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Spatial Clustering of Abandoned Buildings in Historic Environments in Bayındır, Turkey

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Abstract
Abandonment is a major challenge in historical urban areas worldwide, including Turkey and other developing nations, despite strong historical context and legal safeguards. This analogy compares abandonment to cancer metastasis, emphasizing its pervasive and insidious nature. Like cancer, abandonment can spread, impacting neighboring structures and the broader urban fabric. This metaphor highlights the urgent need for a comprehensive analysis of abandonment's spatial characteristics in historic urban areas. A study in Bayindir, Turkey, using GIS, revealed a 20% abandonment rate within its protected urban area, with clusters of low and high abandonment identified. Mapping these clusters showed how they relate to land use types, offering insights for policymakers and planners to preserve and revitalize historically significant urban areas.

Keywords: Abandonment; Spatial Autocorrelation; Moran's I; Urban Conservation Area

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1.0 Introduction

People's living spaces are disappearing for various reasons. This destruction occurs at different scales, from the city to the parcel scale, and for different reasons. Forced abandonment of living spaces due to large-scale investments and their consequences stand out.

Historical cultural heritage is a set of values that are the concrete expression of human and spatial interaction in the context of living spaces, a limited, non-renewable resource that enables the transfer of knowledge, culture, and models between the past and the future (Kiper, 2004). Homeowners' preferences in protected areas are directly related to the sustainability of protected areas. The human factor is very important in transferring this limited resource to future generations. Today, two types of population movement can be mentioned: The abandonment of the traditional fabric within the same settlement boundaries and moving towards the modern fabric, and the abandonment of small-scale and traditional settlements and moving toward the large-scale modern city. Ryberg-Webster (2016) criticizes conservationists for their lack of guidance on what decisions should be taken to prevent abandonment in traditional settlements. While the maintenance of abandoned historic fabric remains minimal, the lack of urban conservation policies further complicates the problem (East, 2016).

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Urban conservation is based on integrating the historic fabric with the needs and trends of contemporary society (ICOMOS-Valletta Principles, 2011). Living in urban protected areas imposes a responsibility on property owners (Tankut, 2005). Historic settlements abandoned for economic reasons are now being transformed into settlements that have been renovated by being converted into tourism functions but have lost their identity (ICOMOS-Valletta Principles, 2011). One of the reasons for the lack of financial resources in historic environments in our country is the lack of use of the houses in the historic environment by their owners. The Amsterdam Declaration (1975) states that the budget required for conservation will be provided both by the budget to be allocated by local authorities and by the resources to be allocated from governments. Ulusan (2014) also states that the legislation, organization, and resource phases of management in protected areas in Turkey are functioning, but there are problems in the coordination and monitoring phases.

When the layout of both the courtyard and interior spaces of historic houses cannot meet today's needs, it paves the way for the owners to make sacrifices. Research on urban conservation thinking and attitudes from a user perspective shows that the spatial configuration of the past does not meet today's needs. The fact that service areas such as toilets, bathrooms, and kitchens, which are among the spatial features in conservation areas, are located outside the house is seen as a difficulty that does not meet today's user needs (Kuban, 2001).

According to the ICOMOS-Washington Charter, the conservation of historic settlements is of primary concern to those who live there. However, neglect and neglect lead to an increase in the proportion of tenants and poverty in the old neighborhoods of historic city centers. In this case, the responsibilities of the owners of houses in historic neighborhoods are higher than those of other owners. According to Ahunbay (1996), homeowners feel an emotional attachment to their homes and their surroundings and are therefore more inclined to protect them. However, the preference of low-income people for historic houses may increase conservation problems. Therefore, the opinions of property owners should be taken into consideration in urban conservation efforts.

International declarations emphasize the use of scientific methods, the importance of owner protection, the transfer of resources under the supervision of local authorities, the importance of inventories, and the importance of holistic protection. In our country, it is observed that conservation plans cannot prevent abandonment by owners and this problem appears as a problem. This study aims to investigate the spatial distribution of abandonment in the protected urban area of Bayındır by interpreting low and high abandonment clusters at the building scale and their relationship with land use type. The objectives of the research are 1) to conduct global and local cluster analyses, 2) to produce a cluster map of abandoned dwellings, and 3) to interpret the results in terms of land use. The other sections of the study are the literature review, methodology, findings, discussion, and conclusion.

2.0 Literature Review

Abandonment, considered both a problem and an indicator thereof, is a significant issue with social, economic, and physical causes and consequences. Studies examine its effects on population decline, focusing on both macro and micro levels. Factors contributing to urban population loss include suburbanization, regional restructuring, reduced investments, racist hostilities, limited growth, and the post-industrial economic structure. Additionally, abandonment is linked to natural disasters, deindustrialization, low birth rates, and globalization.

Despite the macro effects of abandonment discussed in the literature, Morckel (2013) shifts the focus to micro effects at the neighborhood scale, providing a new perspective on the phenomenon. Hillier et al. (2003) emphasize the need for more spatial statistical analysis in abandonment studies, highlighting the importance of the scale of the study in analyzing relationships. According to Wang et al. (2022) using the spatial autocorrelation method at the building scale, abandonment increases from the center to the periphery of the city. Some studies have considered data with both temporal and spatial characteristics (Hillier et al., 2003).

There is a significant overlap between studies of housing abandonment and urban economics, showing that abandonment leads to a reduction in tax revenues across the city. This decrease in value also reduces the city's budget and, consequently, the services it can provide. According to Han (2013), the presence of abandoned houses in a neighborhood affects the prices of houses in the immediate vicinity. If houses remain abandoned for many years, they can also affect the prices of homes further away. Proximity to vacant and abandoned buildings leads to a dramatic decrease in building and land values.

Spatial analysis has identified clusters of abandoned buildings around deteriorating areas, with abandoned houses clustering significantly at the neighborhood scale (Morckel, 2014). Morckel's (2014) study found that neighborhoods with high abandonment rates are located close to each other, while neighborhoods with infrequent abandonment are also clustered together. The inverse relationship between abandonment and building conditions was identified by Sternlieb et al. (1974), who showed that abandonment rates decrease when building conditions are good. According to Mouraz et al. (2022), cluster maps can help identify areas with higher defect rates, which may include abandoned buildings that require attention and intervention in historic city centers. On the other hand, Joo and Lee (2021) found through cluster analysis that abandoned houses are more likely to occur in areas with environmentally vulnerable characteristics, such as poor air quality, proximity to industrial areas, inadequate waste management, or exposure to natural hazards such as floods or landslides.

Bassett et al (2006) found that changes in the demographic structure of neighborhoods (increases in ethnic groups) (South et al., 2023), proximity to schools, the transformation process of the neighborhood, and foreclosure status were the most influential variables for abandonment. According to their survey results, the main reasons for abandonment are homeowners not living in the neighborhood, lack of investment, lack of good leadership, and economic structure. In studies on rural areas, Kim and Ham (2023) state that the clustering averages of vacant dwellings vary according to whether they are located in urban or district areas. Mardock (1998) attempts to predict abandonment using variables such as tax debt, water debt, proximity to high-crime areas, non-homeownership status, building

condition, and proximity to abandoned buildings. Verdil and Ünlü (2009) find that there is a strong relationship between slope and abandonment, but that the transport system does not have a direct impact on housing abandonment.

The negative consequences of abandonment are not only economic. The abandonment of buildings leads to a deterioration of public cohesion, an increase in crime, and an increase in the risk of fire. Teixeira (2016) explains the scale of the problem with the 'broken windows theory'. If broken windows in a neighborhood are not repaired (if residents do not intervene), this situation can encourage more crime and lead residents to be indifferent to any crime and live in fear in their properties. According to South et al. (2023), abandoned housing rehabilitation is directly linked to significant relative reductions in gun violations and gun attacks. Tisher (2013) argues that if one window is broken, it is inevitable that other windows will also be broken, suggesting that abandonment should be seen as an issue that needs to be addressed on a larger scale rather than just at specific points. In parallel with this theory, abandoned buildings have a high potential for crime (e.g. drug use), which makes residents feel unsafe when passing by vacant buildings (Teixeira, 2016). Furthermore, when young people are asked about their feelings towards abandoned buildings, these feelings are fear, concern, and sadness (Teixeira and Zuberi, 2016). The views of urban managers towards these buildings are that they are cancerous, that they are a blight on the city, and that they are an eyesore.

In short, in the literature, researchers investigate which factors are effective in the abandonment of housing units and create predictive models through regression analysis. On the other hand, spatial clustering analyses are often used, knowing that abandonment has a contagious effect and that abandoned houses also affect neighboring houses in good condition. It is also highlighted that abandonment studies are usually conducted at the neighborhood scale, but this issue should be addressed in different cities and different contexts (Mardock, 1998; Bassett et al., 2006; Sternlieb et al., 1974; Morckel, 2014; Bentley et al., 2016; Reiss, 1996).

3.0 Methodology

The ICOMOS Athens Charter (1931) and the Venice Charter (ICOMOS, 1964) emphasize the need for conservation based on scientific data and modern techniques. The Washington Charter (ICOMOS, 1987) stresses the need for a systematic and disciplined approach to urban conservation. This study uses a clustering method, highlighting the need to increase quantitative studies, as emphasized in international declarations.

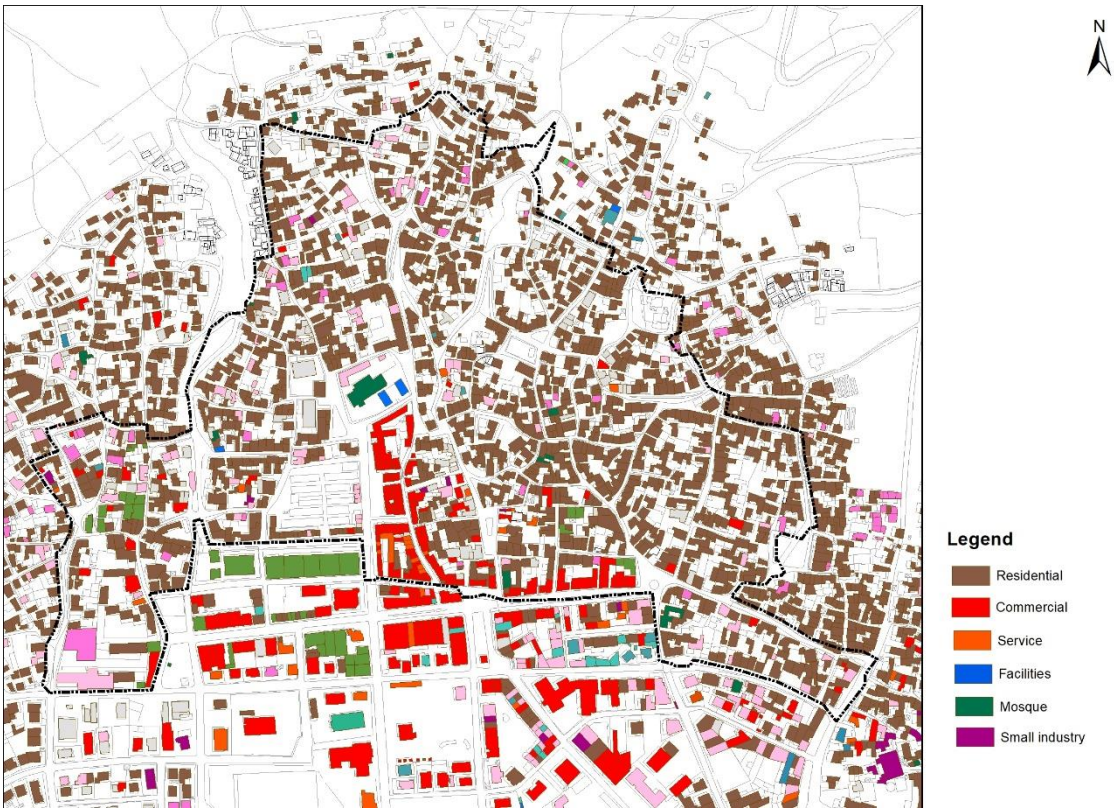


Fig. 1: Land use map.

Bayındır, a medium-sized city in western Turkey, was selected for its historical significance and significant abandonment issues. Most of the commercial areas are located in the traditional bazaar in the historic part of the city (Figure 1).

In this study, spatial autocorrelation methods were utilized to ascertain the spatial clustering patterns of structures with high or low numbers of abandonment. The analysis, distinguishing between global (global spatial autocorrelation) and local (local spatial

autocorrelation) spatial autocorrelation, aimed to determine the presence of spatial relationships between parcels housing residential and commercial buildings.

Global spatial autocorrelation (Moran's I) calculates a single index and statistic to test whether there is spatial clustering in the entire sample of observation values. Moran's I index is used to determine whether there is a clustering of abandonment among parcels, and this determination is statistically tested to assess its significance (Çubukçu, 2015).

According to a single Moran's I index and statistic calculated separately for all points in the sample in terms of observation values with *local spatial autocorrelation*, spatial clusters of similar variables as well as the locations of outlier points are determined. According to the calculated Moran's I indices, the proximity of similar parcels in terms of high or low abandonment status is determined and whether this determination is statistically significant is tested by hypothesis testing (Çubukçu, 2015).

4.0 Findings

Univariate cluster analysis was employed in GEODA to evaluate the likelihood of abandonment. Global Moran's I was utilized to ascertain the presence of spatial autocorrelation within the urban conservation area at large, rather than at individual sites.

The hypothesis test is structured as follows;

- Null Hypothesis (H0): The spatial distribution of abandoned parcels is random (uniform/dispersed).
- Alternative Hypothesis (H1): The spatial distribution of abandoned parcels is not random (uniform/dispersed).

The slope of the regression line shows the Moran's I value. According to Moran's I scatter plot, which describes the relationship between the abandoned buildings on the x-axis and the abandonment of neighbors whose weight on the y-axis, is calculated by queen contiguity, Moran's I value is 0.280 and the findings reveal that there is spatial autocorrelation (clustering) see Figure 2 below.

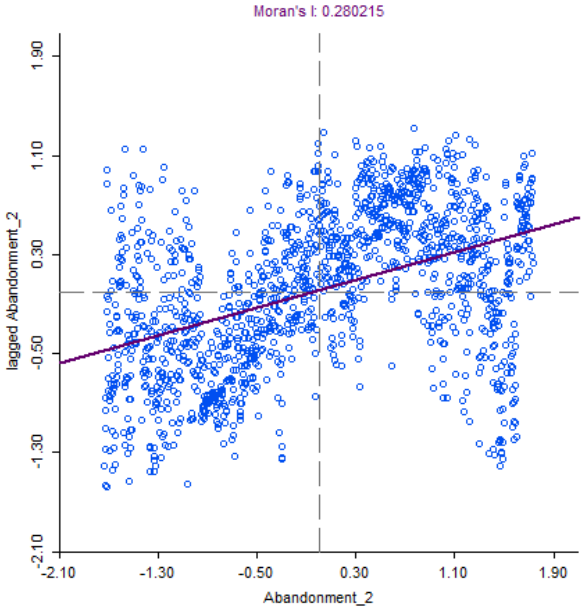


Fig. 2: Moran Scatter Plot for the abandonment status of buildings in Bayındır urban conservation area.

The univariate analysis encompassed both the Univariate Global Moran's I and the local spatial relationship indicator (LISA). LISA was employed to detect local clusters and evaluate their significance.

The hypothesis test is structured as follows;

- Null Hypothesis (H0): There is no relationship between abandonment according to the parcel analyzed and abandonment in parcels close to this parcel.
- Alternative Hypothesis (H1): There is a relationship between abandonment according to the parcel analyzed and abandonment in the parcels close to this parcel.

Accordingly, Figure 3 is the map obtained as a result of local spatial autocorrelation analyses and shows the spatial patterns of abandonment calculated based on the abandonment status of buildings in Bayındır in 2016. There are four classes of abandonment: high-high (hot-spot), low-low (cold-spot), high-low, and low-high ($p<0.05$). According to Table 1, 84% of the buildings in the high-high cluster in terms of abandonment are commercial (Table 1).

Table 1. Clusters and percentage of commercial building

Clusters	Number of Abandoned Buildings	Percentage of commercial building
High-high (hot-spot)	64	%84
Low-low (cold-spot)	-	-
Low-high	102	%35

High-low	50	%12

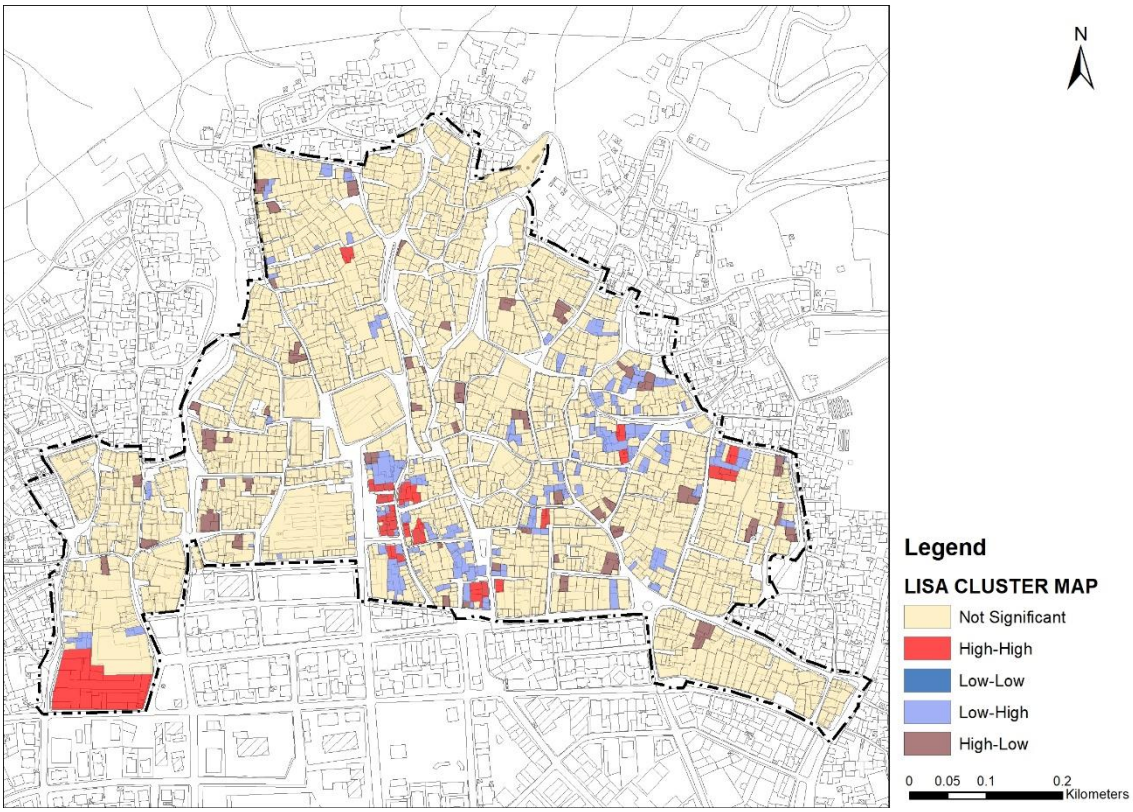


Fig. 3: Local spatial autocorrelation: Abandonment status by parcel.

5.0 Discussion

Studies on abandonment and spatial clustering reveal several critical insights. Spatial analysis has identified clusters of abandoned buildings around deteriorating areas, with abandoned houses clustering significantly at the neighborhood scale (Morckel, 2014). Recent studies have provided important insights by analyzing the clustering of abandonment. Wang et al. (2022) found that abandonment increases from the city center to the periphery. Mouraz et al. (2022) showed that cluster maps can identify areas with higher defect rates, including abandoned buildings in historic city centers. Joo and Lee (2021) found that abandoned houses are more common in environmentally vulnerable areas. Kim and Ham (2023) found that clustering averages of vacant dwellings vary with distance from the city. In addition, South et al. (2023) linked the rehabilitation of abandoned houses to a significant reduction in gun crime and assaults.

Based on the observations from Figure 3, a distinct clustering pattern of abandoned commercial units, identified as hot spots, emerges within the urban conservation area. This clustering is characterized by a higher density of abandoned parcels, both in absolute numbers and in comparison to the surrounding parcels. This spatial clustering suggests a strong spatial interaction among commercial activities within the area's land use framework.

Furthermore, the vitality of urban conservation areas is closely tied to the vibrancy of commercial units. In areas where commercial activities thrive, the urban conservation zone tends to be more lively and sought after. Conversely, regions experiencing a decline in commercial activity are prone to faster rates of desolation and abandonment, potentially leading to a negative impact on the overall vitality and attractiveness of the urban conservation area.

This relationship underscores the importance of maintaining a healthy commercial sector within urban conservation areas, not only for economic reasons but also for the overall livability and sustainability of these areas. Efforts to revitalize and support commercial activities in such areas can thus play a crucial role in enhancing their long-term viability and attractiveness.

In housing areas, there is an observable risk of abandonment. This risk is particularly pronounced in the low-high zone, where buildings that have not been abandoned are more likely to face abandonment due to the circumstances surrounding them. This suggests that clustering analyses play a crucial role in conservation planning, as they help identify structures that are truly at risk. Therefore, when formulating conservation plans, it is imperative to consider the spatial relationships and clustering patterns of abandonment for effective interventions and preservation efforts. Such analyses can provide valuable insights into the dynamics of abandonment in residential areas and aid in the development of strategies to mitigate this risk and ensure the long-term sustainability of urban conservation areas.

6.0 Conclusion& Recommendations

The analogy likening abandonment to cancer metastasis underscores its pervasive and insidious nature, with abandonment in one property potentially triggering a domino effect in neighboring structures and the broader urban fabric. This highlights the urgent need for a comprehensive analysis of abandonment's spatial characteristics in historic urban areas.

By using the spatial autocorrelation method known as Moran's I, this study identified clusters of buildings with both low and high abandonment rates within Bayindir's protected urban area. This highlights areas of potential concern and provides insights into the spatial patterns of abandonment in the area. By examining housing abandonment at parcel scales, this study adds to the literature on housing abandonment at the parcel scale.

The clustering of abandoned commercial units in urban conservation areas as hot spots suggests a significant spatial interaction among commercial activities. The vitality of these areas is closely tied to the vibrancy of commercial units, emphasizing the importance of maintaining a healthy commercial sector for long-term sustainability. In residential areas, particularly in the low-high zone, there is a notable risk of abandonment, underscoring the critical role of clustering analyses in conservation planning to effectively target interventions.

The outcomes of this study will contribute significantly to the field, particularly in urban conservation and restoration areas. One of the primary reasons for the abandonment of houses in urban conservation areas is the lack of financial and technical resources. Therefore, it is crucial to determine how the limited budget should be allocated. This study aims to prioritize houses identified as at risk, enabling local governments to make timely use of the budget and necessary interventions. The limitations of this study are that the study area is limited to a small city. In large metropolises, abandonment, and land use may be different, as there will be quite different relationships in the conservation areas in the city center. This approach will facilitate the planning and implementation of effective interventions for houses at risk of abandonment in urban conservation areas. Investigating the spatial clustering of socio-economic factors in abandonment and historic fabric is a new direction for further research.

Turkey is a developing country experiencing rapid urbanization. The preservation of its existing historical fabric can only be achieved through collaboration with its residents. The preference for modern apartment buildings over historical structures poses a threat to the sustainability of historical fabric. It is the responsibility of urban conservation experts in our country to conduct research aimed at better understanding the social, economic, and spatial dynamics in historical environments.

Understanding abandonment clusters is vital for policymakers and urban planners, as it offers insights into the factors driving urban decay and enables targeted interventions to preserve and revitalize historically significant urban areas. Such analyses can provide valuable insights into the dynamics of abandonment in residential areas and aid in strategies to mitigate this risk and ensure the long-term sustainability of urban conservation areas.

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