-income families "are stuck in kullas, in time and space." This is partly due to institutional apathy toward this type of cultural legacy, which has harmed community knowledge of the assets' importance. If we go deeper into the details of the contexts of Kosovo, Albania, and Montenegro, we can see that kullas have been targets of destruction from their construction and continue to be so today. Political situations and wars (the most recent Kosovo war of 1998-1999), uncontrolled buildings in their location, lack of institutional protection, lack of owner knowledge, natural aging process, and lack of maintenance were the main causes of their destruction.

Transformations that resulted in the loss of authenticity of kullas in the cross-border region began during the Ottoman period in the 19th century and continue to be one of the key reasons for their degradation now. With a very different socio-political context, these modifications now take place under the pretext of "building adaptation to current requirements," which has a negative impact on their authenticity and integrity. Moreover, if we concentrate on the institutional protection and administration of this type of cultural heritage, we can see that, despite their multiple values, only kullas in Kosovo (the majority of them) have been designated as monuments, whereas those in North Albania and the Plavë and Guci regions have yet to be mapped, researched, and protected by state institutions. Furthermore, kullas in the cross-border region have never been a target for institutional expenditures in terms of physical preservation, since their preference has always been to invest in the states' geographic capitals. All of the aforementioned factors have had an impact on the condition of kullas, some more than others, and have contributed to their current abandoned, neglected, and degraded state. These resourceful assets, however, are the most important cultural heritage sites in the Western Balkans, due to their regional significance and propensity to impart global values.

However, not only kullas but all historic buildings need to be conserved and adapted to the actual needs of the communities, in order to survive the new requirements and developments that are taking place every day and more. They need to fulfil at least the basic sustainable requirements of their users to continue to stand still and be in the larger picture of hamlets and cities.

Sustainability of historic buildings, notably thermal comfort upgrading, is being widely investigated throughout many integrated as well as individual initiatives, while being a relatively new topic in the field of cultural heritage. Furthermore, for the energy efficiency of historic buildings, developed countries have enacted directives, laws, policies, technical standards, and construction requirements. Many historic buildings have been sustainably upgraded and their lifespan has been extended by complementing the actual demands of communities in the name of these regulatory mandates and research programs.

However, in Kosovo, Albania, and Montenegro, there are no historic building legal requirements for sustainable upgrades or energy efficiency, no technical guidelines, and no substantial research programs in this subject. As a result, no such project has yet been undertaken in these areas. This creates a harsh atmosphere for the everyday usage of Albanian historic buildings in general, and fortified dwellings in particular, especially for living purposes, given that sustainability living necessities are not being met.

In terms of kullas' construction, builders from Dibra have always had sustainability in mind, including local materials, adaptation to the terrain, orientation to the sun, thermal mass, the use of minimal areas, and natural heating and ventilation. Furthermore, because the family household has traditionally used locally grown food as a result of the development of farms and cattle, the concept of "slow food" was incorporated into these structures a long time ago. If we compare the initial concept of sustainability and the current condition of these buildings, the results from the case studies analysis show us that in terms of sun exposure, most of exterior walls of kullas are in need of thermal insulation, since they have only few to no hours of sun exposure, due to the surrounding mountains and their setting. In terms of temperature analysis, the data show that the outdoor temperatures are characterized by high temperature peaks and large temperature fluctuations, whereas the interior temperatures are predominantly in a thermally very comfortable range of values. The relative humidity data readings show that the Kulla of Isuf Mazrekaj has accepted values for a historic building, since it is in the range of 40-65 %, whereas the Kulla of Selimaj family and that of Deli Gjonbalaj, during some periods have higher values of relative humidity in the interior, and as such may pose risk to the building structures. The outdoor RH in the three sites is characterized by high values and large fluctuations.

If we take into account the data of temperature and relative humidity analysis of the context from time and date, it can be understood that during all seasons, there are high fluctuations of temperature, whereas relative humidity is higher than accepted values for historic buildings during Autumn, in the three sites.
In a historic structure, the most essential climatic characteristic is relative humidity (RH), which should ideally be between 40 and 65 percent. When the relative humidity (RH) is too low, organic materials might crack and furniture joints can loosen. Mold growth, dry rot, and insect infestation are all more likely when RH is too high.

In terms of case study physical condition, it can be said that the Kulla of Isuf Mazrekaj in Dranoc is in good condition, having been restored multiple times and being maintained by the family. The kulla of Deli Gjonbalaj in Vuthaj, on the other hand, is in poor physical condition because it has only been partially used and as a result has not been adequately maintained. Finally, the Kulla of the Selimaj family in Valbona has been subjected to a number of inappropriate interventions, but is physically sound.

To attain kullas' thermal comfort, their structure must first be consolidated with appropriate traditional materials and techniques. Following that, their temperature and relative humidity levels must be monitored and, as a result, optimized through appropriate actions. Finally, the building structures must optimize the absence of sunlight, which has a direct impact on their long-term viability.

Finally, not just architecturally, but also environmentally, socially, and culturally, the sustainable upgrade of kullas can have a direct and indirect impact on the up-growth of their larger setting. The upgrade to the small kulla clustering can be part of a larger development and promotion cycle. This means that once these assets are livable and/or profitable (i.e., bed and breakfast, slow food restaurants, etc.), they will reclaim the historic and cultural image of the places in which they are located. Because they will have a location to live and work, this will be a beginning point for locals who migrated and abandoned their origin. Furthermore, this will serve as a solid platform for regional (i.e., Western Kosovo) as well as cluster-based cultural and natural tourist development (in the whole cross-border region, with the main topic of Kullas). The serial world heritage nomination of kullas in Kosovo, Albania, and Montenegro as either transnational or transboundary sites, which began with the Ilucidare Project, is another protection, development, and promotion approach.

In this context, this study may contribute to the international debate by revealing the importance of a shared Albanian vernacular cultural heritage that spans three countries, as well as response measures for its consolidation and long-term upgrade, so that kullas are no longer frozen in time as "stone museums" but can be lived and enjoyed by communities and tourists. Kullas may become part of UNESCO's series world heritage sites in the near future, and their diverse values will be cherished around the world.

17. RECOMMENDATIONS

Given that no technical guidelines on the sustainable upgrade of historic buildings have been produced in the respective countries, and this topic is still seen as a paradigm, and as such it is not a requirement in the national cultural heritage laws, we don't even have a single implemented case, on the sustainable upgrade of a historic building. As a result, this thesis provides the following recommendations for kullas thermal optimization that can be used not only by owners and specialists, but also by the central and local governments. Furthermore, this can be used as a model to create a variety of cultural heritage typologies standards for long-term upkeep. The following table gives specific recommendations for the structure consolidation and thermal comfort improvement of case study kullas.

INSULATION			
CS	**EXTERIOR WALLS**	**LOFT AREA**	**WINDOWS**
KULLA OF ISUF MAZREKAJ, DRANOC	Removal of the existing wall plaster down to the stone masonry, scraping out and repairing joints. Application of insulating plaster (preferably with mineral aggregate, e.g. perlite) or lime mortar with sheep's wool, layer thickness: approx. 6 cm. Petroleum-based aggregates should not be used. Exterior walls should be insulated on the warm/heated side, i.e. as interior insulation. Partition walls between heated and unheated room areas should be insulated on the cold side, i.e. the unheated side.	Use of ecologically compatible building materials; e.g. straw, hay, sheeps' wool- diffusion-open insulation materials such as straw are laid without a vapour barrier but with trickle protection and diffusion-open sarking membrane to create airtightness and prevent air flows through the building component. Insulation should not be exposed to too much wind and should be covered by diffusion-open wood-based panels or sarking membranes, overlapped or glued. (This top cover should have a lower diffusion resistance than the sarking membrane.)	New enlarged windows: Insert a new slim profile of double-glazed glass units in the casements. The casements can be taken to the workshop and replaced with new double-glazed pieces. Maintain the timber frames, as they are in a good condition, only sand the timber and polish them with oil.

KULLA OF SELIMAJ FAMILY, VALBONA	Removal of the existing wall plaster down to the stone masonry, scraping out and repairing joints. Application of insulating plaster (preferably with mineral aggregate, e.g. perlite) or lime mortar with sheep's wool, layer thickness: approx. 6 cm. Petroleum-based aggregates should not be used. Exterior walls should be insulated on the warm/heated side, i.e. as interior insulation. Partition walls between heated and unheated room areas should be insulated on the cold side, i.e. the unheated side.	Use of ecologically compatible building materials; e.g. straw, hay, sheeps' wool- diffusion-open insulation materials such as straw are laid without a vapour barrier but with trickle protection and diffusion-open sarking membrane to create airtightness and prevent air flows through the building component. Insulation should not be exposed to too much wind and should be covered by diffusion-open wood-based panels or sarking membranes, overlapped or glued. (This top cover should have a lower diffusion resistance than the sarking membrane.)	New enlarged windows: Insert a new slim profile of double-glazed glass units in the casements. The casements can be taken to the workshop and replaced with new double-glazed pieces. Maintain the timber frames, as they are in a good condition, only sand the timber and polish them with oil. Plastic windows shall be totally removed and replaced with timber ones.
KULLA OF DELI GJONBALAJ, VUTHAJ	Removal of the existing wall plaster down to the stone masonry, scraping out and repairing joints. Application of insulating plaster (preferably with mineral aggregate, e.g. perlite) or lime mortar with sheep's wool, layer thickness: approx. 6 cm. Petroleum-based aggregates should not be used. Exterior walls should be insulated on the warm/heated side, i.e. as interior insulation. Partition walls between heated and unheated room areas should be insulated on the cold side, i.e. the unheated side.	Use of ecologically compatible building materials; e.g. straw, hay, sheeps' wool- diffusion-open insulation materials such as straw are laid without a vapour barrier but with trickle protection and diffusion-open sarking membrane to create airtightness and prevent air flows through the building component. Insulation should not be exposed to too much wind and should be covered by diffusion-open wood-based panels or sarking membranes, overlapped or glued. (This top cover should have a lower diffusion resistance than the sarking membrane.)	New enlarged windows: Insert a new slim profile of double-glazed glass units in the casements. The casements can be taken to the workshop and replaced with new double-glazed pieces. Maintain the timber frames, as they are in a good condition, only sand the timber and polish them with oil.

Table 13 Recommendations for insulation of kullas

SEALING DRAUGHTS				
CS	**CHIMNEY**	**DOORS**	**WINDOWS**	**FRËNGJI**
KULLA OF ISUF MAZREKAJ, DRANOC	Installation of a chimney balloon in the flue slightly above the grate as an alternative to permanent closure to restrict air passage in the winter and during heavy winds. When ventilation is desired, such as during the summer and other warm months, the balloon can be removed.	Use of draught-stripping in the form of mastic or foam, or silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins.	Use of draught-stripping in the form of mastic or foam, or silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins. A self-curing silicone rubber sealant can be injected into the gap between the window and the frame for timber casements.	Insert timber in the hole, with the same dimensions as frëngji, and seal the hole during cold weather, whereas take the timber out during hot weather, for natural ventilation.
KULLA OF SELIMAJ FAMILY, VALBONA	Installation of a chimney balloon in the flue slightly above the grate as an alternative to permanent closure to restrict air passage in the winter and during heavy winds. When ventilation is desired, such as during the summer and other warm months, the balloon can be removed.	Use of draught-stripping in the form of mastic or foam, or silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins.	Use of draught-stripping in the form of mastic or foam, or silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins. A self-curing silicone rubber sealant can be injected into the gap between the window and the frame for timber casements.	Insert timber in the hole, with the same dimensions as frëngji, and seal the hole during cold weather, whereas take the timber out during hot weather, for natural ventilation.
KULLA OF DELI GJONBALAJ, VUTHAJ	Installation of a chimney balloons in the flue slightly above the grate as an alternative to permanent closure to restrict air passage in the winter and during heavy winds. When ventilation is desired, such as during the summer and other warm months, the balloon can be removed.	Use of draught-stripping in the form of mastic or foam, or silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins.	Use of draught-stripping in the form of mastic or foam, or silicone rubber tubes, polypropylene and nylon-filled pile brushes, or rubber, polyester, or sprung-metal 'Z' and 'V' fins. A self-curing silicone rubber sealant can be injected into the gap between the window and the frame for timber casements.	Insert timber in the hole, with the same dimensions as frëngji, and seal the hole during cold weather, whereas take the timber out during hot weather, for natural ventilation.

Table 14 Recommendations for sealing draughts in kullas

RESTORATION				
CS	CRACKS	WALLS AND CEILINGS	RISING DAMP	ROOF
KULLA OF ISUF MAZREKAJ, DRANOC	**X**	**X**	**X**	**X**
KULLA OF SELIMAJ FAMILY, VALBONA	Existing cracks should be structured with sequential actions, their opening in straight lines and at a wall depth of up to 50mm while the thickness of the opening should be such that allows the introduction of the injection mechanism (not wider than 5mm). After opening the channels in the cracking lines, their planes should be cleaned of dust in order to achieve the eventual adhesion of the masonry units as well as the layers of mortar. Injection mass should be made of polymer-based (or hygroscopic) expansion material with expanding effects and resistance> 25N / mm2. The injection of the mass should be realized in pressure not less than 3 Bar and not more than 5Bar in order to achieve the maximum depth of injection in cracking.	**X**	Since the rising damp has damaged the structure of the walls in the lower parts, french pipes should be placed on the entire perimeter of the building to eliminate this problem. After the excavation is done on the entire outer perimeter of the building, the soil should be compacted, and then the gravel layer should be placed, followed by the plastic drainage pipe that has holes on all sides, which is wrapped with a geotextile layer. Afterwards gravel and the final layer of the setting shall be put.	When there is a chance, it is recommended to remove the aluminium sheet roof cover, and put a new timber roof cover, alike as the original timber boards "furde". These timber planks were mainly the "red" heart of the black rock pine cut only with an ax, 1 m long and 30-40cm wide. For a more long- durance pressure treated pine wood or cedar can be used.

KULLA OF DELI GJONBALAJ, VUTHAJ	Since the rising damp has damaged the structure of the walls in the lower parts, french pipes should be placed on the entire perimeter of the building to eliminate this problem. After the excavation is done on the entire outer perimeter of the building, the soil should be compacted, and then the gravel layer should be placed, followed by the plastic drainage pipe that has holes on all sides, which is wrapped with a geotextile layer. Afterwards gravel and the final layer of the setting shall be put.	When conserving the structure, the original masonry should be highlighted. In places where stones are missing or damaged, they should be replaced with the same stones. When the mortar is damaged or missing, it should be re-applied with the same mixture as the existing one. Damaged plaster of walls and ceilings should be treated by applying the same quality of lime mortar mixture applied in two or three layers. Plaster should be applied to clean and smooth surfaces. Before plastering the surfaces should be cleaned, sprinkled with lime milk, ratio 1: 1. Plastered surfaces should be flat, without deformations, with sharp and straight edges. The mortar should be wetted to prevent rapid drying and dusting. All walls should then be painted with the base color and then again with the same color (white).	Since the rising damp has damaged the structure of the walls in the lower parts, french pipes should be placed on the entire perimeter of the building to eliminate this problem. After the excavation is done on the entire outer perimeter of the building, the soil should be compacted, and then the gravel layer should be placed, followed by the plastic drainage pipe that has holes on all sides, which is wrapped with a geotextile layer. Afterwards gravel and the final layer of the setting shall be put.	When there is a chance, it is recommended to remove the aluminium sheet roof cover, and put a new timber roof cover, alike as the original timber boards "furde". These timber planks were mainly the "red" heart of the black rock pine cut only with an ax, 1 m long and 30-40cm wide. For a more long- durance pressure treated pine wood or cedar can be used.

Table 15 Recommendations for restoring defects in kullas

TREAT/ REMOVE INNAPROPRIATE INTERVENTIONS				
CASE STUDIES	**WINDOWS/DOORS**	**INTERIOR WALLS/ CEILING**	**ADDITIONS**	**CEMENT**
KULLA OF ISUF MAZREKAJ, DRANOC	**X**	**X**	**X**	**X**
KULLA OF SELIMAJ FAMILY, VALBONA	Remove all exterior and interior doors, and design new timber doors. Put new doors where they are missing. Remove all plastic windows and design new timber ones.	Remove the new timber varnish in interior walls and ceiling and reveal the original structure.	Tremove the toilet addition if possible. If not, redesign the whole part, by not affecting the authenticity of the structure.	Remove all cement mortarif not hardly attached to masonry and substitute it with lime mortar.
KULLA OF DELI GJONBALAJ, VUTHAJ	Remove all new doors and design new timber ones same as the original.	Remove the new block walls (if possible).	**X**	Remove all cement mortarif not hardly attached to masonry and substitute it with lime mortar.

Table 16 Recommendations for treating/ removing inappropriate interventions in kullas

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- Member of the Professional Commission for Assessment of Assets for Temporary Protection of Cultural Heritage, MCYS, 2017.
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Institution: CHwB Kosovo / Heritage Lab
Duties: Organizer and coordinator of restoration camps with students within the Heritage Lab program. Camps organized so far:
Revitalization and interpretation of cultural heritage in Letnica (designed according to the requirements of the course curriculum Protection of Architectural Heritage in the Faculty of Architecture), in 2018; Art led Regeneration of the Tabakë Bridge in Gjakova, 2019;
Revitalization and digitalization of the content of Cinema Jusuf Gërvalla, Peja, 2019; Archaeological discovery and presentation of the Cathedral of Our Lady Help of Christians in Prizren, 2019; Rediscovery of Letnica heritage, 2019; Restoration of the Clocktower in Prishtina, 2021.

PROFESSIONAL EXPERIENCE:

Date: 23.01.2012- ongoing
Position: Cultural Heritage Expert / Program Manager
Institution: Cultural Heritage without Borders Kosovo Foundation - CHwB Kosovo, Prishtina
Duties: Management of Illucidare project for capacity buildings, value mapping and creation of the UNESCO nomination dossier for Kullas in Kosovo, Albania and Montenegro; Management of research and publications department, management of "Heritage Lab" restoration camps, management and design of projects for conservation and revitalization of cultural heritage assets, management plans and interpretation of monuments, drafting of regeneration plans for historic centers, museum exhibitions and various campaigns and debates.

Date: 01/02/2018- ongoing
Position: Coordinator of ICOMOS members (without National Committee) in Kosovo

Institutions: ICOMOS
Duties: Contact person with ICOMOS International for all issues related to ICOMOS members from Kosovo, drafting a heritage report at risk for cultural heritage in Kosovo, Kosovo's representative at ICOMOS Southeast Europe meetings, voting in ICOMOS General Assembly.

Date: 12/08/2018- 31/03/2022
Position: Kosovo Coordinator for Interpret Europe
Institution: Interpret Europe - European Association for the Interpretation of Heritage, Witzenhausen (Germany)
Duties: Establish and coordinate a team of LE members in order to develop the interpretation of heritage in Kosovo; training of EI members in various fields of heritage interpretation, development of projects for cultural heritage interpretation.

Date: 07.06.2020- 06.08.2020
Position: Interpreter of cultural heritage
Institutions: NGO Monumenta
Duties: Research and data collection for the residential complex "Kurrizi" in the neighborhood Dardania, Prishtina, with a special focus on the development of social and cultural life in this complex during the 90s.

Date: April-May 2019
Position: External evaluator for the World Monuments Fund
Institution: World Monuments Fund, New York (United States)
Duties: Review of the nomination file for the monument "Former Gërmia Department Store" in Prishtina.

Date: 2018-2019
Position: Exterior Conservation Architect
Institution: Ministry of Culture, Youth and Sport, Prishtina (Kosovo)
Duties: Drafting a plan for the conservation and revitalization of the building of the First Albanian School in Prishtina and drafting a plan for the conservation and revitalization of the Red Cross building in Prishtina.

Date: May 2009- September 2010
Position: Officer for Water Permit
Institution: Ministry of Environment and Spatial Planning, Prishtina (Kosovo)
Duties: Analysis of applications and development of procedures for water permits, organization of consultations with permit applicants, field supervision, providing professional recommendations for relevant permits.

Date: May 2009- ongoing
Position: Freelance Architect
Duties: Interior design, design of houses and administrative buildings, project analysis, 3D modeling, preparation of final drawings and application for building permits and field supervision.

TRAININGS:
Date: 25.02.2019- 02.03.2019

Training: Heritage Management Workshop - Personal Interpretation for Natural and Cultural Heritage
Institution: Heritage Management Organization, Elefsina (Greece)

Date: 04/08/2012–18 / 08/2012
Training: Training program in stone constructions
Institution: International Built Heritage Conservation Training Center, Bontida (Romania)

LANGUAGE SKILLS (1 to 5; 1- lowest rating and 5-fluent):

Albanian: native
English: 5-conversion, 5-writing, 5-reading
Serbian: 3-conversion, 3-writing, 4-reading
Spanish: 3-conversion, 3-writing, 3-reading

KALTRINA THAÇI

Date: 15.05.2022