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Original Research Article

The Role of Sunlit Space in Creating a Favorable Micro-climate in Rural Houses of Mountainous Areas Case Study :Villages of Shemiranat in Tehran*

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Abstract

Problem statement: Energy crisis and energy saving, have turned the necessity of construction method reconsideration into one of the most important goals of planning and design in the country. This issue is vital in villages that have fewer resources, so the climatic design is at the top of rural architecture. The need to use sunlight as a suitable climatic solution in cold and mountainous villages doubles the importance of sunlit spaces. The title (sunlit spaces) introduced in this study can be part of the open or semi-open space in the body of rural houses, which causes a change in microclimate.

Research objective: The purpose of this study is to investigate the importance of sunlit spaces and show how to create a microclimate in the houses of mountainous villages. The most important question of this research is what is the role of sunlit space in the microclimate of mountainous rural houses? And what is the function of new constructions in this field?

Research method: This research employed analytical method and included field studies. The samples in the case study were the villages of Shemiranat in Tehran. To answer the research question, several vernacular buildings with sunny courtyards were selected. First, to use the residents' experiences about the importance of the sunlit space, they were surveyed and interviewed. At this stage, the satisfaction and reasons for people's dissatisfaction were identified. In the next step, the shadow mask and the examination of the sunny hours of the samples were analyzed using Ecotect software.

Conclusion: The results of this study indicate that sunlit spaces on the south front with a geometry protected from winter winds have a very important role in creating a favorable micro-climate and saving energy consumption. In new constructions, much attention should be paid to the solar envelope, and creating unwanted shadows should be avoided.

Keywords: *Sunlit space, Micro-climate, Shading mask, Solar envelope, Mountainous villages.*

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Introduction and Problem Statement

The relationship between humans and the environment is a topic that has received much attention in the last century. Nature and its facilities, along with the knowledge of many generations, have created another characteristic feature and the most desirable and efficient relation between environmental components. Responding to housing and demands of the rural community is required the participation and attention of many experts in rural issues. It should be noted that any rural housing policy and planning in the country could be successful when the plans are in harmony with the features of rural architecture, cultural traditions, and climatic differences in the country. Otherwise, what we will have is uniformity in all parts of Iran, regardless of the materials, rural landscape, climates, and cultures (Haji Ibrahim Zargar, 2009). Each environment has unique characteristics that distinguish it from others, so one of the main features of a geographical environment is the existence of a distinction (Varmaghani & Soltanzadeh, 2020). Since the villagers have a creative and dynamic nature, for research in this field, this feature should be considered and the same method and solution should be avoided (Afsharipour, 2021). This article deals with rural housing from a climatic point of view and pays attention to open and semi-open spaces, effective in micro-climate. The case study is the mountainous villages of Shemiranat in Tehran province. The purpose of this study is to introduce the space of sunlit space in rural houses, which its function has changed over time due to new constructions. The most important question is what is the role of sunlit space in improving the micro-climate of mountainous villages? In addition, what is the function of new constructions in this field?

Research Background

Significant studies have been carried out on villages and climates in Iran. The Housing Foundation of the Islamic Revolution has played a significant role. However, no research has examined the role of the sunlit space. The term sunlit space is

introduced professionally in this research. The Housing Foundation of the Islamic Revolution in a study entitled "Typology of rural housing" in different provinces examined rural housing from different aspects and provided design criteria for new constructions in different climatic zones such as "Typology Rural housing in Tehran province" (Divandari, 2008). "Typology of rural housing in Kurdistan province" (Janipour, 2006). "Typology of rural housing in Zanzan province" (Taheri Tafti & Khodabandeh Lou, 2006). Also, a collection of typology books such as "Typology of rural housing in Markazi province" (Sartipipour, 2013). This study examined various features of the formation of rural fabric based on climatic zones. "Typology of rural housing in West Azerbaijan province" written by (Ahmadi, 2020). In this book, the context of different villages is presented by providing samples and finally analyzing the findings and offering solutions. Regarding the rural and energy discussion in other countries, the book "Comparative Studies of Rural Housing Improvement in India, China, and Turkey" introduces rural housing production planning and management policies in these countries Especially in China, which refers to the inactive use of renewable energy (Housing Foundation Studies and Research Office, 2011). An article entitled "Rural housing in the mountainous settlements of Iraq" discusses the importance of topography in the rural context (Qadir Rasul & Ahmed, 2018). In a paper entitled "Bioclimatic Architecture in Libya", three climatic zones are considered and indigenous examples and new constructions are compared in terms of energy (Elwefati, 2007). An article entitled "Architectural Design of Traditional Buildings in the Mountainous Areas of Cyprus" is about the optimal location of spaces at different levels according to heat energy (Malaktou, Philokyprou, Michael, Savvides, 2015). An article entitled "Architecture and Traditional Materials in Central Poland" refers to the use of indigenous materials in new constructions (Gorączko & Gorączko, 2015). By reviewing the studies, which were briefly reviewed in this section, it can be seen

that reducing energy consumption and optimization and the use of renewable energy have become one of the main concerns in different countries.

Theoretical Foundations

Architecture is the product of politics, economics, and culture (Oktarini, 2019). Home can be considered as a physical mechanism, a mechanism that reflects the worldview and ethics of a people and contributes to their emergence, and in this respect is comparable to different social institutions or mechanisms that play the same role (Rapaport, 2009). Security and well-being are also two qualitative concepts that we expect to be realized at home. "Home is still related to the known values that give us security" (Nurberg-Schultz, 2002). Rural house has a deep connection with the environment, is dependent on it, and serve as a residence for people who are engaged in productive activities (Sartipipour, 2011). A rural house is a space consisting of the all-around presence of a rural man in the place he has chosen to live in. This presence includes all aspects of his individual and social life (Alalhesabi & Raheb, 2008). Housing, as the manifestation of the concept of human habitation in an environment, has always been influenced by historical conditions, goals, and policies that have occurred in the growth or decline of its formation. According to Edward Hall's research on the realm of living creatures, "all animals need a minimum space without which survival is impossible. This space is the critical space (realm) for them" (Hall, 1966). Sense of place means a strong and emotional connection between the person and the place and its component, which is a positive relationship that expands the depth of communication and interaction between the person and the environment (Tuan, 1974). The sense of place explains a kind of relationship between humans and place and means a deeply emotional and sensory connection that is created between the person and the place. The result of this feeling for people is creating security, and comfort, and becoming familiar with the place and motivation to stay and live in it (Ardoin, 2006). Observing and studying rural housing seems

simple and rudimentary, but in fact, these buildings were built by people whose members are connected to the institutions of social life, so they have unlimited knowledge received from other members (Haji Ibrahim Zargar, 2009). The quality of rural life reflects the efforts and satisfaction of the people with their living conditions, a sense of security, and well-being. Researchers argue that the quality of life in rural areas will develop if governments improve economic, social, and environmental processes and attempt to raise the level of the village and living conditions to the life of the urban communities (Futa & Ewuola, 2010). Spatial organization and the way of establishing and building rural housing shows the quality of using the environment and the impact of the economy, traditions and norms governing the rural society. The role of housing in rural areas becomes more objective when we pay attention to its dominant role in the set of elements making rural textures. Housing is the main element of rural texture (Sartipipour, 2005)

• Open and semi-open spaces of rural houses

Important and effective factors in the formation of various architectural spaces in the general classification can be divided into two groups: first, material and environmental factors; and second, cultural and historical factors (Soltanzadeh, 2011). Many activities take place in open spaces, which include a wide range of social and individual activities. These spaces are so important in rural areas. These open spaces, in addition to providing the possibility of many daily activities, include various events that include traditions and rituals, and economic and social activities. The shape, extent, position, and amount of use of these spaces are influenced by various environmental and cultural factors and require good knowledge of the environment. These factors have led to the creation of various types of open spaces with different shapes that are seen in rural communities (Norouzzian Maleki & Rezae, 2010). The design of open spaces (courtyards) and semi-open spaces (porches) should be in such a way as to create an area for multi-activities (Sartipipour, 2011).

Open and closed spaces have an equivalent role in rural housing due to the extensive function of open spaces. Therefore, in many cases, the organic process of forming these two types of space is intertwined and they cannot be considered as separate components, only find meaning in combination. Also, open and closed space plays a complementary role to respond to climatic, social, and cultural factors. The composition of these spaces in indigenous architecture follows a special system, and the combination of these two spaces indicates its conscious and intelligent organization.

• Sunlit space

Cold weather and high altitudes provide problems for human settlement, including heat loss due to low ambient temperatures and air movement due to the existence of multiple elevations. To solve these problems, it is necessary to control the factors affecting heat loss at the first, and then provide suitable conditions for obtaining heat as much as possible. It is very difficult to raise the temperature of open spaces, because the heat dissipates quickly in the environment, especially if the wind blows. Therefore, direct sunlight and protection against wind are the two main methods of improving comfort conditions in open spaces in winter (Brown & Mark, 2007). Sunlight may promote thermal comfort in the outdoor environment in the cold season. The best time to reach the sun is at noon and most of the radiation occurs in the middle of the day between 10 AM and 2 PM (ibid., 91).

Small yards in cold climates control the wind better but should be deep enough in the north and south to have winter sunshine (ibid., 208). According to the

information based on years of research in this field in cold regions, open spaces (courtyards) and semi-open spaces (porches) that affect the level of comfort and functional quality of houses, have been introduced as ‘sunlit space’ by the authors. According to the definition, “a sunlit space¹ is an open or semi-open space that can be effective in creating a favorable micro climate².” This space, especially in cold villages with the correct orientation and structure, can be effective in absorbing and receiving sunlight. Of course, it must be a little enclosed and protected from the cold winter winds (Fig. 1).

• Micro climate

Climatic factors are divided into two categories: air factors and land factors. The land factors that form the basis of the plan are related to several factors such as altitude, latitude, topography, and the type of land cover. Air factors include meteorological characteristics such as temperature, humidity, wind currents, sunlight, rainfall, frost, etc. The set of these conditions determines the climatic situation of a place. In general, four main climatic layers can be identified in each region: macro-climate, medium climate, local climate, and micro-climate. Microclimate depends on ground details such as land cover, land slope, vegetation, soil moisture, air conditions, shade and sun, wind current, etc. An architect plays a great role in deciding the type of microclimate and determining its diversity (Tahabaz, 2013). For example, determining the shady or sunny areas that are the subject of this study can affect the micro-climate. When solar energy shines on an object, some energy is absorbed. The absorption of solar energy by external surfaces causes their temperature to rise by several degrees

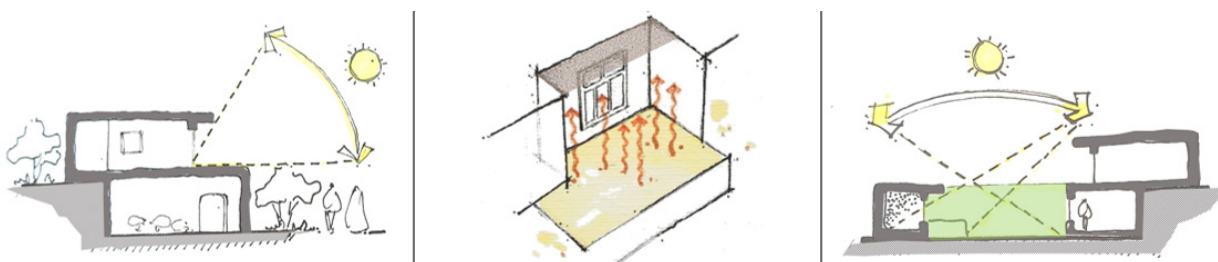


Fig. 1. Sunlit space in different forms (central courtyard, porch, and platform). Source: Authors.

higher than the surrounding temperature (Watson, 2003). Another example of the comfort of open and semi-open spaces is the shading on the walls. In mountainous villages, which experience cold weather most of the year, the optimal use of sunlight and heat can create a favorable climate, and this doubles the importance of sunny spaces, which are introduced in this study as sunlit spaces. In urban and rural areas, the shading of buildings on each other prevents the solar heat from reaching buildings during the winter. In the next part, some terms are explained such as Timetable climatic needs, Skydome, Sun path, and Shading mask which are considered in this research. All the concepts are given in the form of the theoretical framework of Fig 2.

Timetable climate needs, Skydome, Sun path, and Shading

mask The Timetable Climate Needs, proposed by Victor Algyay in 1973, graphically shows the climatic needs of each location in a year. This timetable has two axes perpendicular to each other, day and hour, which cover all days of the year and allow the climatic needs to be displayed simultaneously in a simple image. Tehran Timetable Climate Needs shows that in the coldest days of December, January, and February, in addition to the use of sunlight, the use of heating equipment is also necessary. November and March using the heat stored in building materials and the early morning with the help of heating equipment can be comfortable. September, March, and April provided

comfort in the shade during the day and using the heat stored in building materials at night (Tahabaz, 2013). The canopy design method which was invented in 1957 by the American architect Algyay, has made it possible to design a suitable canopy for any architectural space, whether open space or indoor space (Tahabaz, 2007). The shading mask method is a drawing and geometric method that is very simple to learn and relies on geometric knowledge. The concept of the Skydome and the Sun path can be generalized to the Timetable climatic needs and the efficiency of the canopy can be controlled according to other climatic phenomena such as hot, pleasant, or cold wind flow, rainfall, frost, cold or extreme heat and comprehensive decisions about all influential climatic factors can be made (ibid.). The Shading mask is a simple mechanism to indicate whether parts of the sky are visible from a particular part or not, and by using the information on the Sun path, indicates whether the selected location is in the shadow or not at different times of the year (Marsh, 2005). A Solar envelope is a set of non-physical boundaries that surround the site of a building that regulates the development of neighborhoods based on the movement of the sun and the buildings inside this Solar envelope do not affect their surroundings and do not create unwanted shadows during periods which is sensitive to receiving solar energy.

Research Methodology

The purpose of this study is to investigate the effect of sunlit space on microclimate in mountainous areas.

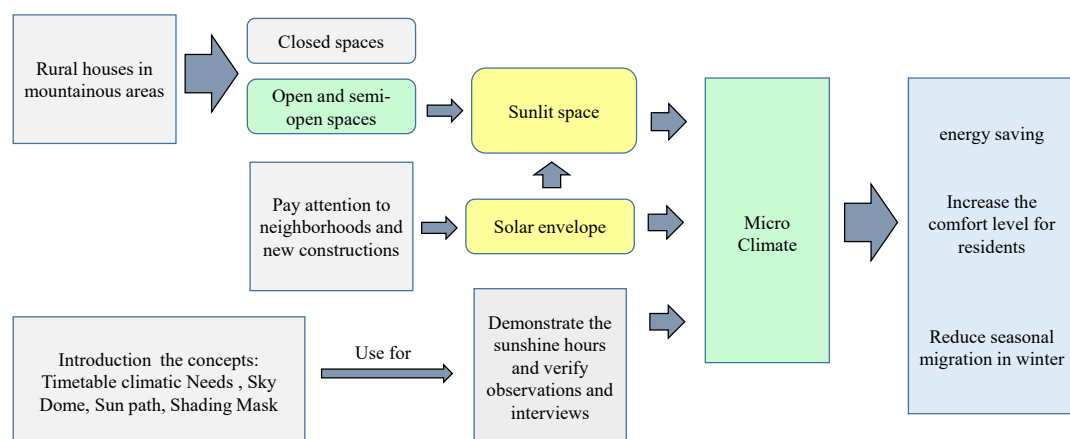


Fig. 2. Theoretical framework, the impact of theoretical studies on the research process. Source: Authors.

According to the research background, the sunlit space is a new topic that is mostly based on field studies and applied analytical methods. Field studies have included observing, photography, interviews, and drawing of the plans of buildings, and Ecotect software has been used to analyze the information. After preliminary studies and theoretical foundations in the first stage, samples of vernacular houses with sunlit spaces were selected in Shemiranat villages. To investigate the role of sunlit space on microclimate changes, observations and field studies were performed with Interviews to use residents' experiences in these homes. After interviewing residents in the next stage, two samples of these houses from Amameh village were intelligently selected to answer the research question with shading mask analysis. An example of a successful reaction against the other is that it has become unsuccessful over time. In the continuation of field studies, all design documents, plans, site plans, etc. were prepared from these two buildings to confirm the statements of the residents and local experiences, and to analyze the shading mask on these two buildings. For this purpose, using the latitude and longitude, the sun path of Amameh village was obtained from the University of Oregon, USA. Then, the information on the Timetable climatic needs of Abali meteorological station, which is suitable for this village according to latitude, longitude, and altitude, was adapted to the map of the Sun path. In the next step, using Ecotect software, shading mask drawings were performed for each building and from various angles. The software analysis, along with the conversations and experiences of the residents, had an answer to solve the problem in this research.

Introduction of Ecotect Software

In this research, Autodesk Ecotect Analysis software was used to investigate the effect of the sunshade. This software is from the Autodesk software series. One of the most powerful software for the passive solar design of the building is considered in which passive design parameters such as orientation,

thermal mass, canopies, insulation, light walls, etc. can be checked in the design of the building. It is a tool for environmental analysis that allows designers to simulate building performance from the earliest stages of conceptual design.

Discussion and Research Findings

According to the research background and studies, which focus on the typology of rural housing, optimization of energy consumption and the use of renewable energy, and the sun in general, the subject of this study has not been studied before. The introduction of a sunlit space is the purpose of this study, and its effect on microclimate and comfort level has been investigated.

• Examination of field interviews and the effect of sunlit space on microclimate

To investigate the importance of the sunlit space and how it creates climate changes and thermal comfort in mountainous villages, field samples have been selected and interviews with residents have been provided in this section. These samples are selected from the villages of Shemiranat and the houses are vernacular with sunlit spaces where life is permanent or seasonal. Five samples have been examined, one and two with a desirable sunlit and examples three, four, and five in which new construction has undermined the performance of their sunlit. And the lack of attention to design principles and solar envelopes in neighborhoods has become a problem for native houses.

- House No. 1

It is a house located in Amameh village. This two-story house has a barn and a storeroom on the ground floor and a residential space on the upper. this house has no yard and has a desirable sunlit space on the upper floor in front of the rooms. Since this space is located on a barn and is not affected by new construction, it has good sunbathing in winter. In the interview with the residents, it was concluded that the heating of the rooms is done through a fireplace, and the proper sunbathing of the rooms also plays an important role in the heating of the house, and many

daily activities are performed in the sunlit space in different seasons, such as drying agricultural products, drying clothes on a strap, and so on. As can be seen in the pictures, in winter, this sunlit space receives good sunshine, and to protect it from the winter winds, the residents have covered it with plastic according to Fig 3. This climatic solution can be seen in most buildings of mountainous villages in the cold season. With this solution, a greenhouse space has been created that complements the sunlit space. According to residents, this plastic space is suitable for them to have lunch and rest in the afternoon without any heating device in winter.

- House No. 2.

It is a two-story house in the Kond Sofla village which is located on a slope and each floor has separate access to the alley due to the difference in levels. The barn and warehouse space is downstairs and the residential space is upstairs with the yard. From the residents' point of view, the yard has a good sunbathing space and responds to many daily activities. Like sitting, drying agricultural products, playing with children, etc. In fact, this yard plays the role of a sunny courtyard for them. According to the residents, this space also has good sunshine in winter, while it also creates suitable heating for the interior spaces through the windows and the sun entering the rooms (Fig. 4).

- House No. 3

It is a two-story house in the Amameh village, with a barn on the ground floor, and residential rooms on the first floor with a large sunlit space on a barn. But due to the shading of the new building, it was practically inefficient and the positive effect it had for years in

creating a favorable climate was forgotten under the unwanted shadow of the new building. According to residents, they move in the winter and migrate seasonally to another house, coming only to look after their livestock. The reason was the high cold and a lack of proper heating. As can be seen in the pictures, the new building, which was built on the south front, without considering the solar envelope of this old house, has created improper shading (Fig. 5).

This space was used for local gatherings and ceremonies in the past due to its extensiveness and location in the barn offering good heat and sunbathing.

- House No. 4

It is a house in the Konde Olya village, which is located on a steep slope and is partly sheltered from the ground and below the level of the passage. It is a house without a yard and porch. According to the resident, due to easy access to the roof, which is sunny at noon, some of the activities are done on the roof such as washing and drying clothes. In fact, the roof of the house plays the role of a sunlit space but this house has been affected by new constructions.

The house has a large room on the south that has almost been turned into a warehouse as an unusable room. The reason was the existence of a new building, which was built at an inappropriate distance from the house, regardless of the privacy of the windows. Not only the room of the native house but also the alley are faced with an unwanted shadow, the alley has become a corridor for undesirable winds (Fig. 6).

- House No. 5

A two-story house in the Konde Olya village, which its sunlit space is a porch covered with a surface (Fig. 7). Looking at the neighborhoods, the reason for this

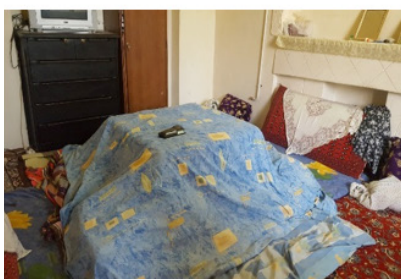


Fig. 3. Pictures of house No. 1. Source: Authors archive.



Fig. 4. Pictures of house No. 2. Source: Authors archive.



Fig. 5. Pictures of house No. 3. Source: Authors archive.



Fig. 6. Pictures of house No. 4. Source: Authors archive.

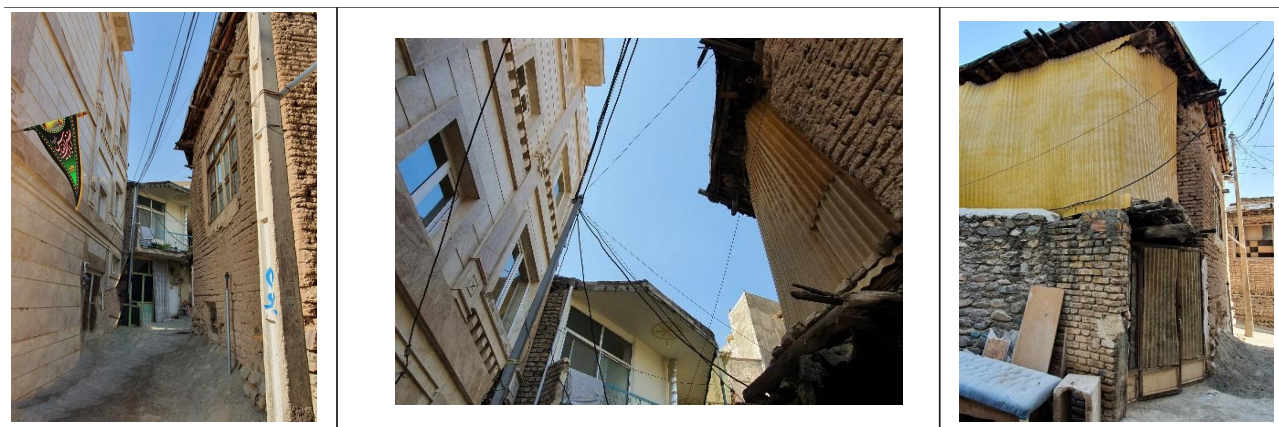


Fig. 7. Pictures of the house No. 5. Source: Authors archive.

behavior was quite clear, however, the residents were interviewed and according to them: not paying attention to the density and new constructions put the sunny porch in an unwanted shadow. Residents used to say: no sun reaches the house and we only have a disturbing view. And they used the porch space as storage.

• **Analysis of the shading mask on the sunlit spaces of the Vernacular houses**

The two houses selected for shadow mask analysis despite differences in the function of the sun visor have some similarities: Both have two floors, the barn is located downstairs, under the sunlit space which faces south, the best direction to receive the sunlight and heat. House A (House No. 1 in the interview) has a desirable sun visor while House B (House No. 3 in the interview)

whose sun visor is affected by the new construction and has poor performance (Fig. 8).

To analyze the shading mask, first, the sun path of Amameh village (Fig. 9) and also the Timetable climate needs of Abali meteorological station (Fig. 10) prepared, which is appropriate to the climatic conditions of Amameh village. Then, to determine the range of need for shade and sun, the information on Abali's climate needs to be transferred to the Sun path. This transfer is based on the axes of the month and the hours of the day. Finally, by determining the sun path, Fig. 11 is obtained, which divides the sun path into three ranges: the range of need for shade in two seasons, the need for shade in one season, and the need for the sun in two seasons. Tables 1 & 2 were prepared to obtain the sun path and unique

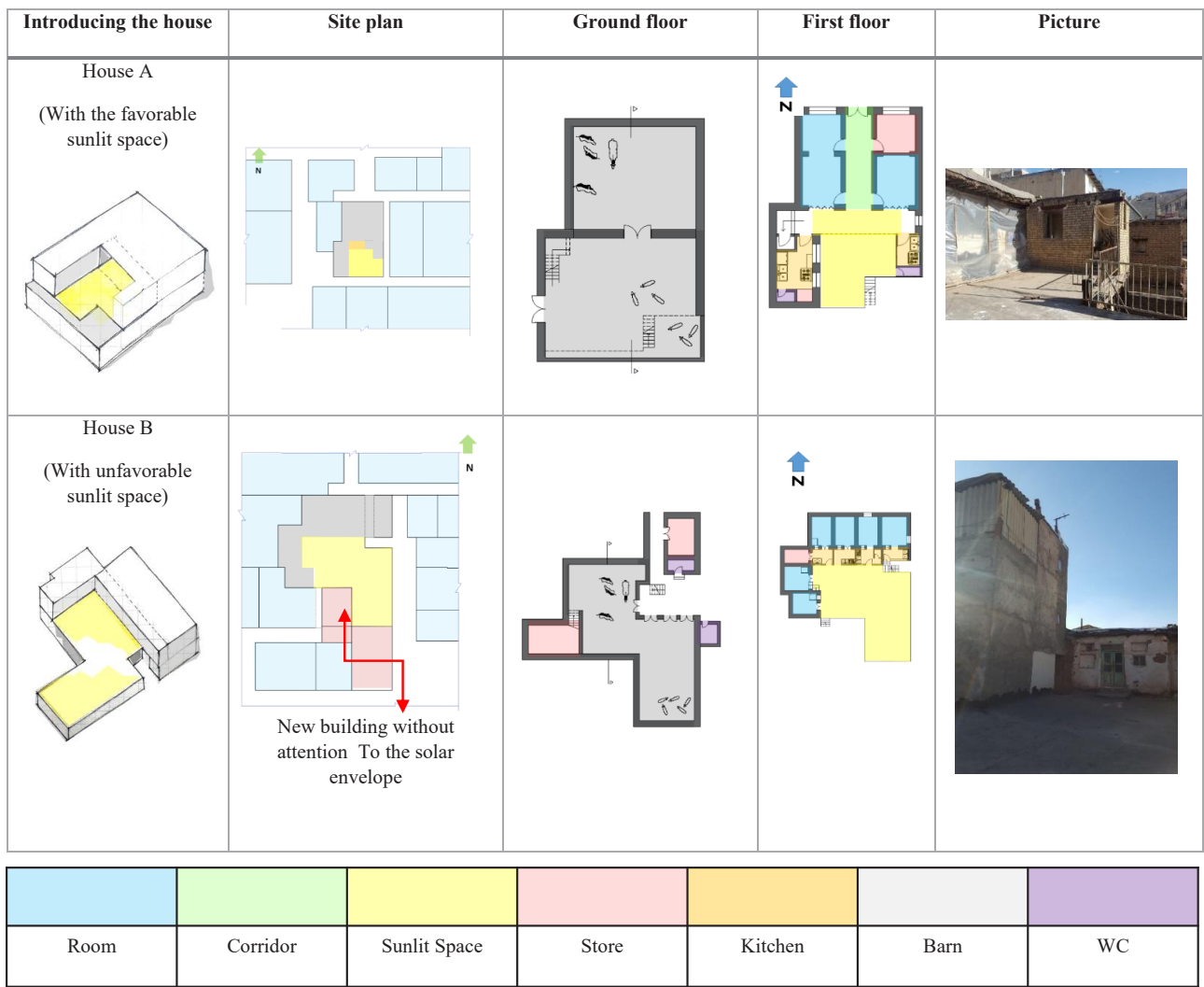


Fig. 8. Documents of both selected houses. Source: Authors archive.

Name: Amameh Village, Tehran

Lat: 35.906719

Lon: 51.5837288

Date: 05/01/2021

Time: 13:30

Azim.: 185.64

Elev.: 31.32

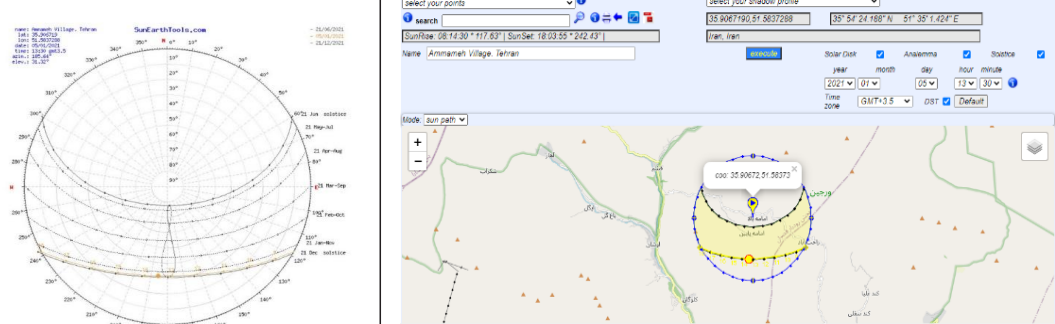


Fig. 9. Sun Path of Amameh Village. Source: Oregon University, USA. Source: Authors.

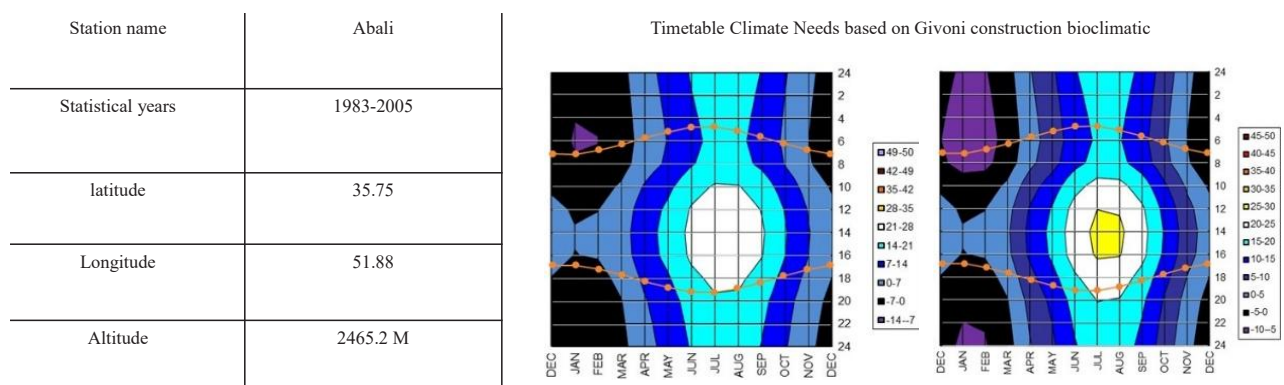


Fig 10. Abali Station, Timetable Climate Needs. Source: <https://www.irimo.ir/far/index.php>.

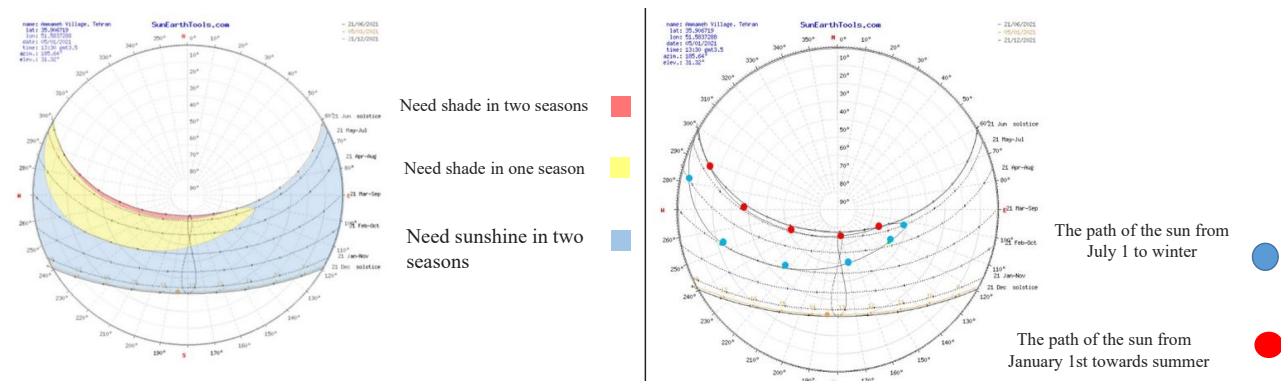


Fig. 11. Abali's Timetable Climate Needs Information of Abali Matching on the Sun path of Amameh Village. Source: Authors.

information about this village, which were adapted to the software analysis in the following.

• According to the software analysis of the shading mask A:

In analysis (a), the point chosen for the analysis is where the family's main living space is and has a good sunbath from 9 a.m. to about 4 p.m. Analysis (b) shows that in the selected range, it receives good sunshine in winter until noon. And in analysis (c),

which is the selected point in the center of the sunlit space, it welcomes the desired sun from morning to evening. The results of the software are in accordance with the residents' interviews about the desirability of the sun visor (Table 1).

• According to the software analysis of the shading mask B

In analysis (a), according to the software analysis, a selected point of sunlit space can only get sunshine in

the morning and due to the disturbing building, it is in the shade and cold of winter from 11 a.m. to evening. Analysis (b) and (c) are considered for this house without disturbing the building. In analysis (b), which is the same selected point in analysis (a), It is assumed that there is no new building in the sunlit space have a good sunbath from morning to evening. Analysis (c) could be sunny until the afternoon, assuming that there is no disturbing building. It has had a negative effect on the efficiency of the sun visor. The result of the software confirms the residents' conversation that the sunlit space is unfavorable, which is due to the existence of a high-rise building and the creation of unwanted shadows.(Table 2)

Therefore, according to Tables 1-3, sunlit space is a climatic and indigenous solution that exists in most houses

in cold villages, and as long as its efficiency is not limited by the impact of new construction, it can play a positive role in the level of thermal comfort.

Conclusion

In this paper, it was shown that the importance of using sunlight as a suitable climatic solution in cold and mountainous villages creates a concept called sunlit space. The title (sunlit space) chosen by the authors can be a yard, a porch, and in general, a part of open or semi-open space in the body of rural houses that creates a favorable microclimate. To answer the questions of this research, the sunlit space has a very important role in creating the favorable microclimate of mountain villages and saving energy consumption, and new constructions without paying attention to

Table 1. House A; Analysis of the Shading Mask. Source: Authors.

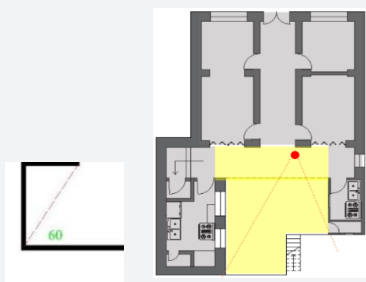
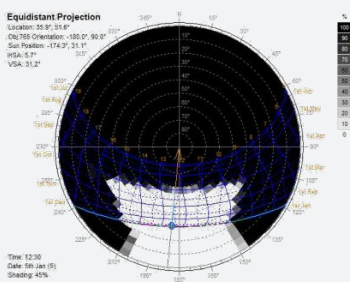
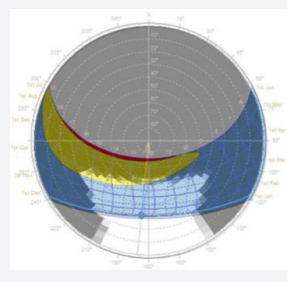
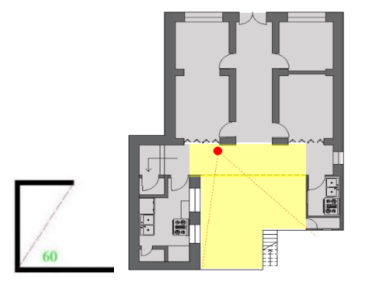
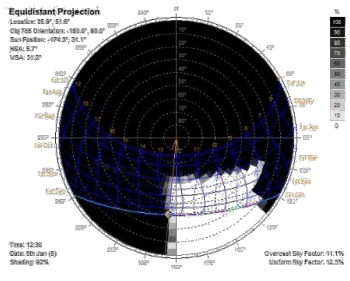
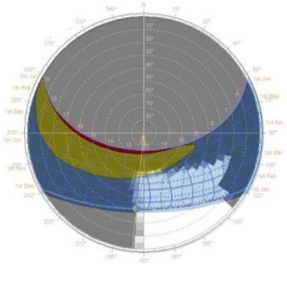
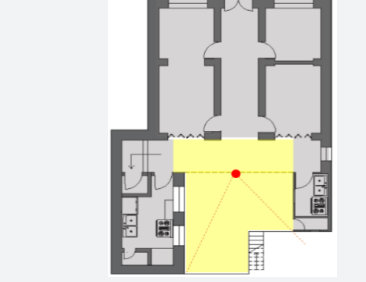
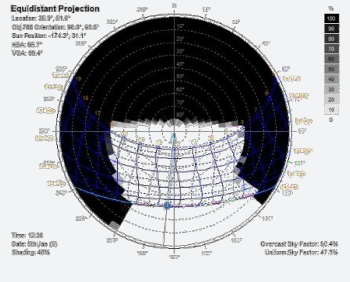
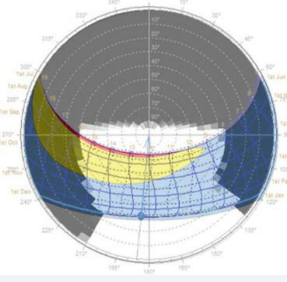
| House A | Selected Points for Shadow Mask Analysis | Shadow Mask Analysis with Ecotect Software | Matching the Shadow Msks on the Sun Path |
|--------------|---|--|---|
| Analysis (a) |  |  |  |
| Analysis (b) |  |  |  |
| Analysis (c) |  |  |  |

Table 2. House B; Analysis of the Shading Mask. Source: Authors.

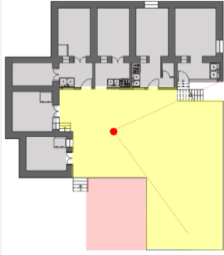
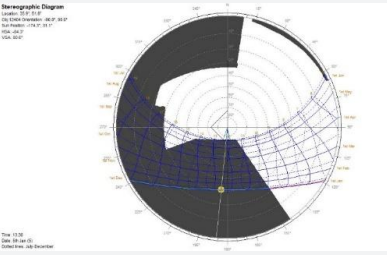
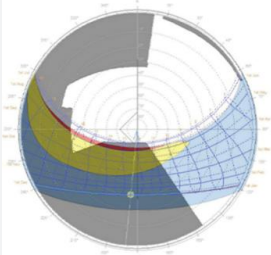
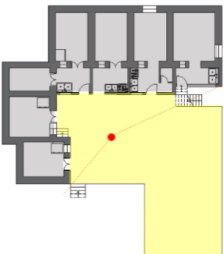
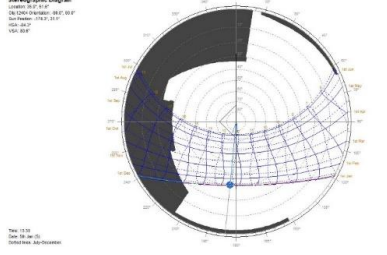
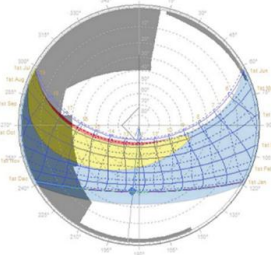
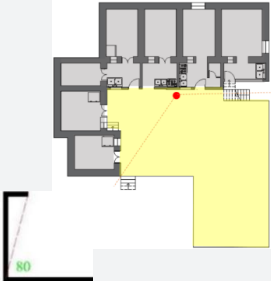
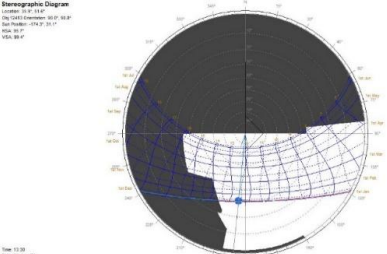
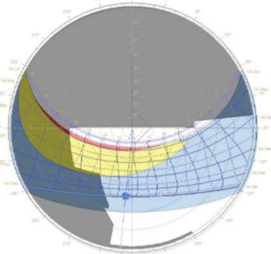
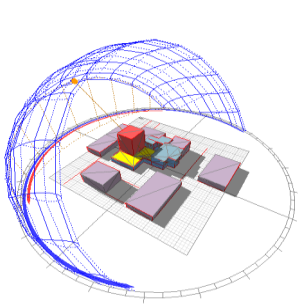
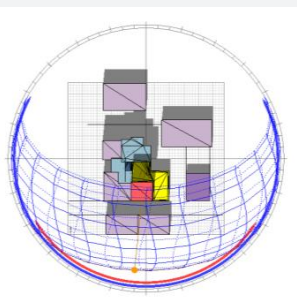
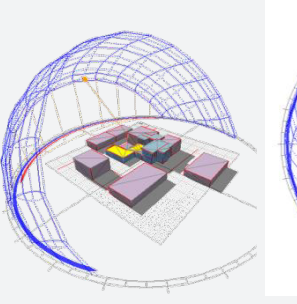
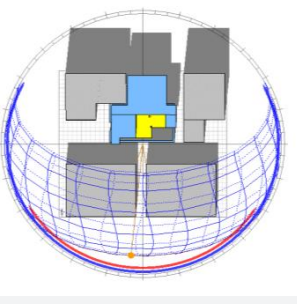
| House B | Selected points for shadow mask analysis | Shadow mask analysis with Ecotect software | Matching the shadow masks on the sun path |
|--|---|--|---|
| Analysis (a) (Despite the annoying building) |  |  |  |
| Analysis (b) (Assuming there is no annoying building) |  |  |  |
| Analysis (c) (Assuming there is no annoying building) |  |  |  |

Table 3. Comparing the sun bath between house A and house B at the same time. Source: Authors.

| Site plan , house B At 13:00 in January (winter noon), a significant part of the sunlit space is in unwanted shade. | Site Plan ,House A At 13:00 in January, the sunlit space has a pleasant sun bath. | | |
|--|--|--|---|
|  |  |  |  |

the solar envelope undermine the performance of indigenous sunlit spaces. According to the interviews with the residents, it was concluded that the sunlit

space is desirable when: 1) It is located on the southern front, which the rural people have paid attention to in terms of experience, 2) They have a geometry that

keeps them safe from the cold winter winds, 3) The roof of the porch and the sunlit space is low enough to use the winter sun, 4) flat-free roofs are used to receive maximum solar radiation, 5) Also, the solar envelope is needed to be observed by the neighbors. According to the residents, with some arrangements, they make the most use of this space even in winters like enclosing a sunlit space with plastic, which, while receiving sunlight, creates a hothouse and warmer place. and the features of undesirable sunlit space: 1) High-depth enclosed porches prevent winter sunshine. 2) Lack of attention to the solar envelope by the neighbors and new construction, create unwanted shadows, especially on the southern front. 3) If its geometry is not safe against winter wind and weakens the effect of sunlight. This is one of the reasons for seasonal migration in winter or changing spaces and their functions. Next, software analysis confirmed the residents' conversations and experiences that the new construction, regardless of the solar envelope, creates the restriction of sunshine hours and consequently unwanted shadow in winter. To provide solutions and respond to the problem solving, new construction must be required to comply with the criteria. The Islamic Revolution Housing Foundation and officials who authorize rural construction must pay attention to the solar envelope in the mountainous villages:

- Height and number of appropriate floors
- Considering construction density in the village texture
- Creating standard distance and observing the privacy of alleys and neighborhoods

Considering the factors and sunbathing in new construction guidelines and standards, while maintaining rural texture, is a very valuable step to reducing energy consumption and sustaining a rural residence.

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