

Research paper

AGRICULTURAL YARDS IN RURAL AREAS IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT – THE EXAMPLE OF BRODEC VILLAGE

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Abstract

This paper first analyses the current state of the various elements of sustainability in the village, and then on a representative sample of the households i.e. agricultural yards, according to previously defined sustainability parameters. The analysis of natural, human, spatial and economic resources gives us a clear picture of the existing situation, but also gives us an insight into the potential for sustainable development. The subject of the research will be the agricultural yards in the village of Brodec. This village in terms of size and importance is the most isolated settlement in the area of Skopska Crna Gora. It is a typical mountain village at an altitude of 870 m and is 15 km away from the city of Skopje. There are great opportunities for livestock farming and forestry in the village, but unfavorable conditions for agriculture and traffic. The aim of this research is to understand the way in which agricultural yards can transform and develop sustainably. The village of Brodec has a large untapped potential in pastures and forests, but the main problem of the village is the depopulation. If the village manages to overcome the problem of depopulation and keep young people in the village, with proper investment in the infrastructure and projects for the development of small businesses, the village has a good perspective and future in sustainable development through livestock farming and rural tourism.

Key words: Village, Rural area, Agricultural yard, Household, Sustainable development

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1. INTRODUCTION

Research on Macedonian villages compared to research on Macedonian cities in the architectural-urbanistic sense is scarce and therefore more intensive work on that problem is needed in the future. The lost time needs to be made up for with a hard and organized field survey of the current state of agricultural yards and an analysis of their impact on spatial changes in rural areas.

In this paper, an attempt has been made to study the sustainability of rural areas through the example of the village of Brodec, which is a typical mountain village 15 km away from the city of Skopje. By its size and morphology, the village belongs in the group of small dispersed villages.

Sustainable development originates from the ideas of sustainable forest management, which were developed in Europe during the 17th and 18th centuries. In 1987, the United Nations Brundtland Commission defined sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” [1].

Sustainable development in rural areas refers to a development approach that seeks to balance economic growth, environmental preservation, and social well-being within the unique context of rural communities. It aims to improve the quality of life for rural populations while ensuring that natural resources and ecosystems are preserved for future generations.

In rural areas in Macedonia, which cover about 87% of the total area of the country, 45% of the total population lives. The most important economic activity in rural areas is agriculture, which affects the alleviation of poverty and unemployment [2].

Agricultural yards are the basic architectural unit of the village. Their main function is to protect the various buildings and landscaped areas that are necessary for the life and work of the village residents. In addition to the house, agricultural yards usually have facilities for raising domestic animals, storing and processing agricultural products, etc. Such organization of agricultural yards represents a complex in which each component, regardless of whether it is a building or a landscaped area, has a precisely defined purpose. From this it can be concluded that the sustainability of the village is to the greatest extent based on their own capacities.

In his research Turnšek defines five factors of the village sustainability: population, village district, living conditions, infrastructural facilities and condition of households and buildings [3].

These factors cover social, spatial, economic, and physical aspects of rural life, and they provide a framework for assessing the long-term viability and resilience of rural settlements. First factor refers to the demographic structure and dynamics of the village population. Village district includes the spatial organization and land use within and around the village. Living conditions represent the quality of life for village residents. Infrastructural facilities cover the physical infrastructure that supports everyday life. Condition of households and buildings involves the physical state of housing and built structures in the village.

Households and buildings represent the agricultural yards. The household was not just a unit of residence, it was also the unit of production. The agricultural yards were the physical manifestation of that dual function. But agricultural yards are more than functional units, they are also cultural artefacts that reflect the family structure, the economy strategy and climatic and topographic adaptation.

The purpose of this paper is to create a recognizable framework for an effective strategy for the observation, qualitative assessment, protection and sustainable development of rural areas in Macedonia, through the analysis of five factors of village sustainability. The concept of sustainable development of villages must rely on their own capacities because otherwise there is a great chance to destroy the most valuable aspects of rural environments such as the natural landscape and the inherited ambient values of vernacular architecture.

2. HISTORY OF THE BRODEC VILLAGE

Brodec got its name from the fact that it lies "on the boat", i.e. at the place where the mountain Skopska Crna Gora crosses from the Skopska Kotlina in the south to the Binacke Morave district in the north. In historical sources, under the name Brodac, this settlement was first mentioned in 1348. Then, as a smaller village of the larger village of Kučeviste, Emperor Dušan attached it to the Church of the Holy Archangels near Prizren. By the end of the World War I, Brodec was a relatively prosperous village. The population grew rapidly and the economy prospered. Most people lived from livestock and forestry. In the north of the village, in the highly mountainous part of the village area, stronger springs emerge: Virovi and Korito, and at one point there were about 20 summer cottages. At that time, numerous mountain fields were also cultivated. In 1920, Brodec had the largest number of houses - 32 in total. Each household had several members, so in 1937 a modern elementary school was built for 37 children. In the 1970s, the village of Brodec began to slowly die out. The reason for this extinction is the ban on raising goats and selling wood in Skopje, as well as great pressure on the land from the larger surrounding villages [4].

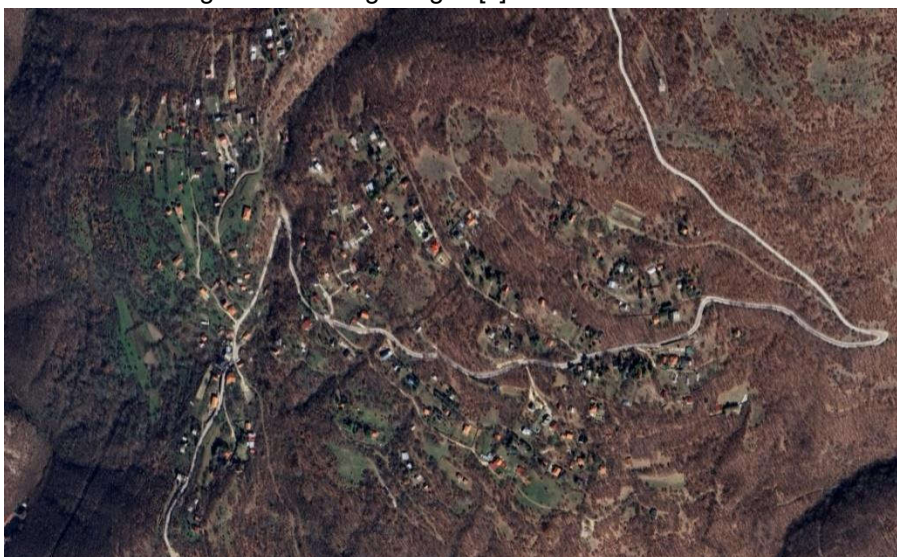


Figure 1. Village of Brodec (map from Google Earth)

At the beginning of the 20th century, the village of Brodec reached its lowest point with only 3 residents. But instead of completely disappearing, today it is slowly starting to recover and increase its population. According to the last census of 2021, 11 inhabitants lived in the village.

3. METHODOLOGY

The methodology for this research should encompass various aspects and should be adapted to the specific objectives, in order to provide accurate data through which precise conclusions can be drawn. The research is largely based on data collected through official statistics, scientific researches and fieldwork.

The data about the population is taken and from the censuses from the World War II to the present day carried out by the State Statistics Office of the Republic of Macedonia. The "Encyclopedia of the Villages of the Republic of Macedonia" by Mitko Panov was used to collect the Informations about the village district. For the remaining three factors of village sustainability, field recording was necessary to collect the data needed to conduct the research. First the interviews were made with local residents to get a clearer picture of the living conditions in the village and the real problems they face. The surveyed households were selected randomly, in order to obtain relevant information for the assessment of the existing situation. Then, the data on the infrastructure was collected from the local public services that are in charge of their maintenance. Finally, photographs were taken of the houses and agricultural buildings in the agricultural yards, and some of them were also documented through architectural recording.

4. RESULTS

According to the five factors of village sustainability, the research results are systematically organized and presented through the titles of each chapter.

4.1. Population

Historically, the village of Brodec experienced a significant decline in population due to the difficult living conditions. The table presents a clear trajectory of demographic change in the village from 1948 to 2021, highlighting a steady and severe population decline over the second half of the 20th century [5, 6].

Table 1. Overview of the population in the village of Brodec, according to the State Statistics Office of the Republic of Macedonia in all census years

year	1948	1953	1961	1971	1981	1991	1994	2002	2021
population	191	170	129	44	28	14	6	3	11

From a population of 191 residents in 1948, the village experienced consistent depopulation, dropping to only 3 residents by 2002. This sharp decrease reflects broader rural to urban migration trends and socio-economic transformations that have had a profound impact on the spatial and architectural integrity of the village.

Interestingly, the slight population increase to 11 residents in 2021 introduces a critical point of reflection. Although only 11 residents are registered as residents in the village, the actual number of residents of the village is much higher, given the fact that a large number of them are also registered at other addresses. Though modest, this demographic shift may indicate a renewed interest in rural living, heritage conservation, or the potential for small-scale regeneration.

4.2. Village District

The village of Brodec is located in the northeastern part of the Skopje Valley, and its territory rises on the ridge of the mountain of Skopska Cma Gora and touches the area of the Lipkovo Municipality. Brodec is typical mountain village at an altitude of 870 m and belongs to the Municipality of Chucher-Sandevo. It is 15 km away from the city of Skopje. The village district covers an area of 9.2 km². Forests cover an area of 480.3 hectares, pastures cover 370.8 hectares, and arable land covers 51.7 hectares [7].

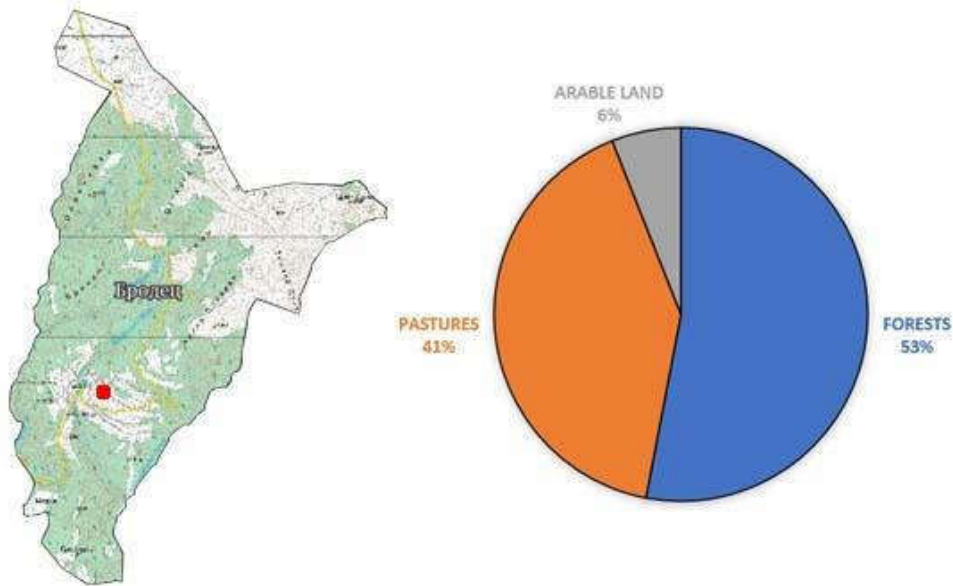


Figure 2. Village district and land use diagram in the village of Brodec

The village district is extremely rich in forests and pastures, which only confirms the fact that the village lived from livestock and forestry in the past. Land use distribution within the village highlights a landscape dominated by natural and semi-natural features: forests account for the majority of the area, covering 480.3 hectares (approximately 53% of the total), while pastures occupy 370.8 hectares (approximately 41% of the total). In contrast, arable land comprises only 51.7 hectares (approximately 6% of the total), suggesting limited agricultural productivity and reinforcing the village's reliance on pastoralism and forestry rather than crop cultivation.

With today's lifestyle pastures and forests can be meaningfully incorporated into rural tourism through ecologically sensitive tourism models. Forests can serve as the foundation for hiking, birdwatching, foraging, photography or wildlife observation and pastures offer scenic open spaces for walking trails, picnic spots, and guided tours of traditional land use.

4.3. Living Conditions

The living conditions in the village of Brodec are currently very limited and reflect the broader issues of rural depopulation.

Table 2. Program contents in the village of Brodec

(●- developed/satisfactory, ■ - exists/unsatisfactory, ▲ - absent/problematic)

program contents	school	health clinic	post office	local community	church	store	restaurant	park
village of Brodec	▲	▲	▲	▲	●	▲	●	■

In the village of Brodec, there is a pronounced lack of facilities of a social, cultural, and health nature. Due to its remote mountain position and extremely small population, the village does not have a school, health clinic, post office, or a store with basic groceries, an absence that significantly affects the quality of life and forces the remaining residents to travel to other villages or the city of Skopje for even the most essential services. There is no active public building functioning as a community hub, although former residential and communal structures exist in an abandoned or partially collapsed state. Historically, the village possessed a stronger social dynamic, but today it suffers from infrastructural and social stagnation. The surrounding mountainous landscape of Skopska Crna Gora offers exceptional natural beauty, clean air, and opportunities for hiking, recreation, and nature tourism. On occasion, hikers and visitors from Skopje and surrounding areas come to explore the area, especially during warmer months. In recent years, isolated efforts by former residents or descendants of Brodec families have led to limited revitalization activities, such as the organization of gatherings around major religious holidays or seasonal visits, often centered around outdoor spaces and remnants of architectural and cultural heritage.

However, these efforts remain architecturally and infrastructurally unsupported, highlighting the urgent need for a more strategic spatial intervention framework. Sustainable reintegration of Brodec into the broader regional context will require targeted investment, adaptive reuse strategies, and a redefinition of its architectural and landscape assets as part of a long-term vision for rural regeneration.

*Figure 3. Photos of architectural and cultural heritage in the village of Brodec*

4.4. Infrastructural facilities

The infrastructure facilities in the village of Brodec are in a highly deteriorated state, reflecting the effects of long-term depopulation, lack of investment, and geographical isolation.

Table 3. Infrastructure facilities in the village of Brodec

(● - developed/satisfactory, ■ - exists/unsatisfactory, ▲ - absent/problematic)

infrastructure facilities	electrical network	water supply	sewage system	TV - internet	telephone network	waste service	roads
village of Brodec	■	■	▲	■	■	●	■

Basic infrastructure is either minimal or entirely absent. Electricity may be present in all homes, but electrical network needs to be improved. There is no centralized water supply system, and because of that water is sourced from natural springs or wells. There is no sewage system, so the wastewater disposal is mostly handled via improvised septic tanks or direct ground infiltration, which presents risks to hygiene and environmental quality. Telecommunications are available but sometimes the signal is weak or inconsistent due to mountainous terrain. Waste management is organized and municipal services perform their work in a timely manner. The road network is very scarce, so apart from the main street through the village which is asphalted and in good condition, all other streets in the village are narrow due to the terrain and are in bad condition. Public transportation does not serve the village, requiring residents or visitors to have private transport.

Improving the infrastructure in the village of Brodec requires a strategic and context-sensitive approach that respects the natural and cultural heritage, but also provides the minimum conditions necessary for rural regeneration, tourism potential, and basic quality of life.

4.5. Condition of agricultural yards with households and buildings

Several agricultural yards were analyzed in order to gain a clearer picture of the way the functional zones for housing, economy and gardening are organized. The displayed agricultural yards represent the characteristic ways of organizing the space within the parcel.

The dominant spatial characteristic of the traditional agricultural yards in Brodec is the presence of a single multifunctional house occupying the entire plot. This multifunctional house was conceived as an integrated unit that accommodated both human and animal habitation. The ground floor functioned as a barn or stable that was housing livestock, while the upper floor was reserved for residential use. During the winter months, the body heat generated by the animals below contributed to warming the living quarters above. This vertical spatial arrangement was not only a response to programmatic efficiency, but also reflected a climatic strategy rooted in local knowledge. Nowadays, these houses no longer serve multifunctional purposes. The ground floors are no longer used to accommodate animals and have typically been converted into storage spaces or living areas. The houses now function solely as private residential homes, adapted to modern standards of comfort and use.

agricultural yard no.1

1.house, 2.warehouse, 3.shed, 4.summer canopy, 5.metal canopy

parcelling



google earth



photography



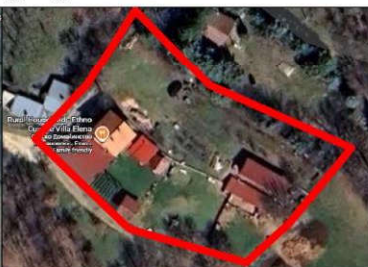
agricultural yard no.2

1.house, 2.warehouse, 3.shed, 4.summer canopy, 5.bar, 6.goat shelter, 7.barn

parcelling



google earth



photography



agricultural yard no.3

1.house

parcelling



google earth



photography



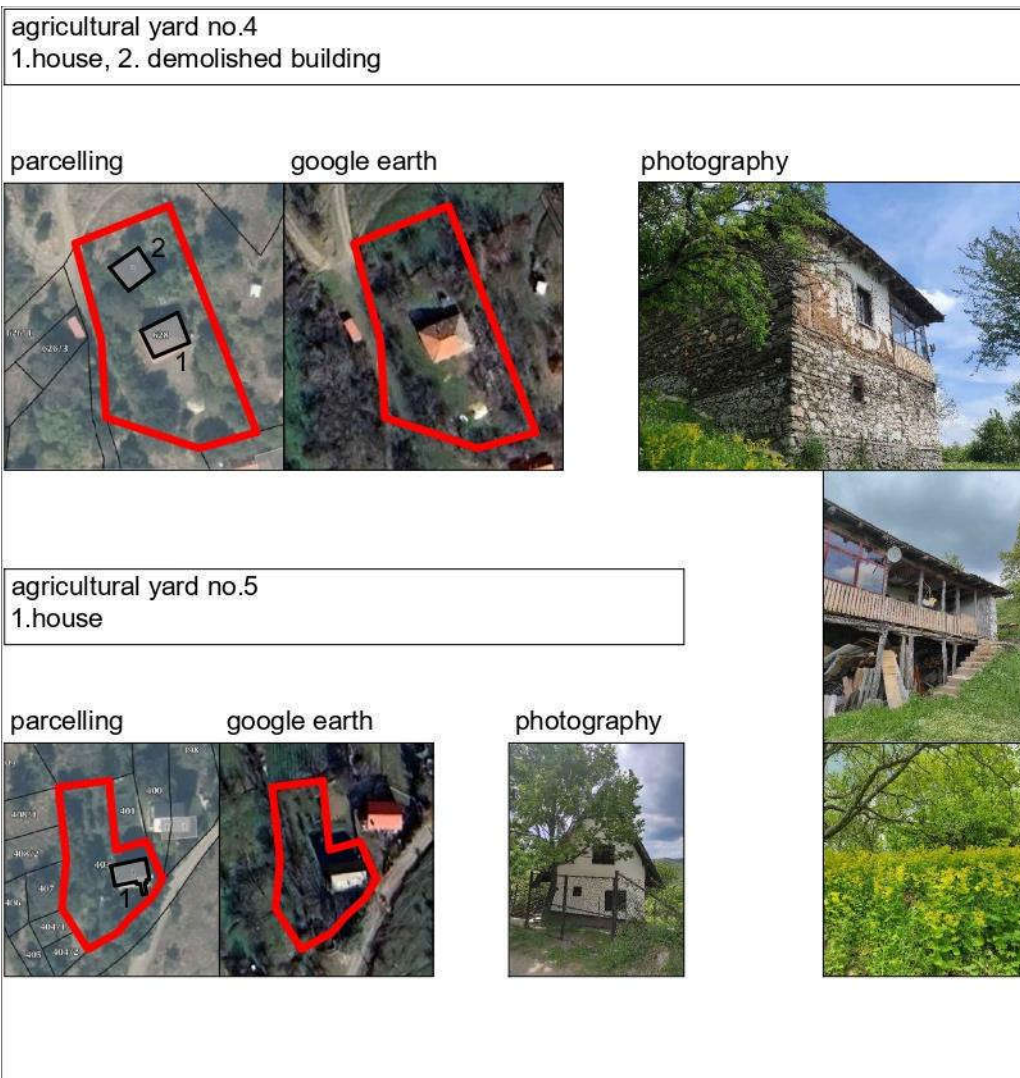


Figure 4. Organization and photos of several agricultural yards in the village of Brodec

Today in the context of agricultural yards, it is evident that those which remain functionally active in agricultural activity (mushroom production and raising goats) tend to occupy larger, consolidated plots. These expanded parcels are typically the result of the merging of two or three adjacent land units, allowing for a more spatially efficient organization of built and unbuilt elements, such as the residential building, economy facilities, and open space for gardening. This process of parcel aggregation reflects both a functional response to contemporary agricultural needs and a transformation in the spatial morphology of the rural fabric.

The households i.e. agricultural yards were analyzed in terms of the size, form, built surface, zoning of functional units, number and quality of the buildings, as well as the number and types of households. One of the tasks was to assess whether the households are oriented toward an agricultural economy or dependent on other jobs in the surrounding villages or the city of Skopje. The collected data for agricultural yards with households and buildings are given in the next table.

Table 4. Presentation of the current state and sustainability of analyzed agricultural yards with households and buildings the village of Brodec, (small agricultural yard – up to 1000m², large agricultural yard – over 1000m²)

agricultural yards with households and buildings	no.1	no.2	no.3	no.4	no.5
size of the agricultural yard - m ²	1982 (large)	2853 (large)	1131 (large)	1827 (large)	580 (small)
built surface of the agricultural yard - m ²	352 (18%)	345 (12%)	72 (6%)	87 (5%)	60 (10%)
number of parcels in the agricultural yard	3 irregular	3 irregular	2 irregular	1 irregular	1 regular
zoning of functions in the agricultural yards (resident./econom./garden)	1+1+1 yes	1+1+1 yes	1+0+0 no	1+0+1 no	1+0+0 no
number of buildings in the agricultural yards	5	7	1	1	1
quality of the buildings in the agricultural yard	new buildings	new buildings	new building	traditional building	new building
number of members in a household	2	3	2	1	1
household type	mixed	agricultural	non-agricultural	agricultural	non-agricultural

The table of the selected agricultural yards in Brodec reveals distinct patterns in parcel configuration, functional zoning, and building typology, reflecting varying degrees of continuity with traditional rural spatial models. The larger plots composed of few parcels exhibit a higher number of buildings, often including both residential and economic structures, and show more complex zoning of use that is clearly visible. In contrast, smaller plots represent the more compact model, composed of a single regular parcel with only one building and minimal built surface.

From an architectural perspective, the built-up surface percentage ranges from 5% to 18%, indicating a generally low-density development pattern consistent with traditional agricultural yards. The prevalence of new buildings in most yards, however, points to a trend of reconstruction or infill, with varying levels of sensitivity to traditional architectural character.

The household composition varies significantly, with larger, multifunctional yards typically supporting mixed or agricultural households, while smaller, mono-functional yards correlate with non-agricultural or single-person households. This suggests that functional diversity and spatial complexity in the yard are often tied to household size, activity type, and long-term occupation.

Overall, the analysis reveals a gradual spatial and functional transformation of agricultural yards, shaped by two dominant architectural and land-use patterns. The first transformation typology is characterized by the amalgamation of multiple parcels into a unified property structure, resulting in expanded yards with an emphasized economic function, typically supporting agricultural production, auxiliary buildings, and flexible working zones. This model reflects a horizontal intensification of rural land use, where spatial consolidation enables more

efficient organization of built and open areas. The second typology involves the retention of singular, compact plots with a minimal built footprint, often reprogrammed for residential or accommodation use. These yards shift away from productive agriculture toward domestic or tourism-oriented functions, representing a form of functional repurposing within a reduced spatial scale. Architecturally, such transformations suggest a redefinition of the yard, from a working agricultural compound to a residential enclave or potential rural hospitality unit, responding to emerging economic opportunities and demographic shifts.

In the village, there is still a small number of older traditional houses in stone and timber frame construction, most of which are in poor condition and non-functional. With their renovation, the traditional ambient values of the village would be restored.



Figure 5. Photos of traditional architecture in the village of Brodec

5. DISCUSSION

The agricultural yard as basic architectural unit, represents a fundamental spatial typology in rural settlements. In the village of Brodec, this typology reflects the complex interaction between topography, economy, climate, and vernacular building practices. Analyzing agricultural yards through the lens of architectural logic and sustainable development reveals both the challenges and potentials of reactivating these spaces in the contemporary rural context.

The observations in the village of Brodec reveal two dominant trends in the transformation of agricultural yards. The first involves parcel aggregation, where multiple parcels are combined into a larger economic unit, preserving the multifunctional role of the yard but often with the introduction of new buildings that deviate from the traditional vernacular style. The second is the reduction of function and scale, where smaller yards with minimal built structures are repurposed for non-agricultural uses, most often as weekend houses or tourist accommodations. These typological shifts raise architectural concerns. In many cases, new construction lacks contextual sensitivity that are ignoring site slope, traditional materials, or the proportionality of built-to-open space. Conversely, the yards that remain in their original form suffer from neglect, structural deterioration, or partial collapse. Without active use or strategic intervention, the spatial coherence and architectural identity of the agricultural yard risk being lost.

The sustainable potential of agricultural yards lies in their capacity to integrate ecological, economic, and cultural dimensions within a single spatial entity. The architectural and spatial configuration of agricultural yards in the village of Brodec, holds considerable potential for adaptive reuse in the context of rural tourism. The thick stone walls, simple construction techniques, and multifunctional interiors provide a strong foundation for restoration,

especially for purposes such as guesthouses, eco-lodges, or educational spaces that promote sustainable heritage experiences. Their compact size and integrated functions make them ideal for conversion into small-scale accommodations that retain the authenticity of the original structure while serving new contemporary uses. However, due to their limited scale and the fragmented nature of surrounding land plots, these yards are generally not suitable for more extensive agricultural production.

The transformation of these yards into tourist-use buildings would also require minimal land consumption, preserving the original footprint and respecting the ecological balance of the site. Additionally, this model supports the principles of heritage conservation through use, ensuring that preservation is economically and socially sustainable, rather than static and museum-like.

The agricultural yard, as seen in Brodec, is more than a unit of land, it is an architectural typology that encapsulates the rhythms of rural life, the ingenuity of vernacular design, and the principles of sustainable development. Its revival depends not only on restoration but on creative reinterpretation, where traditional spatial values inform new functions and programs. In this way, agricultural yards can evolve from forgotten spaces into architectural frameworks for a sustainable rural future.

6. CONCLUSION

The field analysis and historical data clearly indicate that Brodec is suffering from a multi-layered form of abandonment: physical, social, and institutional. The collapse of built structures, the absence of basic services such as water supply, sewage system, road maintenance, and the disappearance of social infrastructure (schools, shops, communal centers) have transformed Brodec into a space of memory rather than a space of daily life.

But, the case of Brodec demonstrates that agricultural yards, though often overlooked, are essential components of rural sustainability. Their architectural form and multifunctional logic, position them as strategic assets for revitalizing the rural space. When supported by appropriate infrastructure, sensitive policy, and community engagement, they can be transformed into hybrid systems that bridge heritage, productivity, and tourism. Sustainable development in Brodec and in similar rural contexts depends on this layered, adaptive understanding of the agricultural yard not just as a remnant of the past, but as a foundation for the future.

Future planning should incorporate interdisciplinary strategies that integrate conservation, sustainable land use and low-impact tourism to ensure a culturally and ecologically resilient future for the village of Brodec.

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