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# Post-Disaster Rural Revitalization or Spatial Displacement? Rural Resilience, Morphological Transformation and Socio-Cultural Sustainability in Gezin Village, Türkiye

**Cafer Giyik**

Elazığ Provincial Disaster and Emergency Management Directorate–AFAD, Elazığ 23040, Türkiye; cgiyik@gmail.com

**Abstract**

Post-disaster reconstruction is often framed as an opportunity to revitalize rural areas, yet its implications for the social and cultural sustainability of traditional rural morphology and identity remain contested. This study examines the spatial transformation of Gezin village, located on the eastern shore of Lake Hazar in Maden, Elazığ (Türkiye), on the East Anatolian Fault Zone, following the relocation and reconstruction processes triggered by successive earthquakes. Using the Hierarchical Morphological Analysis Method, the pre-disaster traditional settlement and the post-disaster residential areas were compared at the building, structure, parcel/building-block, and macroform levels, drawing on field studies, TOKİ housing plans, Microsoft Building Footprints, HGM orthophotos, and Sentinel-2 land use/land cover data processed in ArcGIS Pro 3.5.0 and QGIS 3.44.11. The findings reveal a two-directional outcome: the transition from adobe and masonry dwellings to reinforced-concrete and light-steel housing increased earthquake resilience at the building scale, but eliminated the production-oriented housing typology—courtyard, barn, hayloft, and storehouse—and replaced the topography-compatible organic fabric with compact, planned blocks. Between 2017 and 2025, built-up areas expanded by about 33% (from 136 to 182 ha), while cultivated land decreased by 66.4 ha and grassland by 73.3 ha. The study concludes that context-detached reconstruction functions as spatial relocation and identity loss, and advocates place-based, sustainable reconstruction approaches.

**Keywords:** rural resilience; sustainable rural development; post-disaster reconstruction; morphological transformation; rural identity; housing typology; socio-cultural sustainability; rural distanciation; Gezin village

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Academic Editor: Angel Paniagua

Received: 29 June 2026
Revised: 24 July 2026
Accepted: 24 July 2026
Published: 28 July 2026

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## 1. Introduction

In recent years, rural areas have been experiencing a multidimensional transformation process not only due to population loss [1], contraction in agricultural production areas [2] and difficulties in accessing services on an equitable basis [3], but also, led above all by climate change [4,5], due to disaster-induced forced displacement [6], tourism pressure [7] and public policies [8]. This transformation makes significant contributions to the revitalization of rural areas and to the achievement of sustainable rural development [9–12]. However, owing to this transformation, it may also give rise to new vulnerabilities in local identity [13], traditional building culture [14], modes of production [15], and the continuity of the rural landscape [16,17]. For this reason, rural revitalization processes should be assessed not only through new housing production, infrastructure improvement, or the

renewal of the physical environment, but also through the historical, cultural, economic, and ecological relations that local communities establish with place [18], dimensions that are central to the social and cultural pillars of sustainable rural development.

In this context, rural resilience should not be evaluated merely as the improvement of the physical capacity of settlements after a disaster. Rural resilience is a process in which the continuity of local knowledge accumulation, traditional construction techniques, production-oriented life practices, social solidarity networks, and place-based spatial organization is considered together [19]. Therefore, although construction processes in post-disaster rural areas make positive contributions to engineering-wise flawless and safer housing production and to physical resilience, their relationship with rural life practices remains a contested issue. Standardized architectural plans driven by public policies, the abandonment of the use of building materials compatible with the natural environment, and the exclusion of basic components such as the courtyard, barn, hayloft, storehouse, and agricultural production areas that support rural life and economy interrupt socio-spatial continuity in rural settlements [20].

These spatial changes, together with socio-cultural transformation, may influence a sense of place. According to the theory of place attachment, communities develop emotional, functional and identity-based bonds with their physical environment [21]. For this reason, housing in particular, along with home extensions and the settlement fabric, make significant contributions to the formation of individual and collective identity [11,13,18]. Socio-spatial approaches also highlight the way in which place and society influence one another [22,23]. Settlement patterns are shaped through the natural environment, daily production and the practices of social life, whilst at the same time contributing to the reconfiguration of these practices [9,11]. In this context, morphological transformation occurs as a result of socio-cultural processes. Changes in building materials, housing typologies, plot layout and the macroform of the settlement are reshaping place-specific practices and meanings. Consequently, the four-level hierarchical morphological analysis employed in this study is used not only to document physical change, but also to track the spatial conditions underpinning place attachment and the socio-spatial organisation of rural life at each level.

In recent years, resilience has become a research field that attracts increasing attention owing to its role in reducing the natural and human-induced risks that disrupt the existing state of settlements against disasters [24]. The term resilience is derived from the Latin word "resilio," meaning to bounce back [25,26], and it denotes the ability of a settlement system and of all the socio-ecological and socio-technical networks that constitute it to maintain or rapidly recover their desired functions in the face of a disturbance, to adapt to change, and to rapidly transform the systems that limit their current or future adaptive capacity, across temporal and spatial scales [27]. In the use of the concept, there is a rather broad research field directed at urban settlements and at revealing the social, environmental, administrative, and economic resilience of these settlements [28]. By contrast, research on the resilience dimension of rural settlements is limited. In this regard, investigating how rural settlements of different types cope with hazards and revealing the multiple pathways of rural settlement transformation is an important research field [29]. Therefore, rural resilience requires a holistic approach that addresses not only the durability of physical structures but also local knowledge accumulation, traditional building culture, social solidarity networks, and the continuity of production systems together [30].

In this context, the rural settlement system, which is an important carrier of the relationship between rural communities and rural land use, also possesses a fundamental resilience property. However, today rural settlements face pressures and crises such as serious labor migration, inefficient/careless land use, industrial decline, and environmental

pollution [30]. In addition, acute and chronic stresses adversely affect the sustainability of rural settlements with each passing day. Enhancing the resilience of rural settlements, beyond being merely a structural arrangement, can make significant contributions to sustainable development.

Therefore, while the post-disaster period is regarded as an opportunity for the revitalization of rural areas, in another respect it is a process that causes the loss of traditional rural morphology, local identity, and cultural memory. For this reason, it shows that rural revitalization does not produce positive results when it is detached from its local context; on the contrary, interventions disconnected from the local context may create a new process of spatial distancing, identity loss, and separation from production in rural areas. Therefore, sustainable resilience in post-disaster rural settlements should be addressed not only through structural safety and technical standards, but also through the modes of production of local communities, their traditional architectural practices, their everyday life organizations, and the relations they establish with the rural landscape.

This study aims to reveal the effects of the post-earthquake relocation and reconstruction processes on the spatial morphology, residential architecture, rural production practices, and resilience capacity of Gezin village, whose history extends to the Middle Ages and which is located on the shore of Lake Hazar in Elazığ. Although the study focuses on a local area, owing to the earthquakes occurring on the EAFZ, numerous rural settlements have either been relocated or have had their physical resilience increased through reconstruction processes. In this regard, while acknowledging the gains provided by the new residential areas built after the disaster in terms of physical/structural safety, the study aims to reveal the transformative effects of this process on the traditional rural fabric, local material culture, production-oriented housing typology, and rural identity.

## 2. Materials and Methods

In this study, the Hierarchical Morphological Analysis Method was adopted to reveal the morphological transformation processes of the rural settlement changing along with post-disaster reconstruction processes, the transformation of rural architecture, and the changes occurring in the settlement macroform. This approach treats settlements as dynamic socio-spatial organisms and examines the built environment in hierarchical layers that encompass one another from the micro scale to the macro scale [31]. For this reason, within the scope of the study, the pre-disaster traditional rural settlement fabric of Gezin village and the new residential areas built after the disaster were examined comparatively at the levels of building, structure, parcel/building block, and macroform.

Morphological analysis is a method that examines the physical form and transformations of settlements, as well as the factors and processes that lead to these changes over time [32]. Morphological studies may be carried out for descriptive purposes; to assess the impact of past theories; or to determine future town planning guidelines, for example [33]. The Hierarchical Morphological Analysis approach is an analytical method that examines the settlement fabric not at a single scale, but across multiple interconnected scales [34]. In the Caniggia tradition, which forms the basis of this approach, an interlinked series of scales is defined, ranging from the spatial element (elementare)—the smallest structural unit—up to the levels of the building, plot, street, urban fabric, settlement and district [34]. Each level of scale is formed by the combination of elements at the level immediately below it, whilst also functioning as part of the whole at the level immediately above it; in this way, a continuous reciprocal relationship is established between the part and the whole [31].

The most distinctive feature of this approach is that, rather than treating the settlement fabric as a static element, it regards it as a dynamic structure that has taken shape step by step over the course of history [31]. Accordingly, a building type evolves over time—

through repetition, diversification and transformation—into a fabric, and the fabric, in turn, comes together to form the settlement as a whole. For this reason, the method does not merely describe the existing physical form; it also aims to reveal the historical layers and typological transformations that have led to the emergence of this form [35].

In the first stage of the Hierarchical Morphological Analysis approach, building material, structural system, construction technique, and architectural character were examined at the building level. At this stage, the adobe and masonry rural dwellings that constitute traditional architecture were compared with the reinforced-concrete, light-steel, and standard-plan disaster housing built after the disaster. Thus, traditional housing using local materials and uniform-plan housing were compared in terms of their contributions to physical resilience. In the second stage, housing plan types, interior space use, and functional parcel use were analyzed at the structure level. In the third stage, the traditional settlement fabric and the post-disaster new residential areas were compared at the parcel and building-block level in terms of open space use, parcel organization, building density, courtyard use, and ownership pattern. In the fourth stage, the changes occurring in the settlement form and land use structure of Gezin village were analyzed at the macroform level (Table 1).

**Table 1.** Data Sets Used in the Study and Hierarchical Analysis Levels.

| Data Analysis Level | Spatial/Architectural Element Analyzed | Data | Source |
|---|---|---|---|
| Building Level | Building material, structural system, and architectural characteristics | Microsoft Building Footprints (building-footprint vector data; accessed in 2025) | Field observations https://planetarycomputer.microsoft.com/dataset/ms-buildings (accessed on 15 March 2025) |
| Structure Level | Housing plan types, number of floors, functional spatial organization (barn–dwelling relationship). | TOKİ housing plans, measured-survey drafts of traditional dwellings (accessed in 2025) | https://www.toki.gov.tr/ (accessed on 10 January 2026) |
| Village/ Neighborhood Level | Parcel/building-block use, Building density | Parcel boundaries (TKGM cadastral data; accessed in 2025) Village boundary | Field observations https://parselsorgu.tkgm.gov.tr/ https://www.harita.gov.tr/urunler/hava-fotografi-tarama/11 (accessed on 18 February 2026) |
| Macroform Change | Rural morphology change | HGM, Digital Elevation Model (DEM 5 m resolution), Sentinel-2 Land Use/Land Cover (10 m resolution; annual data, 2017–2025) Provincial boundary District boundary | https://livingatlas.arcgis.com/landcover/ (accessed on 15 March 2025) https://www.harita.gov.tr/urun/sayisal-yuzey-modeli-5-m-seviye-0-sym5-l0-/1 https://www.harita.gov.tr/urun/turkiye-mulki-idare-sinirlari/232 (accessed on 1 May 2025) |

Within the scope of the research, data sets from different sources and auxiliary geographic data sets were used to determine the transformations occurring in post-disaster rural space and to analyze the spatial change. The data sets at the building level were obtained as a result of field studies. In the analyses at the structure level, the disaster housing plans of the Housing Development Administration (TOKİ), measured-survey drafts of traditional dwellings, and housing plan schemes were used. The data used in the analyses at the parcel and building-block level were obtained from the data of the General

Directorate of Land Registry and Cadastre, HGM orthophotos, Google Maps imagery, Microsoft Building Footprints, and field studies. For determining the macroform and land use change, the Sentinel-2 10-Meter Land Use/Land Cover data set was used (Table 1).

ArcGIS Pro 3.5.0 and QGIS 3.44.11 software were used to process and map the data obtained from various sources and field studies and to carry out the spatial analyses. All the obtained data sets were transformed into the WGS 1984 UTM Zone 37 coordinate system, clipped within the boundaries of the study area, and classified according to the analysis levels. Thus, the traditional settlement fabric, post-disaster built-up areas, plan types, and land use classes were analyzed comparatively. In this way, the post-disaster morphological transformation process of Gezin village was revealed holistically, together with its multi-layered effects extending from the building scale to the settlement macroform.

*Location and Boundaries of the Study Area*

Gezin village is a rural settlement in the Maden district of Elazığ province, located in the Upper Euphrates Section of the Eastern Anatolia Region of Türkiye. In terms of geographical location, it lies between 38°30′ north latitude and 39°30′ east longitude. Gezin is situated on the eastern shore of Lake Hazar, to the southeast of the Elâzığ provincial center and to the west of the Maden district. The location of Gezin village on the shore of Lake Hazar, the surrounding mountainous-topographic structure, and the traditional settlement fabric that developed in connection with the valley floor have enabled it to establish a strong spatial relationship with both the natural environment and rural production practices. For this reason, Gezin is a unique study area in which the relationships among the natural environment, rural landscape, traditional residential architecture, rural tourism, and disaster risk can be observed together, and not merely an administrative rural settlement unit (Figure 1).

One of the foremost reasons for selecting Gezin village as the research area is that the region has undergone a construction process that departs from traditional rural settlement characteristics. In addition, the settlement is located on the East Anatolian Fault Zone, one of the most active tectonic lines in Türkiye, and has experienced numerous disasters. The East Anatolian Fault Zone has produced numerous earthquakes of varying magnitudes in both historical and recent periods; these earthquakes have caused significant damage particularly to the adobe, stone, and masonry building stock located in rural settlements. Indeed, the earthquakes that occurred in the region—the 1998 Adana-Ceyhan Mw 6.2, the 2003 Bingöl Mw 6.3, the 2003 Tunceli-Pülümür Mw 6.0, the 2007 Elazığ-Sivrice Mw 5.5 and Mw 5.7, the 2010 Elazığ-Kovancılar Mw 6.1, the 2020 Sivrice Mw 6.5, and the 2023 Kahramanmaraş earthquakes centered on Pazarcık and Elbistan with magnitudes of Mw 7.8 and Mw 7.6—demonstrate that the East Anatolian Fault Zone is a tectonic system producing high seismic hazard at the regional scale [36] (Figure 1).

This earthquake history has directly affected the development and spatial transformation process of Gezin village. In particular, the fragility of the adobe, stone, and masonry structures that constitute the traditional rural housing fabric against earthquake effects has accelerated the post-disaster reconstruction and relocation processes in the village. In this process, alongside the traditional intra-valley settlement fabric, disaster housing built in different periods, reserve settlement areas, and new building blocks have emerged. Therefore, Gezin village is regarded as an important case area in which the effects of post-disaster rural reconstruction can be analyzed not only at the building scale but also on the settlement macroform, rural landscape, land use, and traditional housing culture.

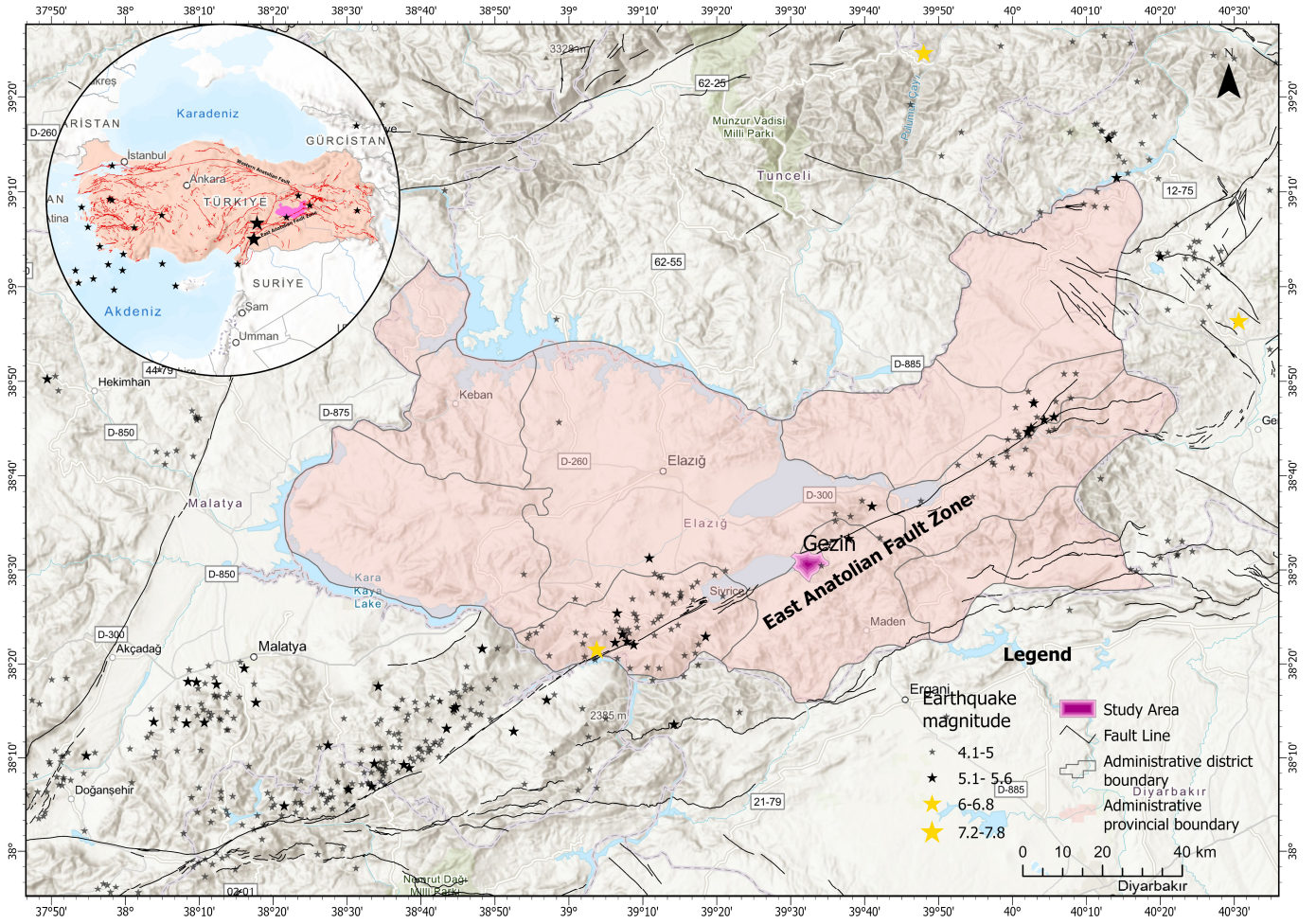


**Figure 1.** Location of Study Area.

## 3. Results

In general, the results reveal two-directional and contradictory spatial outcomes in post-disaster rural land use in terms of resilience and sustainability. On the one hand, engineered reinforced-concrete and light-steel structures, compared with traditional adobe and masonry structures, have played an important role in reducing disaster risks by increasing physical resilience. On the other hand, the abandonment of traditional production areas and the construction of structures exhibiting urban characteristics have led to the exclusion of the basic spatial components of everyday rural life such as the courtyard, barn, hayloft, and storehouse from the housing organization, and to the replacement of the topography-compatible traditional settlement fabric with standard building blocks. At the macroform level, disasters and tourism activities have caused the expansion of built-up areas and the emergence of pressure on the sustainability of rural production landscapes such as agricultural and rangeland areas. Within this framework, the findings are addressed in four stages, from the building level to the macroform level, in accordance with the Hierarchical Morphological Analysis Method.

### *3.1. Morphological Transformations Occurring at the Building Level*

Rural dwellings are the most fundamental elements reflecting the basic structural components that form the built environment, the material culture, and the manner in which these materials are brought together. In many rural settlements, the elements that constitute the natural environment determine the residential architecture. In Gezin village, the rural

dwellings that emerged as a cultural accumulation throughout the historical process have almost completely disappeared after the disasters that occurred (Figure 2).

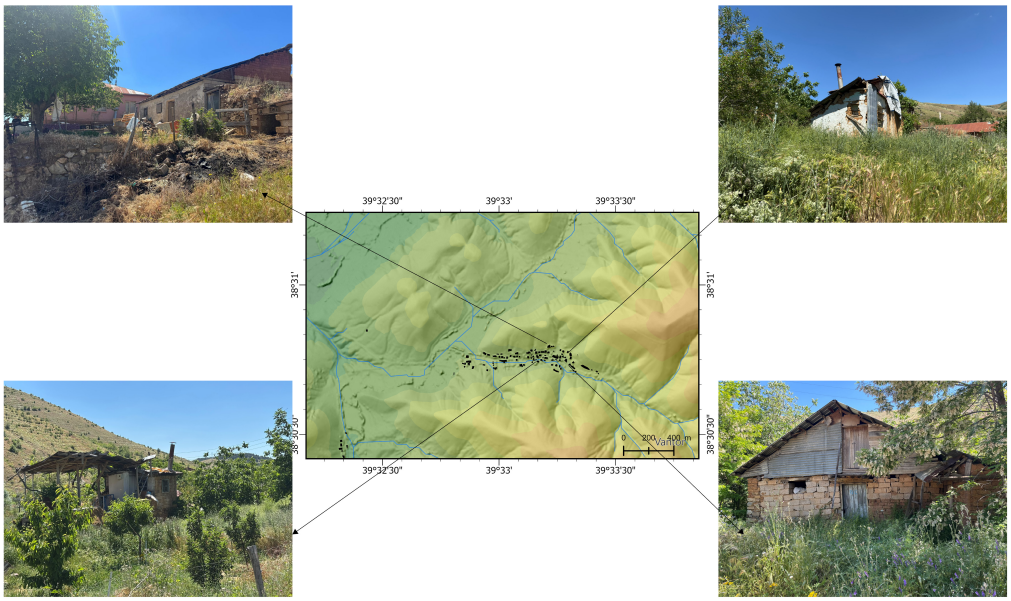


**Figure 2.** Historic Settlement Area and Dwelling Types.

Almost all of the rural dwellings built in the periods without public intervention after the disasters were constructed in a sheltered area within the valley. The building material of these dwellings was constructed entirely from adobe, stone, and timber-laced masonry elements obtained from the immediate surroundings. The rural dwellings built in the traditional fabric consist of thick adobe blocks suitable for the microclimatic conditions of the region and the stone bases supporting them. The hipped roof of the rural dwellings is covered with sheet-metal material in accordance with the climatic conditions of the region.

By virtue of its founding location, the village is situated on the EAFZ. The earthquakes that have recently occurred on the EAFZ have caused major destruction in rural dwellings. In particular, after the earthquake with a magnitude of Mw 5.9 that occurred on 21 February 2007 at 13:05 local time, significant damage occurred in adobe and masonry structures. As a result of the disaster, reconstructed housing mostly took place away from Gezin village (Figure 3).



**Figure 3.** Earthquake-Damaged Traditional Dwellings.

In this regard, 80 disaster dwellings were built by the Housing Development Administration in two separate reserve areas on the eastern shore of Lake Hazar. These dwellings are planned structures that are fully engineered, replacing the traditional material culture. All of the dwellings are structures with reinforced-concrete structural systems built to a single, uniform architectural plan (Figure 4).



**Figure 4.** The First Disaster Housing Built in the Region After the 2007 Earthquake.

The dwellings built after the 24 January 2020 Elazığ earthquake and the 6 February Kahramanmaraş earthquakes were shaped with load-bearing elements normalized so as to minimize vertical and horizontal seismic loads, factory-produced light-steel profiles, and modular "Agaplar System" framework elements. The roofs are galvanized corrugated steel supported by timber trusses, with exterior wall claddings of corrugated steel, selected in view of the region's climatic conditions (Figure 5).

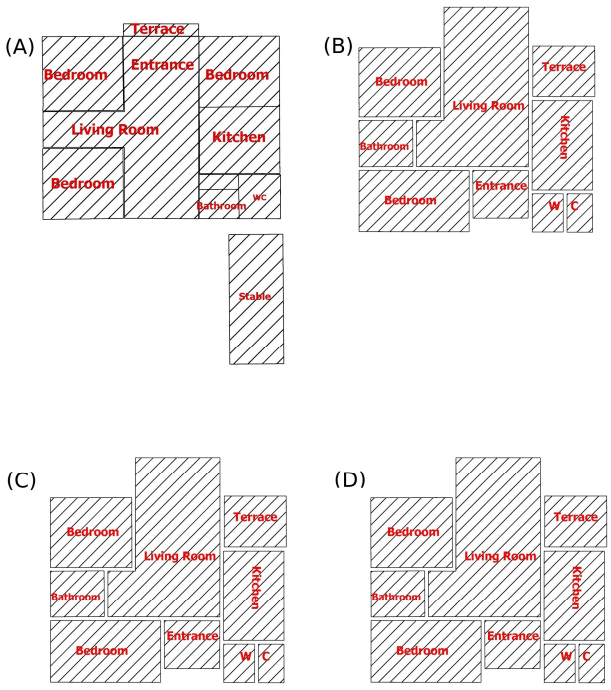


**Figure 5.** Housing Plans: (**A**) pre-earthquake dwelling and its annex; (**B**) ground-floor plan of the two-storey 2008 dwelling; (**C**) light-steel construction dwelling; (**D**) plan of the reinforced-concrete dwelling built after the 2023 earthquakes. The barn, hayloft, and storehouse annexes present in the pre-earthquake dwelling (**A**) are absent in the post-disaster plans (**B**–**D**).

The findings obtained at the building level show that the change the region has undergone throughout the historical process has increased physical resilience. In this regard, it shows that adobe-masonry structures underwent a transformation first toward reinforced-concrete disaster housing and then toward the industrial light-steel modular system. While this situation increases resilience to seismic disasters at the building level in rural areas, it also shows that the building materials and housing type used have become uniform and that the influence of the natural environment on rural housing production has disappeared.

### *3.2. Typological Transformation and Functional Adaptation*

In the analyses carried out at the structure level, which constitute the second stage of the typomorphological analyses, the interior space layout of rural dwellings, the functional partitioning of interior space, and the dialectical link of this spatial configuration with socio-economic life practices are revealed. A comparison of the traditional housing typology with the post-disaster uniform dwellings in Gezin village reveals a typomorphological transformation from a production-oriented rural housing character toward a consumption- and shelter-oriented urban model.

In this regard, the pre-disaster traditional rural housing architecture was shaped mainly to support agriculture and animal husbandry and to contribute to the maintenance of the household's livelihood activities. Beyond being merely spaces where the need for shelter is met, traditional dwellings have an integrated fabric in which agricultural products are stored, and animal husbandry activities are carried out together (Figure 6).



**Figure 6.** Functional Spatial Organization of Traditional Rural Dwellings.

The boundaries between the interior and exterior spaces of traditional dwellings are clearly separated. Generally, the lower floors or rear perimeters of the structures are directly integrated into the dwelling body with pantry, hayloft, and barn (outbuilding) units. This situation has enabled the human-space-nature relationship to merge within a flexible and organic typological scheme.

In the rural dwellings built after the disasters, however, this situation shows that standardization and dwellings with urban functions have been applied to rural areas. These dwellings are single-story dwellings designed according to a 2 + 1 or 3 + 1 plan consisting of 2 or 3 rooms shaped around a corridor axis, a living room, a kitchen, a bathroom, and a toilet. This situation shows that the dwelling, beyond merely resembling the apartment-flat plan built in urban areas, has been applied to the rural area without any

change to the plans. Furthermore, the production units such as the barn, pantry, grain store, or hayloft that form the basis of the economic cycle in traditional housing architecture have been completely removed. The dwelling, separated from agricultural production processes, has been transformed into a space where only everyday life is maintained and the need for shelter is met.

Furthermore, when the infrastructure characteristics of the dwellings built after the disaster are examined, it is observed that the socket and lighting circuit distributions and the electrical distribution panels were designed to suit the urban consumption standards for white goods and electronic devices of each interior space (living room, kitchen, rooms). The interior space use shaped around the kitchen in the interior of the traditional dwelling has given way to homogeneous, rational, and sharply delineated interior spaces organized evenly by electrical and heating installation networks. While this situation supports the production of high-standard, modern, and earthquake-resistant housing for the household, it causes the disappearance of the traditional rural residential architectural heritage.

### *3.3. Transformation of Fabric and Pattern*

When the built environment of Gezin village is examined, it is observed that the element systems composed of parcel, building block, and street fabric were produced and transformed over time through disasters and institutional planning decisions. The initial settlement fabric of Gezin village—the use of rooms, structures, and courtyards—had an organic development hierarchy suited to the topographic structure. During this earlier time, the producers and users of the settlement were the individuals living in rural households. The building-block use that constitutes the traditional fabric is irregular and amorphous in character. This situation is a result of the flexible dialectic established between the topography and the users in spatial use, rather than of design. Parcel subdivision is shaped according to ownership status, slope, and aspect. The street system of Gezin village, established within the valley, is in a form suited to the topography. Although this morphological situation causes a low level of connection with the main transportation axes at the meso scale, it has contributed to the settlement being sheltered against external threats and hazards. However, as a result of the earthquakes experienced in the region, the involvement of institutional planning actors in the space and earthquake-resistant housing production policies accelerated the transformation of this organic rural settlement fabric (Figure 7).

In this transformation, in contrast to the parcel use bound to the amorphous ownership subdivision in Gezin village located within the traditional valley boundaries, a new housing fabric clustered within compact building blocks with rational boundaries has emerged.

As a result of the transformations that institutional interventions created in the settlement fabric after the disasters, four different settlement patterns have emerged. The first of these patterns is the old settlement pattern established within the abandoned valley. This area was largely destroyed in the earthquakes that occurred in 2007 and began to largely lose its settlement function. While in the first settlement pattern the dwelling, courtyard, barn, hayloft, storehouse, and small-scale production areas were present together, this integrated rural spatial organization has been fragmented in post-disaster new housing production. The second pattern is the new housing built with public support after the 2007 earthquakes. These dwellings formed a repetitive housing order based on standard plans within building blocks with distinct boundaries. The courtyard, production area, and outbuilding units, which are inseparable parts of the traditional housing typology, have largely disappeared in this new order. Thus, the parcel, ceasing to be a multifunctional living space that supports rural production activities, has been transformed into green areas close to urban norms defined around the dwelling (Figure 7).

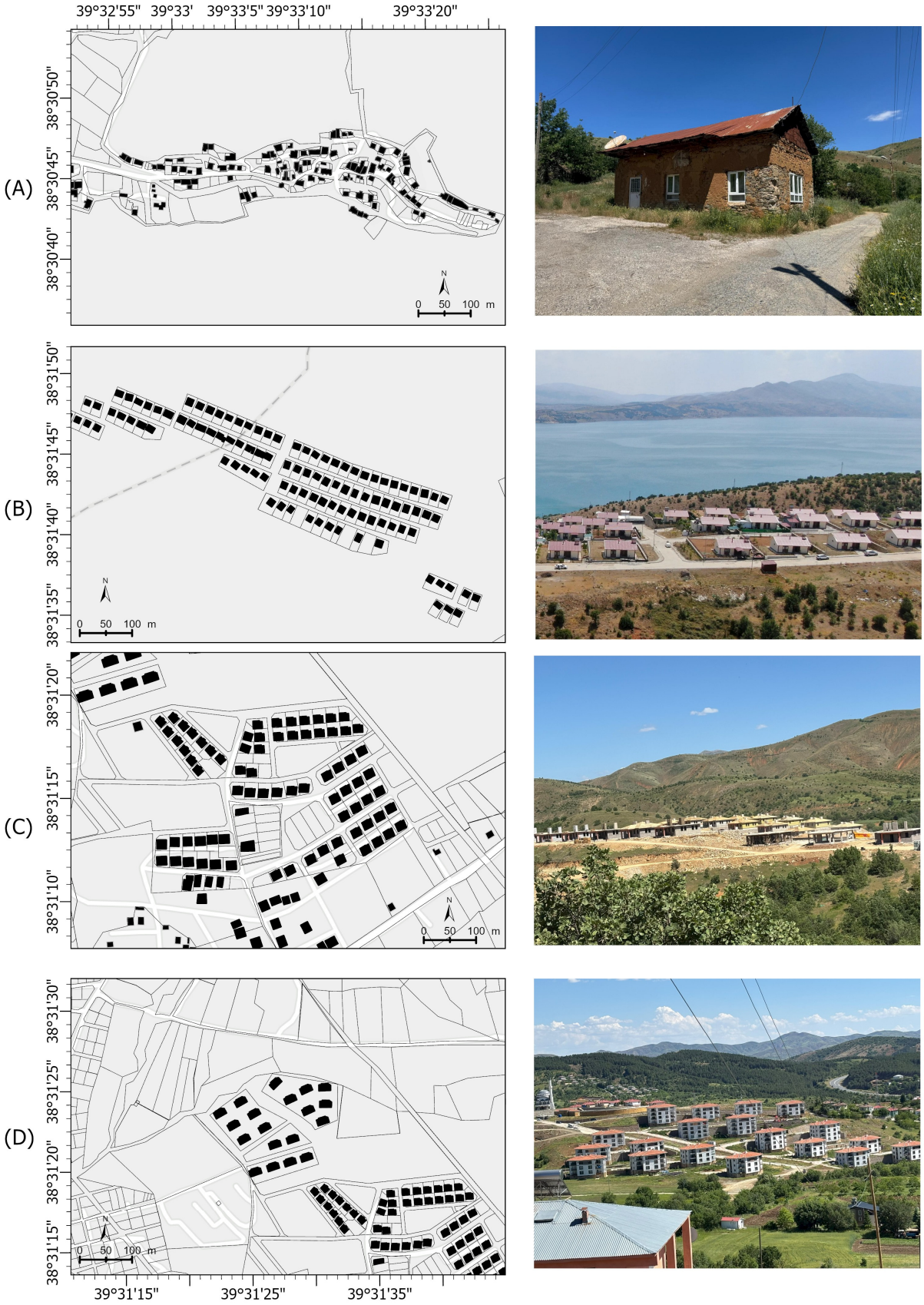


**Figure 7.** Transformation of Dwelling Types in Gezin Village: (**A**) old adobe (mudbrick) dwelling; (**B**) lake-view single-storey light-steel dwelling; (**C**) single-storey reinforced-concrete dwelling; (**D**) apartment blocks.

The third pattern is the new residential areas built in reserve areas after the 24 January 2020 Sivrice earthquake and the 6 February 2023 Kahramanmaraş earthquakes. First, the structural system, material use, and placement within the parcel of the lake-view dwellings whose construction began after the Sivrice earthquake were determined according to more standardized technical criteria. This situation is evaluated positively in terms of the earthquake resilience of the dwellings. In particular, the structures were built with steel construction material owing to the flexibility and lightness properties of the material used. This contributes to earthquake resistance due to the high flexural capacity of steel framing. In addition, because it is much lighter than reinforced-concrete structures, it minimizes the load on the building during an earthquake and greatly reduces the risk of collapse. However, the insufficient inclusion of the production spaces that ensure the continuity of the rural household economy in the housing plan and parcel organization has weakened the spatial counterpart of traditional rural life practices (Figure 7).

After the 6 February 2023 Kahramanmaraş earthquakes, light-steel housing production became less used in favor of reinforced-concrete structures. One of the main reasons for this change is that users stated that light-steel structures are not sufficiently suited to local climatic conditions, thermal comfort expectations, and traditional housing-use habits. Perceptions regarding interior comfort, particularly in the summer and winter months, directly affected satisfaction with the building material. The low level of user satisfaction shows that light-steel dwellings should be evaluated not only in terms of engineering performance but also in terms of social acceptance, climatic compatibility, and everyday use practices (Figure 7).

The fourth pattern is the new settlement area consisting of multi-story housing blocks and planned building blocks. This represents a marked departure from the rural housing typology and a transition to the urban housing production model in terms of building scale and settlement order. This shows that the post-disaster reconstruction process in Gezin village has transformed not only the housing type but also the scale, silhouette, and rural spatial character of the settlement.

In conclusion, the post-disaster reconstruction process in Gezin village has created a strong morphological transformation from an organic, topography-compatible, and production-oriented traditional rural settlement fabric toward standard, rational, compact, and shelter-centered new housing patterns. Although this transformation has provided significant gains in terms of earthquake safety and structural resilience, it has led to marked losses in terms of rural identity, traditional housing typology, courtyard use, and the continuity of production spaces.

### *3.4. Spatial Relocation and the Disappearance of the Traditional Rural Settlement*

In post-disaster rural settlements, the transformation has involved marked changes not only at the building scale but also on the settlement macroform and the rural landscape. In this context, Gezin village is undergoing a multidimensional transformation owing to both the earthquakes and the tourism activities around Lake Hazar.

The analyses carried out using Sentinel-2 satellite imagery (2017–2025) show that the transformation experienced in Gezin village changed not only at the building scale but also in the settlement macroform (Figure 8).

The built area, which was 136.09 ha in 2017, rose to 182.12 ha in 2025. In the region, which experienced two major earthquakes in approximately eight years, there has been an increase in construction of approximately 33.82%. The main reason for this situation is the construction of numerous post-disaster new dwellings in the region and the fact that it has begun to receive migration from these nearby rural settlements. This increase became particularly evident after 2020. Post-earthquake housing production and resettlement

policies accelerated this change. By contrast, in the same period, agricultural areas declined from 639.0 ha to 572.6 ha; thus, a decrease of approximately 66.4 ha occurred. Similarly, rangeland areas fell from 1948.7 ha to 1875.5 ha, and a loss of approximately 73.3 ha emerged. This change shows that the post-disaster expansion of the settled area creates pressure on the rural production landscape. The decrease in agricultural and rangeland areas in the Gezin rural settlement indicates not merely a change in land use but also a change in rural everyday life practices and rural identity (Table 2).

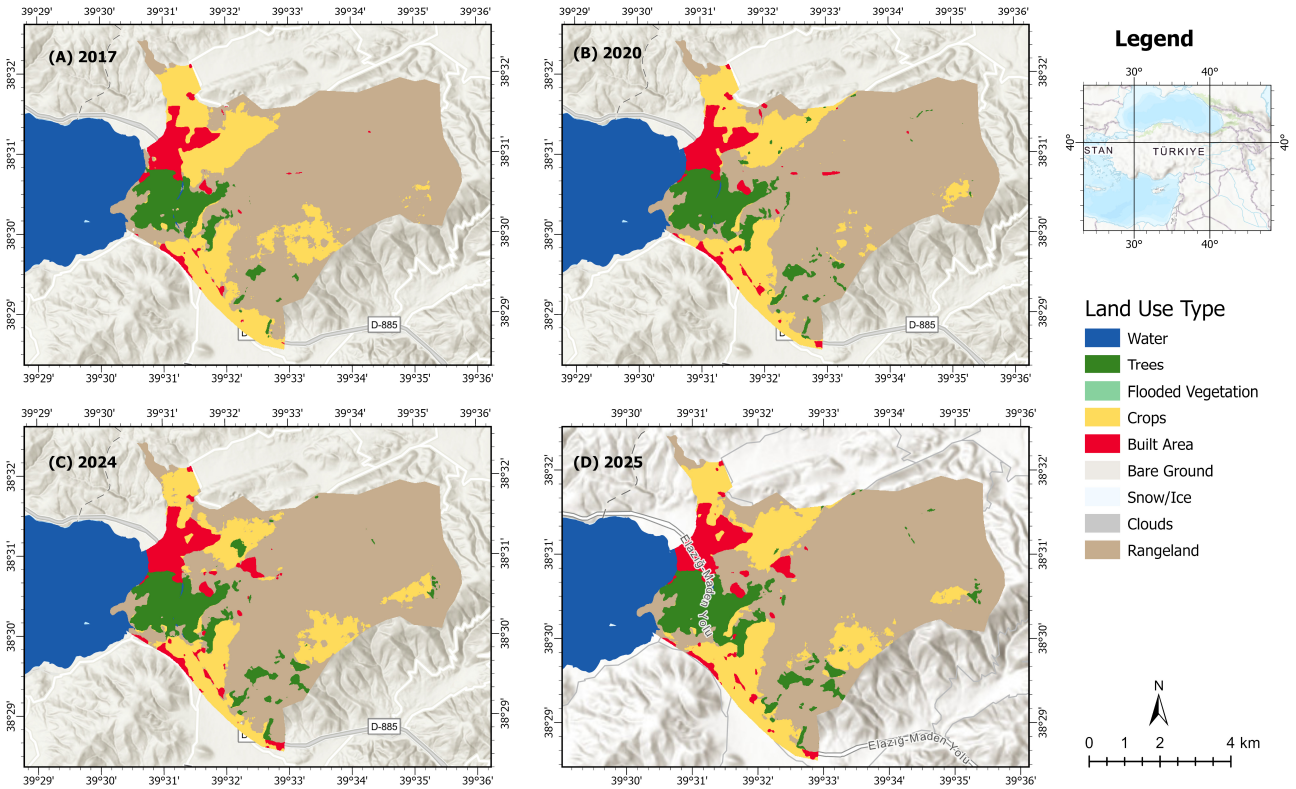


**Figure 8.** Land Use/Land Cover Change in Gezin Village (2017–2025).

**Table 2.** Land Use/Land Cover Areas by Class in Gezin Village (2017–2025).

| Years | Water | Trees | Crops | Built Area | Bare Ground | Rangeland | Total |
|---|---|---|---|---|---|---|---|
| 2017 | 210.73 | 221.77 | 639.02 | 136.09 | 1.34 | 1948.71 | 3157.66 |
| 2018 | 212.3 | 229.96 | 501.24 | 148.02 | 0.35 | 2065.79 | 3157,66 |
| 2019 | 218.07 | 262.17 | 575.37 | 155.43 | 0.11 | 1946.51 | 3157,66 |
| 2020 | 220.94 | 274.18 | 515.04 | 156.9 | 0.02 | 1990.58 | 3157,66 |
| 2021 | 221.37 | 264.77 | 690.66 | 171.5 | 0.68 | 1808.68 | 3157,66 |
| 2022 | 221.96 | 277.52 | 660.72 | 165.22 | 0.14 | 1832.1 | 3157,66 |
| 2023 | 220.15 | 289.79 | 515.99 | 162.92 | 0.18 | 1968.63 | 3157,66 |
| 2024 | 222.49 | 292.16 | 509.1 | 189.88 | 0.19 | 1943.84 | 3157,66 |
| 2025 | 218.38 | 290.99 | 572.64 | 182.12 | 0.01 | 1875.45 | 3139.59 |

*Note: Values denote the area of each land use/land cover class in hectares (ha), derived from the Sentinel-2 10 m annual land use/land cover dataset (2017–2025).*

In the 2017–2025 period, there was a significant increase in the proportion of wooded areas. Over the eight-year period, wooded areas rose to 291.0 ha. Although the increase in wooded areas is important for the rural landscape, it should not be regarded as an area that would compensate for the decrease in the production areas, namely agricultural and rangeland areas (Figure 9).

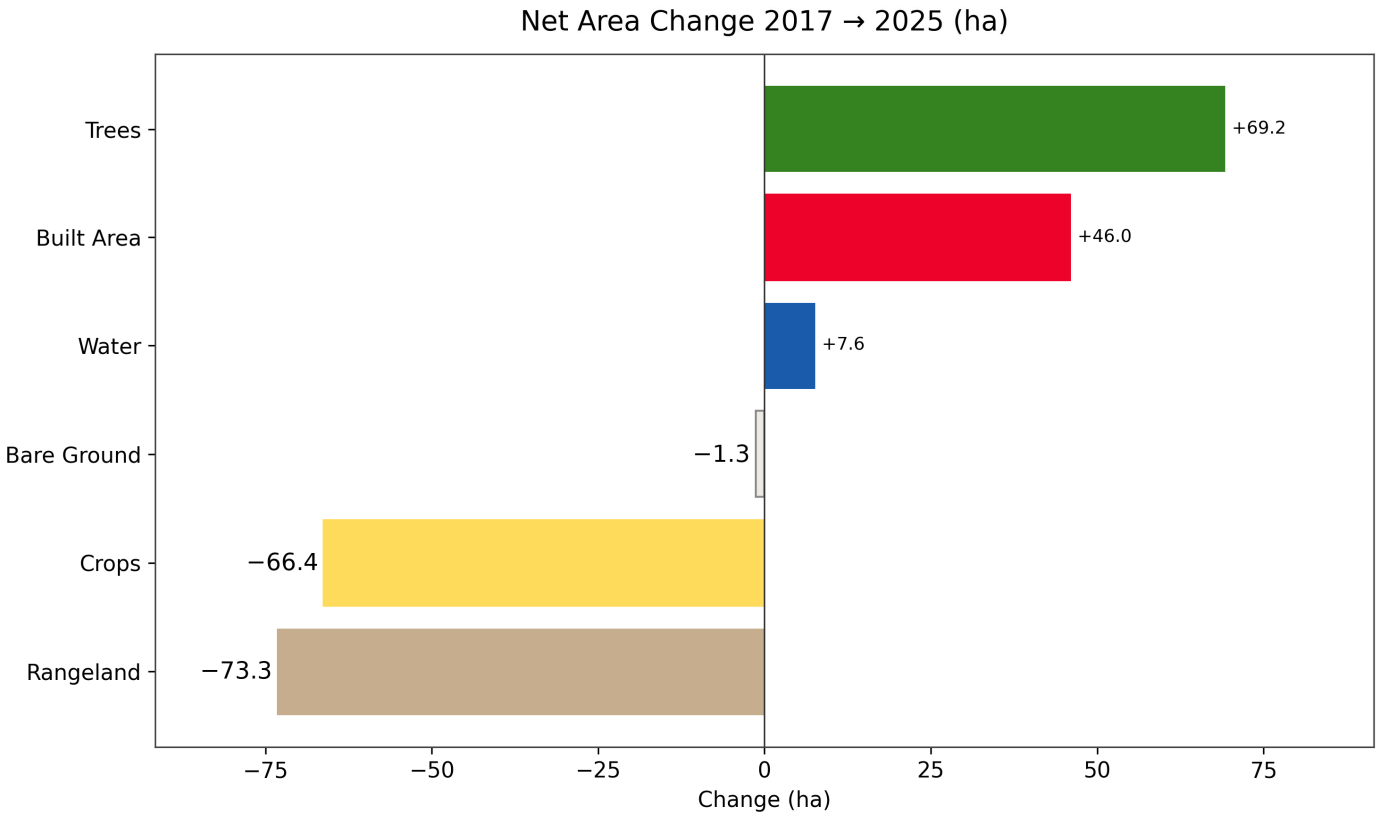


**Figure 9.** Annual Trends in Land Use/Land Cover Classes (2017–2025).

The main reason for this change experienced in the macroform of Gezin village parallels the development of disasters and tourism in the region. The fragmented and organic settlement fabric, established within the valley and compatible with the topography, has formed a more compact, planned, and geometric settlement form under the influence of reconstruction activities after earthquakes experienced in the region and of tourism. This relocation and transformation reveals significant effects in terms of sustainable rural resilience. On the one hand, the new residential areas, with their engineered structures and safer structural systems, increase physical resilience against earthquake risk; on the other hand, they have caused the disappearance of the production-oriented spatial organization of the traditional rural settlement and of the rural settlement character. For this reason, the relocation of the settlement in Gezin village, beyond being merely a spatial process, is an important indicator of a process in which rural identity is lost.

## 4. Discussion

This study reveals that evaluating the construction processes of post-disaster rural areas merely in the context of uniform housing production policies aimed at increasing physical resilience and of earthquake-resistant housing production is not sufficient in the context of sustainable rural space use, and that they should at the same time be evaluated in terms of rural housing typology, settlement form, rural landscape continuity, and production practices. The findings reveal that although the creation of safe settlement plans dependent on public resources and policies is a process that increases physical resilience, the traditional rural way of life, the production-oriented housing typology, and local identity are being lost. This shows that the rural revitalization process, when detached from its local context after a disaster, will lead to new vulnerabilities, spatial distancing, and the loss of rural identity.

In this regard, rural revitalization is regarded as an important means for rural areas to become economically, socially, and spatially resilient again in line with sustainable development goals [37]. However, the research findings show that this process does not always produce positive results when it is evaluated in detachment from its local context. It reveals that post-disaster reconstruction, while increasing physical resilience, can weaken rural identity, the production-oriented housing typology, and the traditional settlement fabric. This two-directional outcome has produced a wide variety of results in the hierarchical morphological order, from the building level to the macroform level.

However, resilience and socio-cultural sustainability should not be viewed as a simple dichotomy. The post-disaster reconstruction process is a highly complex and challenging one. In this context, ensuring that survivors have access to earthquake-resistant housing is the top priority [38]. Household-based studies carried out in the areas affected by the 12 May 2008 Wenchuan earthquake show that rural residents actively weigh up trade-offs between safety, the continuity of their livelihoods and settlement preferences, and that their adaptation strategies vary according to the pre-disaster, emergency response and recovery phases [39,40]. The locations of households and their experiences of disasters are shaping their perceptions of resilience. This suggests that residents of rural settlements personally negotiate the trade-offs between safe housing and the continuity of the traditional settlement pattern, and do not view these two elements as mutually exclusive options [39]. For this reason, the normative approach of this study is not to reject engineering-led restructuring. On the contrary, the study argues that structural safety is a necessary but not, on its own, sufficient condition, and that reconstruction models should aim to safeguard both earthquake safety and site-specific rural continuity, rather than sacrificing one of these two elements for the other.

In this regard, is post-disaster rural reconstruction a revitalization or a relocation process? In other words, how does earthquake-resistant housing production in post-disaster rural areas contribute to the sustainability of rural areas by increasing resilience? The research conducted specifically on Gezin village shows that the transformation—from adobe and masonry structures created by drawing on the traditional natural environment toward reinforced-concrete and light-steel architecture through public support—has undoubtedly increased earthquake resilience. However, this transformation is a result of addressing the rural settlement solely at the building level. When resilience is defined beyond the resilience of individual structures, as a holistic capacity enhancement encompassing all elements of the rural community [41], it shows that the gains achieved in Türkiye are one-dimensional [42]. Although structurally durable dwellings have been produced, the sustainability of rural areas has largely disappeared [43].

At the building scale, this is a significant gain as the spatial reflection of a politically strong state policy [44]. The new residential areas established in the aftermath of the disaster are not only modern homes with high earthquake resistance but also offer interior spaces that meet modern architectural standards. Furthermore, as it is situated on the shores of Lake Hazar, it may create new opportunities for diversifying tourism-based income. These improvements should be regarded not merely as incidental outcomes of resettlement, but as genuine benefits of regeneration.

However, it shows that the rural revitalization process does not always produce positive results. In this regard, although revitalization is addressed within a positive framework as a means for rural areas to attain sustainable development goals [45–48], it shows that the practices carried out in Gezin village may produce new vulnerabilities. The relocation of the old Gezin settlement unit's pattern suited to the topographic structure within the valley to the reserve areas on the shore of Lake Hazar, and the transformation of the production-integrated traditional housing typology into a solely shelter-oriented urban

model, are a concrete manifestation of the "rural distanciation" process conceptualized by Paniagua (2025) [11]. What is at issue here is not merely a physical relocation, but the gradual dissolution of the historical relationship that the rural community has established with place, production, and the natural environment. Therefore, although the post-disaster intervention is implemented with a discourse of revitalization, in practice it can create a dynamic of distancing that leads to the displacement of rural life.

This distancing from the rural way of life can be traced most clearly in the morphological structure of the settlement [49,50]. The dwellings built with traditional adobe, stone, and timber materials and suited to the natural environment and microclimatic conditions have given way to uniform, centrally planned structures with urban characteristics. The production units such as the barn, hayloft, and storehouse, which are inseparable parts of rural economic life, have completely disappeared, and the settlement fabric has been transformed into rational and compact building blocks [51]. This transformation has caused local communities to move away from the rural way of life [52]. The loss of the traditional building culture [14] and of the identity-based rural landscape is not merely an architectural loss; it is also a loss of cultural memory that can weaken the disaster perception and risk management capacity of rural communities [13,50].

However, the findings presented in this study regarding the erosion of rural identity and cultural continuity are based on field observations and changes in housing typology and architectural features. Studies conducted at household level show that they can directly reveal local residents' adaptive behaviours and perceived resilience [39,40,43]. It is therefore important that future studies include a similar interview-based and GIS study in addition to the spatial transformation analysis [53].

The morphological transformation experienced in the region creates additional pressure on the sustainability of the rural landscape at the macroform and land use levels. In particular, it shows that while built-up areas expanded by approximately 33%, agricultural areas decreased by approximately 66 ha and rangeland areas by approximately 73 ha. This situation indicates that, owing to resettlement policies and the tourism pressure around Lake Hazar, the rural landscape has retreated in favor of the settled area. These findings show that the change in rural land use is not merely a quantitative change in pattern, but that rural everyday life practices, livelihood forms, and the space-production relationship are simultaneously being dissolved.

## 5. Conclusions

The results of the study reveal whether post-disaster rural reconstruction in Türkiye is a rural revitalization process or a process of increasing resilience at the building level through spatial relocation. The findings show that the process is multidimensional. The transition from adobe and masonry structures to reinforced-concrete and light-steel dwellings resembling urban building use increased earthquake resilience at the building scale; however, as a consequence of this, it caused the loss of rural identity, the production-oriented housing typology, and the topography-compatible organic settlement fabric.

When the research findings are assessed as a whole, the post-disaster reconstruction of Gezin constitutes not only rural regeneration but also spatial resettlement. Whilst the revitalisation has taken place solely in structural terms—such as safer buildings and improved architectural standards—the productive, morphological and socio-cultural foundations of rural life have been displaced.

As for the changes in land use, while built-up areas expanded by approximately 33% (from 136 ha to 182 ha), agricultural areas decreased by approximately 66 ha and rangeland areas by approximately 73 ha. This pattern reveals that, through the combined effect of disaster housing production, resettlement policies, and the tourism pressure around Lake

Hazar, the production-oriented rural landscape has retreated in favor of the settled area. Thus, the increase in physical resilience has occurred together with a weakening in the continuity of rural production systems and everyday life practices.

The prioritization of earthquake resilience in the dwellings produced with the financial support of the central authority is, of course, inevitably quite important. However, this shows that it may produce new vulnerabilities in the form of a distancing (rural distanciation) of rural life practices. It reveals that, in settlements shaped by tourism and earthquake pressure, such as the case of Gezin village, defining resilience solely through structural safety and engineering standards remains insufficient for comprehending the rural lifeworld holistically.

In conclusion, this study argues that post-disaster reconstruction policies should be built on place-based approaches that integrate local material culture, production-oriented typology, and topography-sensitive settlement fabric with sustainable architectural principles, instead of uniform and context-detached housing models that result from a centralized planning process. Thus, planning decisions will enable the transformation of sustainable rural settlements supported by bottom-up participatory processes that place the knowledge accumulation and livelihood systems of local communities at the center. This approach will transform post-disaster reconstruction from being merely a technical intervention providing safe shelter into a holistic resilience strategy that preserves rural identity, production continuity, and sense of place.

In the Turkish context, this structural resilience approach can be translated into several concrete reform measures: (i) adopting a planning approach that supports local architecture and rural life rather than standardised housing design; (ii) developing plans specific to each rural settlement; (iii) prioritising on-site reconstruction, or reconstruction adjacent to the existing settlement, over reserve areas located away from the existing residential fabric, where seismic and geological assessments permit; and (iv) establishing formal mechanisms to ensure the participation of rural residents in decisions on housing plan and site selection. These measures would ensure that reconstruction policies treat rural settlements not merely as sites for the construction of resilient housing, but as integrated social and productive systems.

Future research should focus on two distinct areas. Firstly, in order to strengthen socio-cultural insights, there is a need for in-depth interviews aimed at determining survivors' levels of satisfaction with permanent housing and assessing their perceptions of resilience [39,40]. Secondly, the transformation taking place in a small-scale area such as Gezin should be compared with domestic and international regeneration processes.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The datasets used in this study were derived from publicly available sources. Sentinel-2 Level-2A imagery is available through the Copernicus Data Space Ecosystem (https://dataspace.copernicus.eu/) and Google Earth Engine (https://earthengine.google.com/). Climatic data were obtained from the Pernambuco Water and Climate Agency (APAC) (https://www.apac.pe.gov.br/), and municipal geographic information was obtained from the Brazilian Institute of Geography and Statistics (IBGE) (https://www.ibge.gov.br/). All data processing, image classification, and multicriteria analysis procedures are fully described in the Materials and Methods section of this article.

**Acknowledgments:** During the preparation of this manuscript, the author used Claude Opus 4.8 solely for the translation of the study into academic English. The conception and development of the content, the writing of the manuscript, the production of the maps, and the photographs were prepared by the corresponding author. The author has reviewed and edited the output and takes full responsibility for the content of this publication.

**Conflicts of Interest:** The author declares no conflicts of interest.

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