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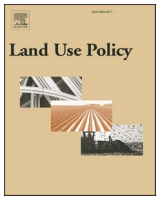

Re-mapping urban vitality through Jane Jacobs' criteria: The case of Kayseri, Turkey

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ABSTRACT

There has been a growing debate in recent decades about the view of city and urban theory. The scope of this discussion has expanded with many different claims about the variable structure of the city and urban society, the boundaries of the urban scale, the nature of the city and urban problems. Jane Jacobs, one of the focal points of these discussions, has offered a different perspective with the approach of urbanism and the principles shaping the city's reconstruction: More important than how cities look is how they work. Therefore, human interactions which create a vibrant environment in cities should be considered to understand the dynamics of cities. Located in the central part of Turkey, the city of Kayseri is a rapidly growing industrial city with approximately 1.4 million population. Despite the fact that the city has a long history, the traditional urban pattern has been largely destroyed via planning decisions and the vast majority of the housing stock in the city has been renewed in the last 40–50 years. This paper examines the city of Kayseri using Jane Jacobs' criteria for what makes a city livable and vibrant. We re-mapped 87 neighborhoods of the city that constitute a continuous urban macroform by using the Kernel Density tool with ArcGIS software, evaluated the "urban vitality" of each neighborhood, and compared outputs with our observations to understand the relevance of Jacobs' views in different contexts. The main findings of the study reveal that not only historical and commercial centers within the city but also several transformed and newly built areas have high urban character values according to Jacobs' criteria. However, the degree of vitality (high, moderate, low, or non-urban), which is measured, may differ from the urban vitality, which is observed by the "naked eyes" in some neighborhoods of the city.

1. Introduction

Since the early twentieth century, concepts of the city and urban theory have continued to be debated in urban studies. The work of the Chicago Urban Sociology School, which is based on a kind of orthodoxy, dealt with cities in terms of sociological definitions and had a great effect on the urban understanding of the period. Wirth (1938), one of the pioneers of the Chicago school, argued that the character of the city would be sociologically determined by the interaction between people, while Harris and Ullman (1945) explained the nature of the city through functions and structural zoning. By the late 1960s, however, Castells, Lefebvre and Harvey began to criticize this school of thought because urban sociology ignored the social organization concealed by capitalist ideology (Scott and Storper, 2015). In that time, Jane Jacobs, one of the most influential figures in urbanism, developed a new view of urbanism. She was not an architect or a city planner. She was an engaged citizen with a desire to improve the conditions of her home city. Her analysis of urbanism, based on inhabiting her space, was about living, working and watching city life with "naked eyes" (Lange, 2012). Jacobs expressed her ideas in her book, *The Death and Life of Great American Cities* (1961), by disputing the discipline of urban planning with radical new approaches (Schubert, 2014). She developed a critique of urban planners and questioned their proficiency considering social and morphological problems resulting from urbanization. Her view of the city still is considered a benchmark in urban planning studies. New York's head of planning, Robert Moses, held a top-down view of city based on form as opposed to Jane Jacobs' ground level view of city based on the interaction between street and individual (Dory, 2018). Most of her important ideas about densities, pedestrian orientation, mixed-use developments and new approaches to the conservation of older buildings were accepted within a decade (Schubert, 2014).

Jane Jacobs tells us that by thinking about cities we can determine

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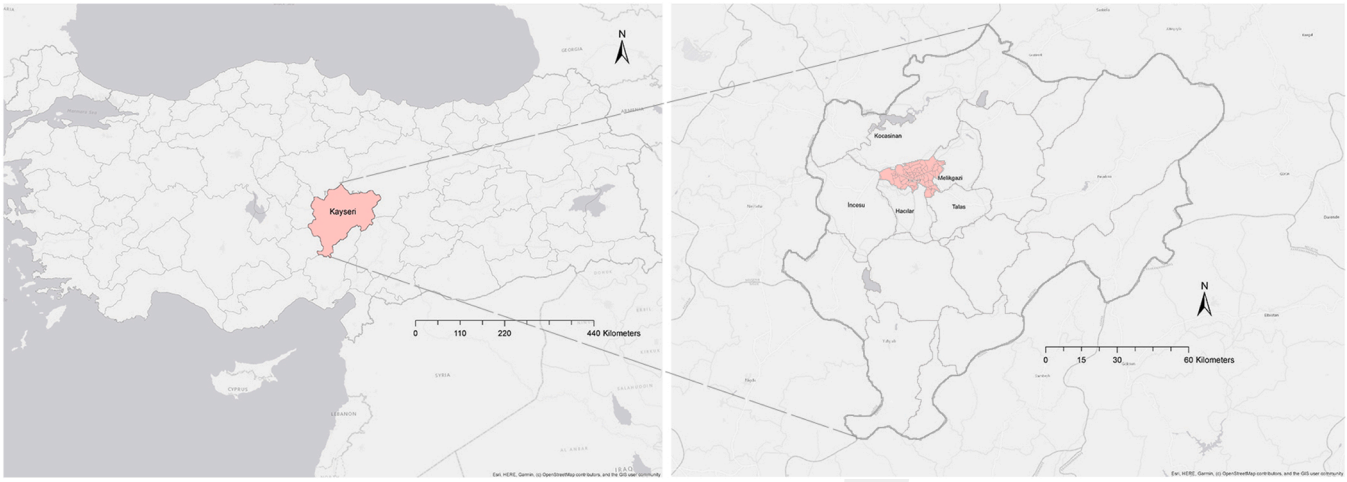

Fig. 1. The location of the study area in Kayseri and Turkey.

Table 1
The methodology of the study.

Condition	Variable	Measurement tool	Dataset	Data reproduced for density analysis	Cell size[1]
Need for Concentration	Population density	Kernel density	Buildings Population	Number of residents in each residential unit	55 * 55 m
Need for Primary Mixed Uses	Mixed-use density	Kernel density	Addresses	Buildings with both residential and non-residential uses	55 * 55 m
Need for Small Blocks	Street density	Line Density	Roads	Urban streets	55 * 55 m
Need for Small Buildings	Short building density	Kernel density	Buildings	Buildings with less than 8 stories	55 * 55 m
Need for Aged Buildings	Old building density	Kernel density	Buildings	Buildings older than 10 years	55 * 55 m
Urban vitality	All variables	Mosaic to new raster	All datasets		55 * 55 m

[1] Despite the fact that there is no strict rule in determining cell size, it is stated that "the cell size should be based on the original map scale and minimum mapping unit" (Mitchell, 2020). Delclòs-Alio and Miralles-Guasch (2018) used a cell size of 100 m * 100 m to measure urban vitality in Barcelona, while Jin et al. (2017) used a cell size of 200 m * 200 m in their vitality analysis in Chinese cities. We preferred a cell size of 55 * 55 m, which is determined automatically by ArcGIS Kernel Density tool as an optimum cell size that is estimated based on 'the output extent" (URL-4, 2019).

Table 2
Jacobs' tools (conditions, descriptions, variables and data sources) used for this study.

Condition	*Description*	*Variables*	*Data Source*
Need for Concentration	A dense concentration of people, housing and buildings is the main condition for a vibrant urban environment.	Population density Housing density	Turkish Statistical Institute (TURKSTAT), 2017 Census Data Kayseri Metropolitan Municipality KMM Deparment of Geopraphical Information Systems (2019) Building Data
Need for Primary Mixed Uses	A mix of primary uses and secondary uses (commercial, housing, work) is necessary to provide usage every hour of the day.	Mixed building use	KMM, 2019 Address Data
Need for Small Blocks	A built environment with high street density that divides the city small blocks to ensure opportunities for contact.	Street density	KMM, 2019 Road Data
Need for Small Buildings	Small buildings contribute to diversity and ensure natural surveillance of streets.	Short buildings	KMM, 2019 Building Heights Data
Need for Aged Buildings	A mix of new and old buildings balances differences in purchasing power and land values.	Old buildings	KMM, 2019 Building Data

the kinds of the problem they create (Jacobs, 1961). Cities are complex organizations that are connected to each other. Her urbanism approach is to solve the problem in this "organized complexity". City planners and architects in the modern era have seen the city as a simple equation or an unorganized problem (Jacobs, 1961). For instance, Ebenezer Howard, who initiated the Garden City Movement, thought the cities were a disease, and therefore designed a city based on a simple equation with a green belt (Fishman, 1977). However, he later saw that this city did not work with the simple equation. Jacobs also debated Lewis Mumford, the famous writer and urbanist, about planning, decentralization, density and mixed-use development. In one of his articles, Mumford criticized Jacobs for not looking outside her small neighborhood and said that her results cannot be applied to all cities or even to the other parts of New York City. According to him, she was a good observer, but her approach to cities was like trying to cure cancer with homemade recipes (Mumford, 1962).

Beginning in the late 1920s in Europe, and in the 1930s in the USA, planners began to apply ideas derived from physical sciences and incorporated statistical analysis and probability mathematics into the planning process (Jacobs, 1961). The Radiant City project by Le Corbusier is a good example of design based on calculations. Although Jacobs likes many of his modern projects, she criticized him for designing cities using mathematical calculations.

Cities can be designed with mathematical calculations and statistical data thanks to developing calculation methods, however, there is a complex structure beyond all this calculation. Cities built on calculations are doomed to die. On the other hand, the cities designed beyond computing and statistics declare their immortality (Jacobs, 1961). In all these discussions, Jane Jacobs' urban theory has had a worldwide influence (Gehl, 2010; Netto, 2018), yet these interpretations have been

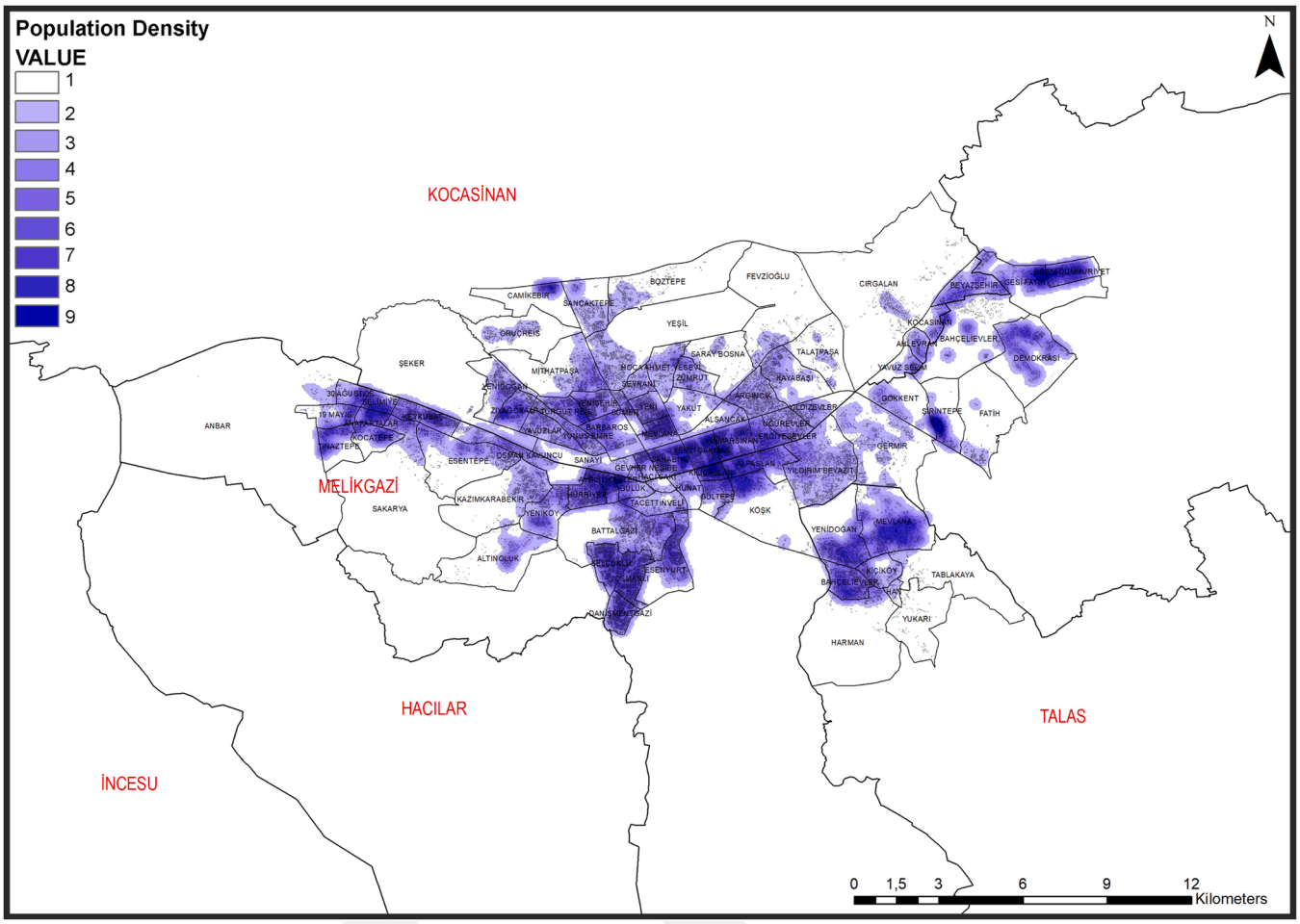

Fig. 2. The map of population density (Buildings).

considered in American, European and Asian cities.

This paper questions the nature of the city and urban vitality by analyzing and re-mapping Kayseri from Jacobs' perspective. Its first section describes Jane Jacobs and her pioneering discussions of urban theory. The second section explains her criteria for livable and vibrant cities, which are the essence of this study's methodology. The third section introduces the methodology, the case of Kayseri, the data and variables used within the scope of the study. The fourth section interprets the results of mapping Kayseri using Jane's tools. The final section discusses the outcomes of this approach to produce policy tools for a rapidly growing city and compare it with other cities in developing countries.

2. Literature review on Jacobs' urban theory and urban vitality approach

Jane Jacobs' views about cities oppose current conceptions of urban planning and reconstruction. Her experiences of the inner-city helped her to understand how cities work in real life. She evaluates neighborhoods not only as spatial beings but also as sets of problems such as crime rates and street-health. Therefore, in order to understand the relationship between urban vitality and form, we need to examine from a microscopic point of view rather than the top-down view (Netto, 2018).

Jacobs' observations offer different approaches to urban studies for research and other planning models. Many studies have evaluated her views about cities and urban planning (Hill, 1998; Amrita, 2000; Laurence, 2006; Klemek, 2008; Kidder, 2012; Barnett, 2012; Schubert, 2014; Kirby, 2019). Some researchers have analyzed some of Jacobs' urban vitality theories in relation to: physical and social diversity (Steil and Delgado, 2019; Talen, 2012), the relationship between diversity and urban planning (Fainstein, 2005; Mohareb et al., 2016), land use mixes (Manaugh and Kreider, 2013; Grant, 2002; Hirt, 2016) and the need for old buildings (King, 2013). Others have tested her theories in different cities (De Nadai et al., 2016). The recent empirical studies have focused on specific issues with the intersections of her key spatial characteristics and conditions, such as the association between the physical environment and pedestrian activities in street life (Sung, Go and Choi, 2013), walkability (Frank et al., 2006), the relationship between land use mixes and the travel behavior (Bordoloi et al., 2013), economical segregation of neighborhoods (Buitelaar and Cozzolino, 2019), public open spaces (Crestani and Pontes, 2016; Nathiwutthikun, 2012), urban health (Putnam and Andrew, 2007).

Cities are living organisms. Many phenomena that provide the formation of these living organisms have been defined in time. Understanding urban vitality, one of the most important of these phenomena, better explains the factors that cause the growth, development or decline of the city. In addition, urban vitality is one of the most essential premises for sustainable urban development (Lang et al., 2016). Researches on urban vitality, which started in the 1960s with the contributions of Jane Jacobs, developed rapidly on the basis of social sciences and scientific thoughts in the 1980s. There are several studies that examined different urban settings using "Jacobs conditions for urban vitality." Zhou (2012) has evaluated urban vitality with a great number of people and their various activities in the city. Sung et al. (2015) have examined the indicators related to Jacobs' conditions for urban vitality, which are

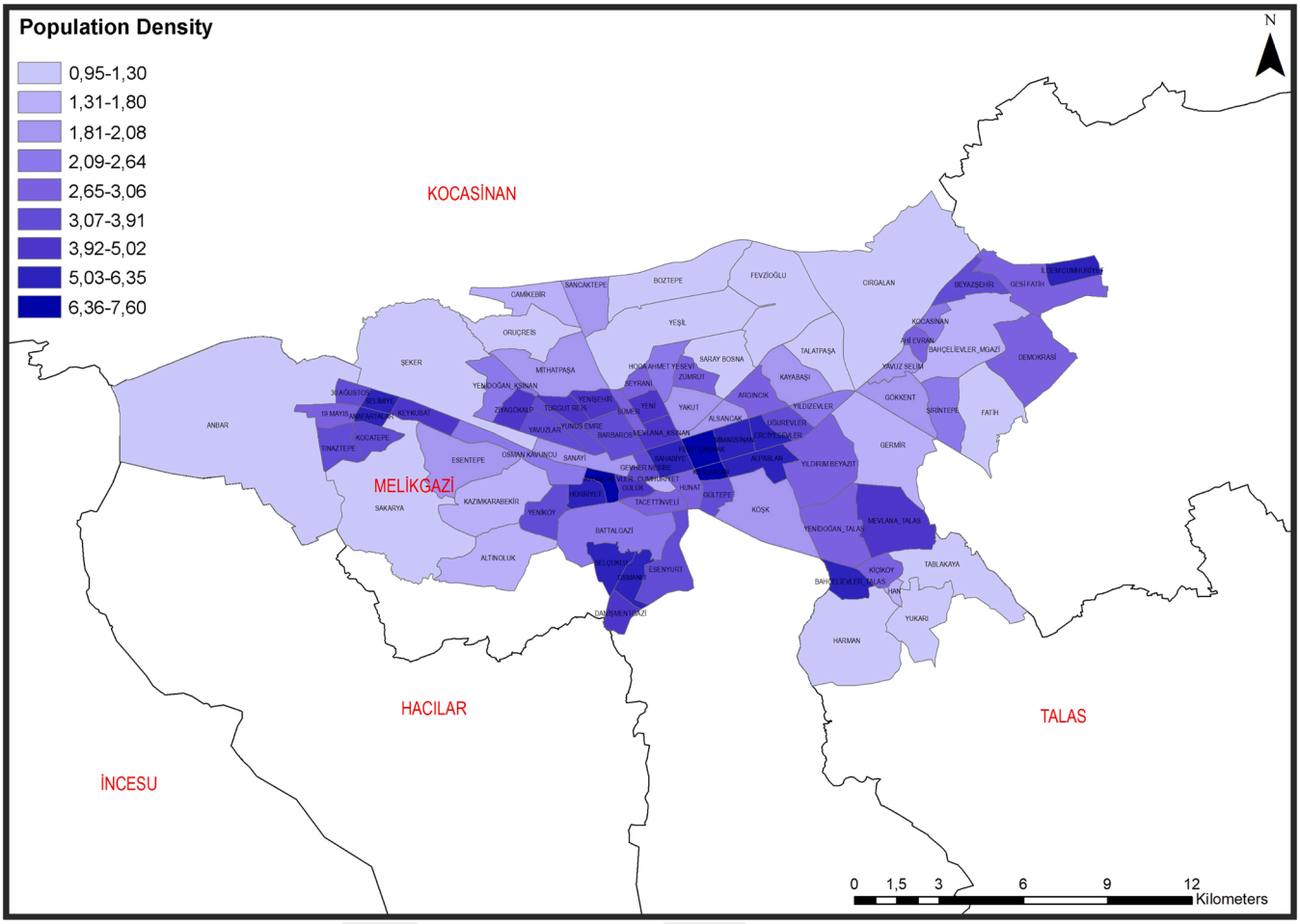

Fig. 3. The map of population density (Neighborhoods).

Fig. 4. Kılıçarslan neighborhood: One of the highest values for population and housing density.[11]

mixed uses, density, block size, accessibility, need of aged building and border vacuums to assess the characteristics of the urban form and to operationalize them with pedestrian activity in Seoul. In the study, they used GIS in order to evaluate indicators of the built environment within a 500-meter buffer zone in which the participants live. Delclòs-Alio and Miralles-Guasch (2018) have investigated Jacobs' conditions for urban vitality in a Mediterranean conurbation. This GIS-based research is of special interest because it analyses the nature of the new urban configurations in Barcelona, Spain by using Jacobs' approach. After this study, Fuentes et al. (2020), as in the Barcelona study, have calculated urban vitality of Santiago, Chile through Jane's conditions and index. Yue et al. (2021), using Ho Chi Minh City and Shanghai as cases, have measured urban vitality and analyzed its spatial pattern by means of the PPM (Projection Pursuit Model)-as a statistical approach- based on three dimensions of built environment (mixed land use, road junction density, and aged building), human activity (population density, point of interest (POI) density and dwelling density),human–environment interaction (road connectivity, physical segregation to urban barriers, and amenity availability.

Despite the fact that the concept of urban vitality is often used in conjunction with Jane Jacobs' view, some studies deal with the concept of urban vitality from different (mostly narrower) perspectives. For instance, Montgomery (1995) has taken into consideration especially the night economies under the topics of urban vitality, urban culture and urban areas in the cities that live 24 h a day. Jin et al. (2017) have used the concept of ghost cities to measure low urban vitality in China

Fig. 5. Anbar neighborhood: One of the lowest values for population and housing density.

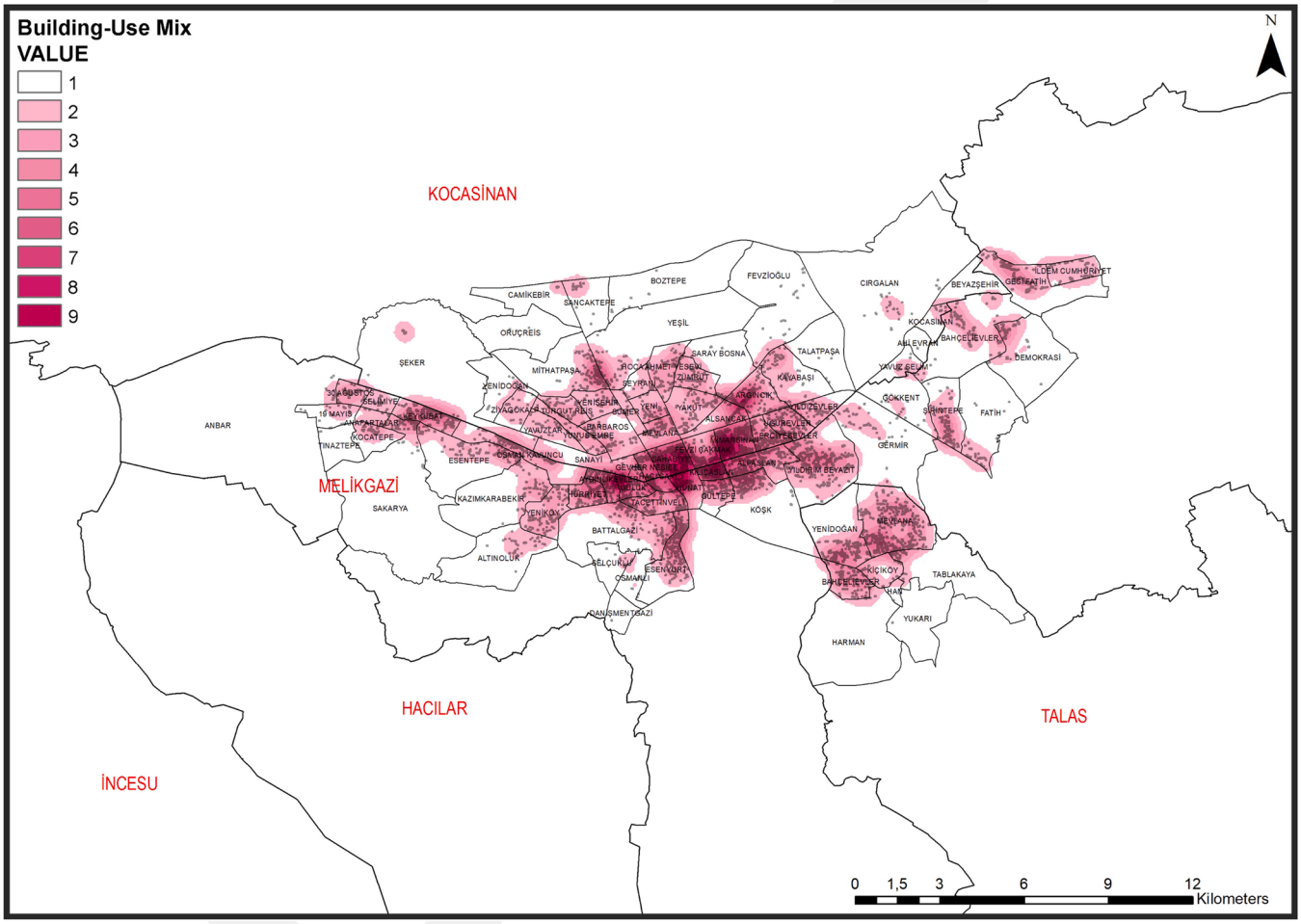

Fig. 6. The map of mixed-use buildings (Buildings).

employing Kernel density tool. They have claimed that, in these cities, it is required well-developed urban form and adequate urban activities to obtain the urban quality of life. Lopes and Camanho (2013) have defended that public sites and green spaces set off urban vitality, which is an important component of urban quality of life. He et al. (2018) searched different urban growth models on urban vitality with the help of geographic 'big data' in China, and urban vitality has been shown to have different effects on urban growth. Chion (2009) has argued that urban vitality is the factor that triggers the development process of the cities, and analyzed it through the city of San Francisco. Mouratidis and Poortinga (2020) have examined the relationships between the built environment and social cohesion in Oslo by using urban vitality as a possible mediator. They have used SEM to test the conceptual model of the research, and measured the urban vitality via the population-based survey. Although there are a number of studies on the measurement of urban vitality, the integrated investigation on the notion of urban vitality in a rapidly growing city in a developing country has been rarely explored. In Turkey, there are some partial studies related to urban revitalization in the historical city centers (Oruc and Giritlioğlu, 2008; Ciftci et al., 2010). However, our study is the first attempt to evaluate a whole urban area in terms of urban vitality in a Turkish city. The study, which focused on urban vitality assessment by Jacob's criteria to

[1] All satellite images in the article are taken from Google Maps. Photos were taken by the authors.

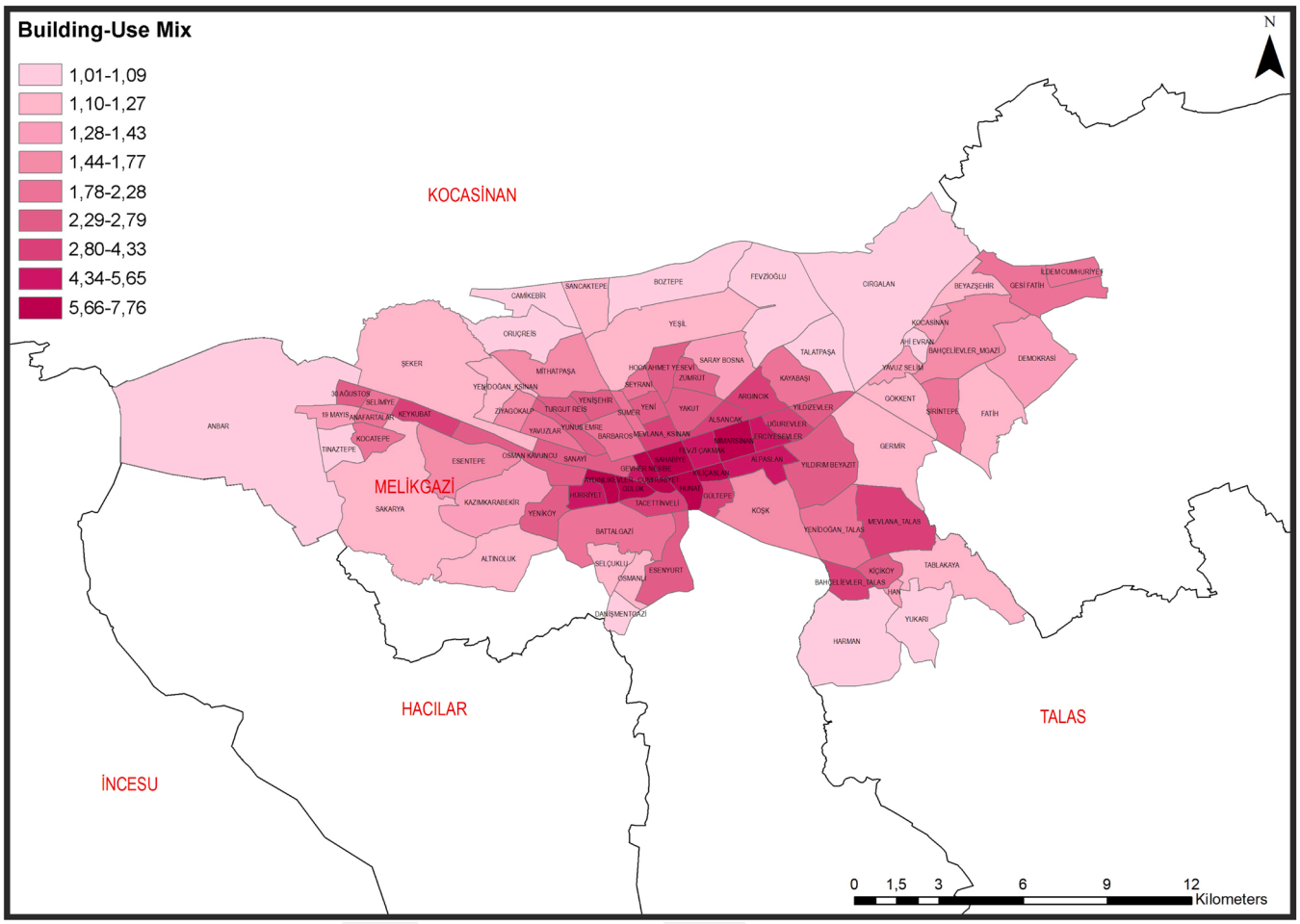

Fig. 7. The map of mixed-use buildings (Neighborhoods).

Fig. 8. Sahabiye neighborhood: One of the highest values for mixed-use buildings.

address the urban pattern exposed rapid change and take precautions to urban decline, is expected to lead new researches in other cities in Turkey.

3. Rethinking urban vitality using Jane Jacobs' approach

According to Jacobs (1961), it is necessary to understand how cities work in real life to be able to find out how urbanism and reconstruction practices affect social and economic viability. However, urban planners have not considered the elements and practices that increase diversity, and consequently, make an urban agglomeration a real city.

Jacobs argues that we must examine combinations and mixtures of uses to sort out the city. In that case, how does the city produce these mixtures? According to Jacobs, the generators of diversity are most essential provisions in order to unearth the potential of a neighborhood (Jacobs, 1961), and thus, Jacobs proposed four conditions that inevitably produce diversity in the streets of a city. The first is that the neighborhoods in a city should have secondary functions in addition to a primary function (Jacobs, 1961). The number of people in the primary areas of use increases at certain hours of the day, but decreases at other times of the day, or these primary use areas are traumatized. Therefore, it should be ensured that concentrations of population expand and contract by generating secondary usage areas. Thus, the neighborhood and streets remain alive at all hours of the day, and small shops can be established along with large commercial enterprises. This provides economic viability and increases the interaction of people during the

Fig. 9. Danişmentgazi neighborhood: one of the lowest values for mixed-use buildings.

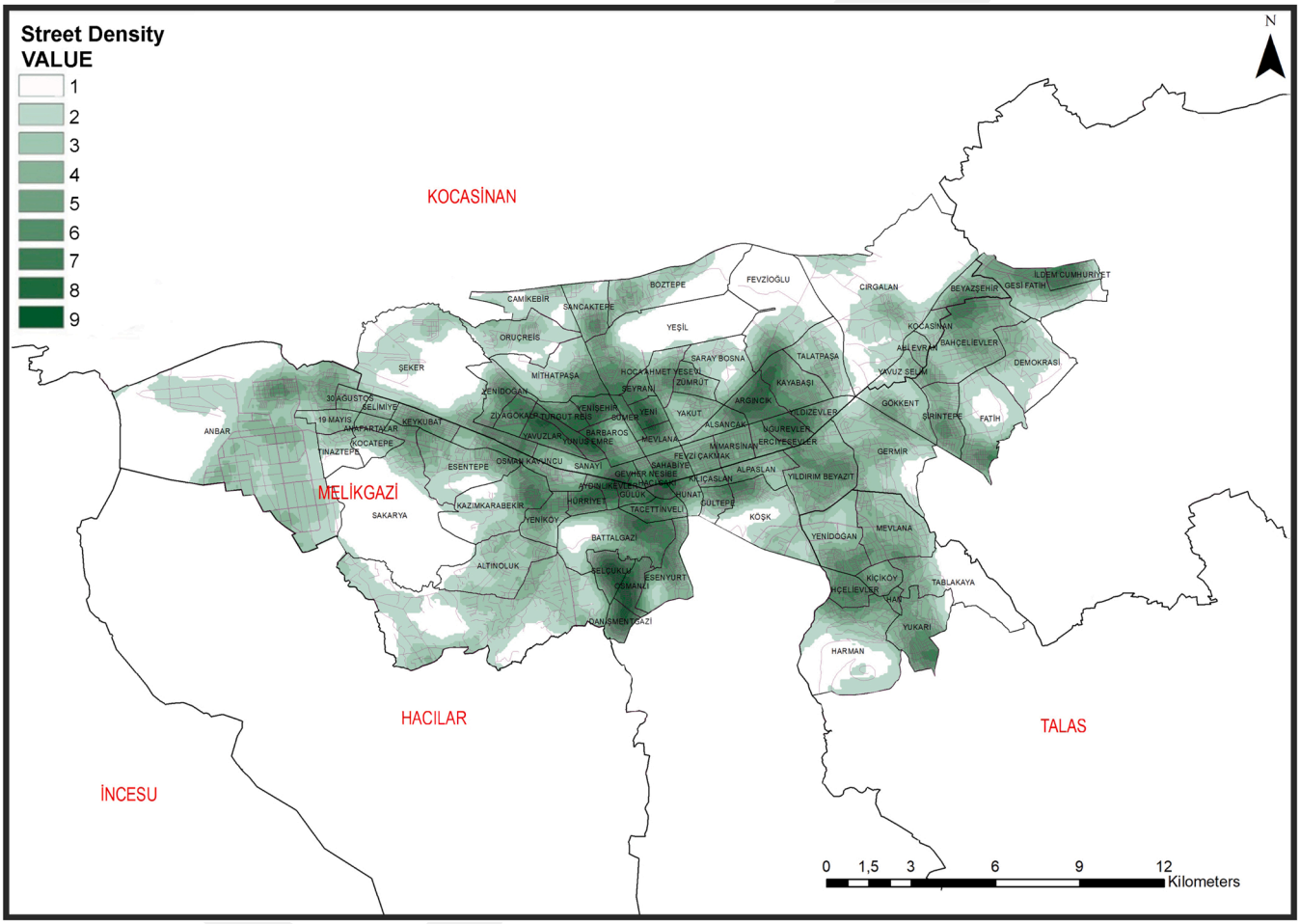

Fig. 10. The map of street density (Street Level).

day.

The second condition is that the city must have streets and frequent corners formed by small blocks that can provide opportunities for contact (Jacobs, 1961). Long blocks in the city prevent interaction and permeability between the streets, and the side streets between them are not used extensively during the day. However, the side streets formed by small blocks increase permeability. Frequent corners make it possible to reach destinations in shorter distances and in a variety of different ways. People use side streets to reach squares or avenues, which enlivens their shops and breaks the monotony.

The third condition is that buildings of different ages should be together in neighborhoods (Jacobs, 1961). The cities need old buildings, which means ordinary buildings with low value. If there are only new buildings in a part of the city, they will be high-cost new buildings. To benefit from the diversity of the city, high-profit, medium-profit and low-profit initiatives should be mixed in the same environment (Jacobs, 1961).

The last condition is the need for concentration. According to Jacobs, what makes a settlement a city is the intense gathering of people in them (Jacobs, 1961). Unlike the orthodox urban planning that she criticizes at all times, for her, high density is a necessity. High density and low density have different effects on cities, and she sees high intensity as a gift to cities (Jacobs, 1961). Intensity and diversity should be regulated correctly to develop and support urban life. This requires dense concentrations of people, both residents and people using area for different purposes.

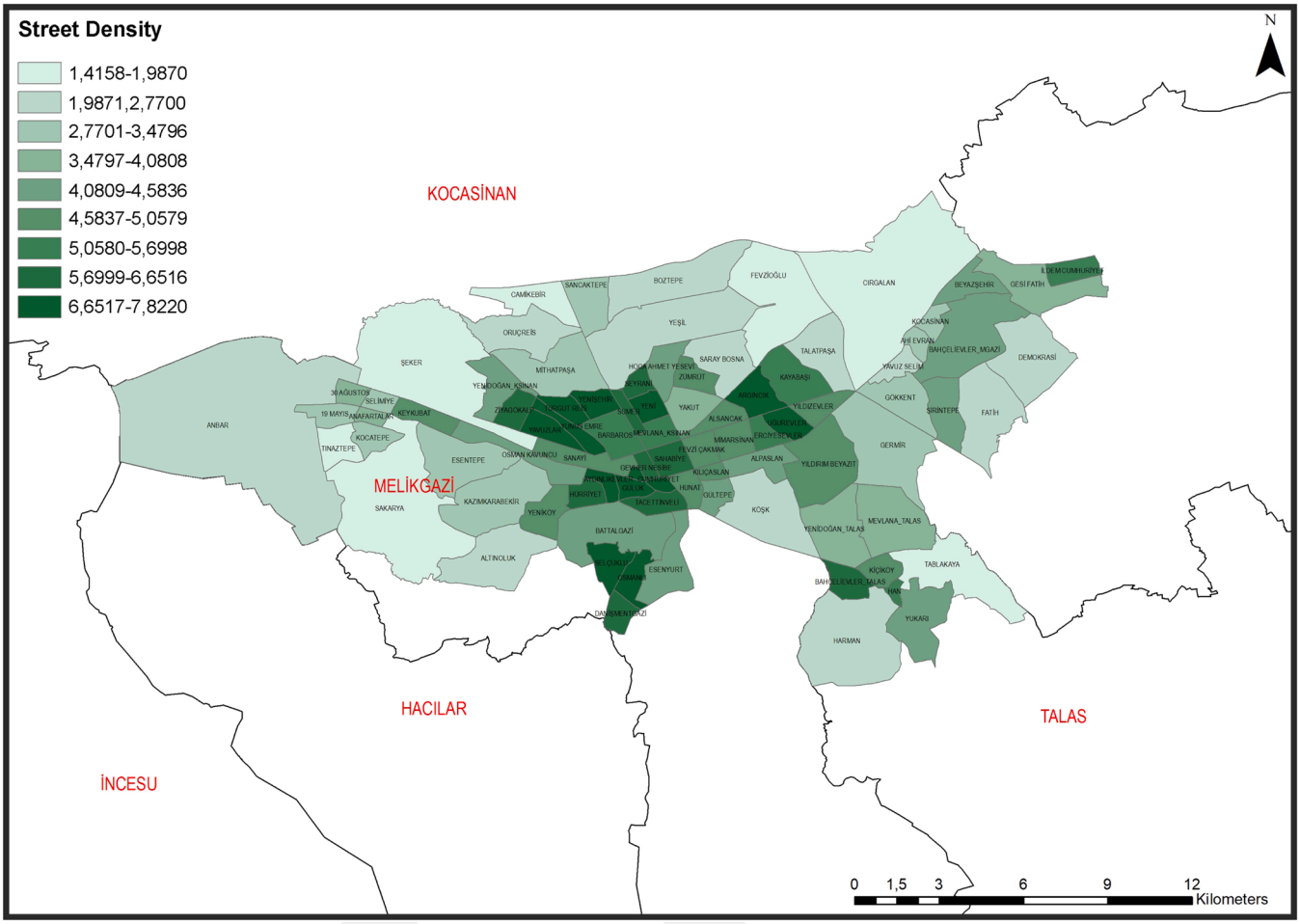

Fig. 11. The map of street density (Neighborhood Level).

Fig. 12. Cumhuriyet neighborhood: One of the highest values for street density.

The two above-mentioned studies (Sung et al., 2015; Delclòs-Alio and Miralles-Guasch, 2018) considered these four conditions to evaluate urban vitality and added two more complementary conditions: accessibility of transportation and parks, and mitigating border vacuums. This paper also considers Jacobs' four main conditions to evaluate urban vitality and added a fifth condition: the need for small buildings. Jacobs (1961) correlates small elements in a city with diversity, and consequently urban vitality. This condition also contributes her notion of "eyes on the street". Jacobs sees this as a vital issue for providing street safety since safety and vitality are related. Street safety is one of the main factors that make a city vibrant because citizens (adults, women, children and elderly people) can go outside fearlessly and frequently. Thus, the city should have vibrant streets, and this vibrant environment will also increase people's sense of safety.

4. Methodology

Within the scope of this study, we used GIS-based physical (population, building, address, and road) datasets obtained for the city of Kayseri to evaluate the vitality on the Jacobs' criteria (the conditions for city diversity), which she explained in her famous book (Jacobs, 1961). For analysis, we firstly re-produced data using given datasets to use it by Kernel Density and Line Density Tools to produce density maps of each variable. Secondly, we calculated the five condition values of each cell of 55 * 55 m in the study area by re-classifying density values. Thirdly, we evaluated the 'urban vitality' value of each cell by merging cells with the

Fig. 13. Cırgalan neighborhood: One of the lowest values for street density.

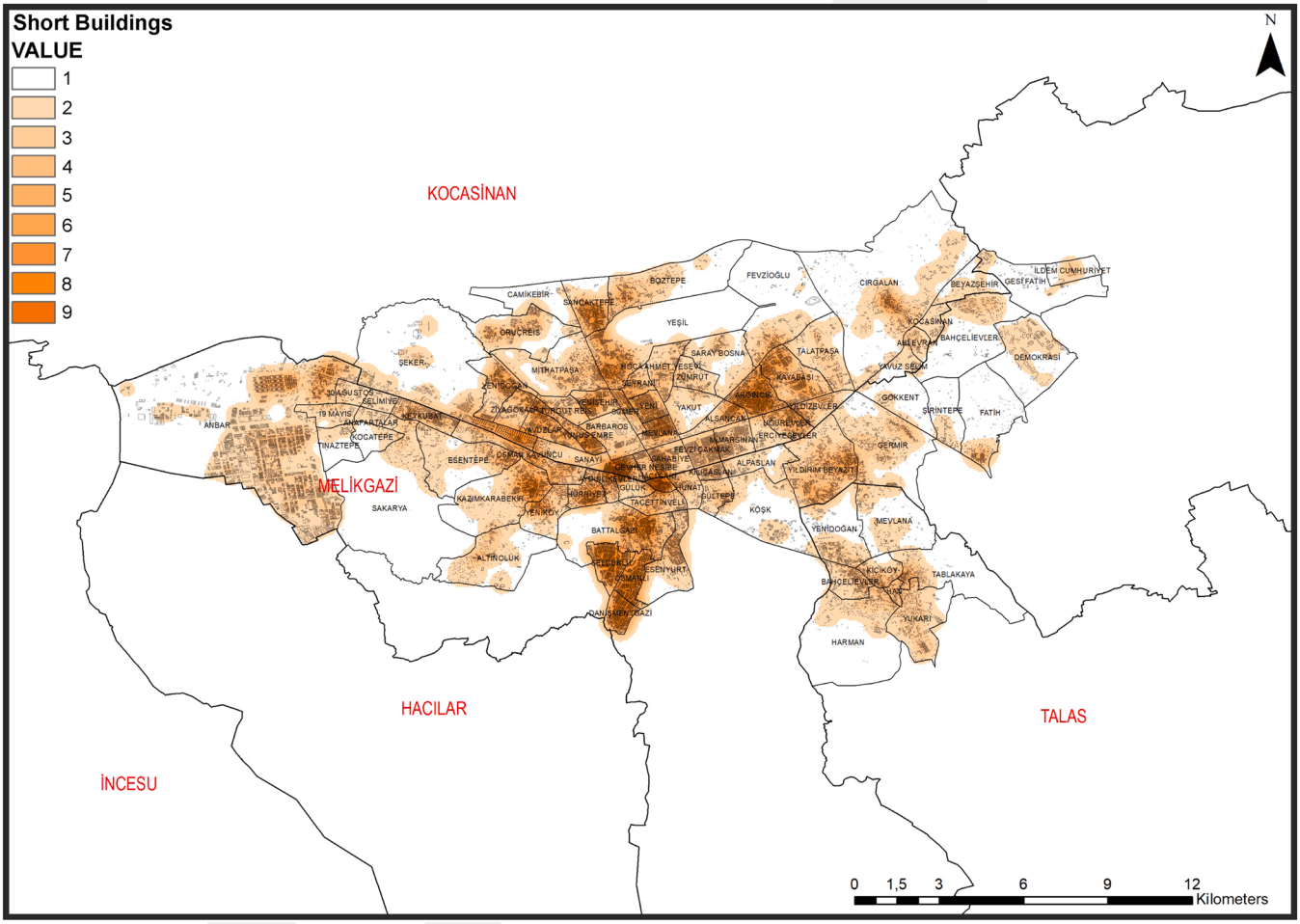

Fig. 14. The map of short buildings (Building Level).

arithmetic mean of five cells in the merging datasets. Fourthly, we transferred the value of cells to the neighborhood scale by using the weighted average (weighted arithmetic mean) formula (URL-1, 2020) that is given below. Finally, we classified 87 neighborhoods of the city as "high, moderate, low, or non-urban" by using the K-means clustering method. In the discussion and conclusion parts, in addition to re-mapping the city we also compared the degree of vitality that is measured with the urban vitality that is observed by the “naked eyes” in some neighborhoods of the city.

4.1. Case study: The city of Kayseri

This study evaluates the city of Kayseri using Jane Jacobs’ views about urban theory. Kayseri has a population of approximately 1.4 million and is one of the most significant Anatolian cities. However, in the city of Kayseri, the traditional urban pattern has been largely destroyed via planning decisions and the vast majority of the housing stock has been renewed in the last 40–50 years. Kayseri was chosen the case study in order to evaluate the vitality of this renewed city which has a long history. It is worth to measure ‘urban vitality’ in different contexts, especially in a rapidly growing city in a developing country between Asia and Europe. The present study is expected to be a leading study to address urban vitality from different aspects and to develop a policy perspective in Turkey and other developing countries. The borders of Kayseri province include 16 municipalities. Nevertheless, the areas within the borders of Kocasinan, Melikgazi and Talas

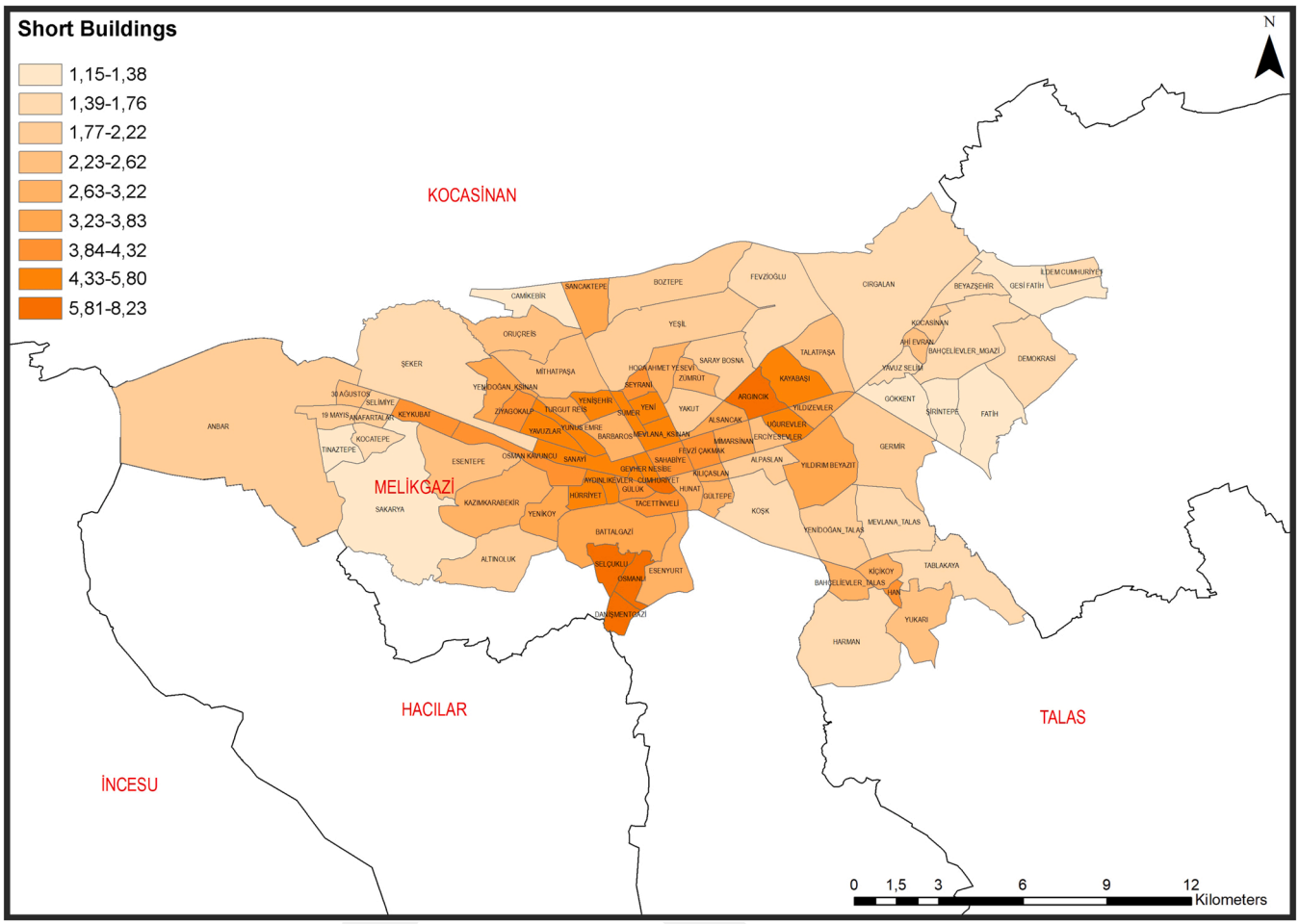

Fig. 15. The map of short buildings (Neighborhood Level).

Fig. 16. Osmanlı neighborhood: One of the highest values for short building density.

municipalities that constitute a continuous urban macroform were selected as the study area. For analysis, the study area was divided into a total of 87 neighborhoods with a population of 903,375 (Turkish Statistical Institute (TURKSTAT), 2017).

The city of Kayseri has developed rapidly since the 1980s thanks to its industrial and commercial activities. The city grew most in the east-west direction because of the locations of its industrial districts, the availability of suitable land and topography, and as a result of planning decisions that urged building high-rise housing projects on this axis. In addition, the old and centrally located neighborhoods of the city with single-family houses and a traditional urban pattern were largely demolished to open space for high rise apartments, offices and commercial units in the expanding commercial business district. These developments radically changed the traditional character of the city, causing some parts to decline and others to liven Fig. 1.

4.2. Data and variables

In this study, we used a dataset to investigate to what extent the medium-sized Anatolian city of Kayseri verifies Jane Jacobs' views about urban theory. This dataset consists of data of buildings (functions, heights and ages), addresses, road data (interurban roads, urban roads, highways and streets) and population data. This dataset refers to five conditions: the need for concentration, the need for primary mixed uses, the need for small blocks, the need for aged buildings and the need for small buildings. The variables defined by these conditions are shown in

Fig. 17. Gökkent neighborhood: One of the lowest values for short building density.

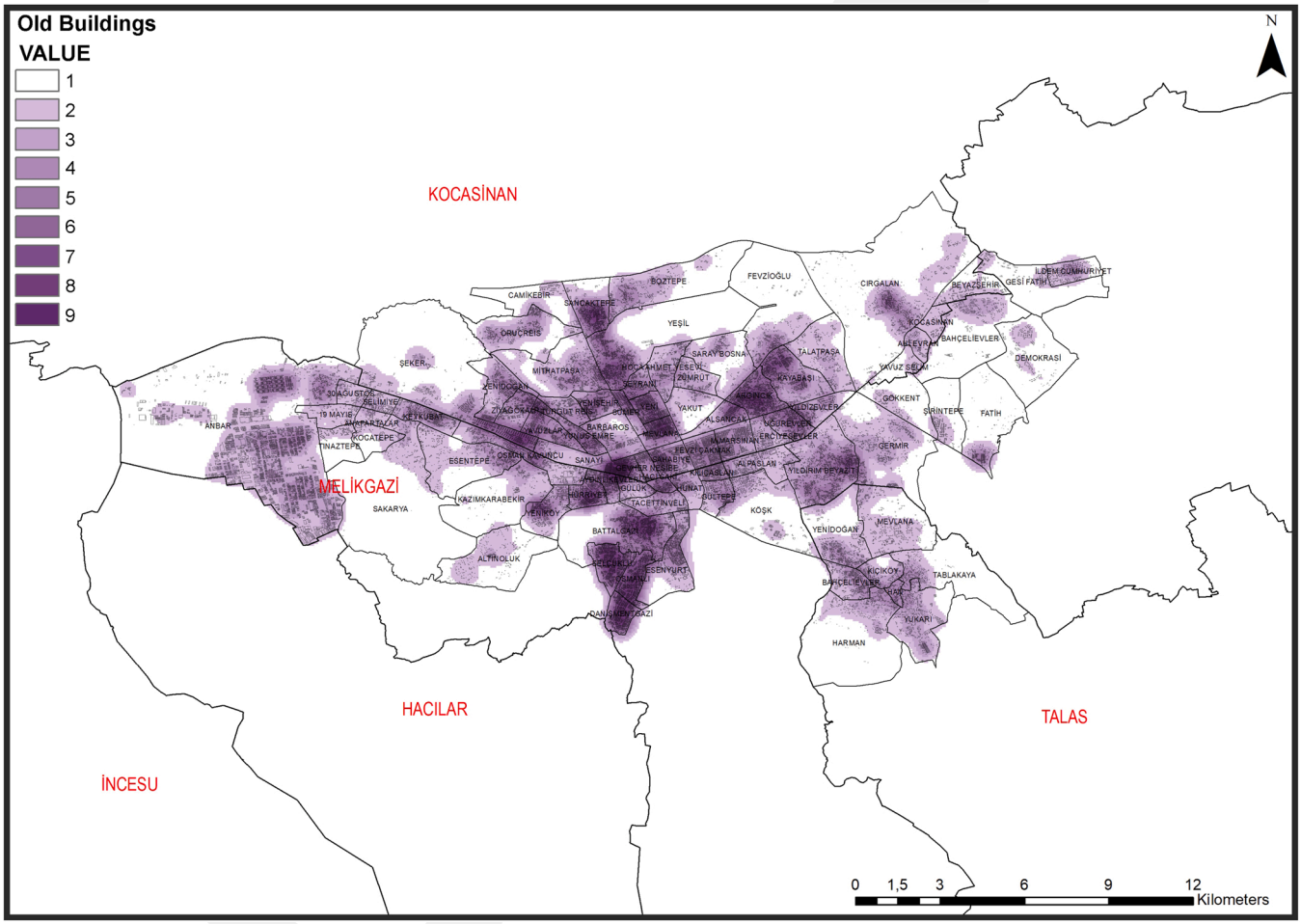

Fig. 18. The map of old buildings (Building Level).

Table 1 and Table 2 along with Jacobs' tools for evaluating Kayseri. The first of these tools which is concentration, consists of population density (PD). Mixed-use which is the second tool, refers to mixed (residential and non-residential) use of buildings. The need for small blocks is based on street density (SD) as the possibilities for interaction on streets and in neighborhoods. The need for small buildings is based on short buildings that ensure natural surveillance of streets. The need for aged buildings is defined by both the age of buildings and real estate values of the urban pattern. The data used in this study were taken from the Geographic Information System of Kayseri Municipality, and the Kernel maps created in ArcGIS program (ESRI) were interpreted by analyzing them.

This study used the Kernel Density and Line Density Tools of ArcGIS 10.3.1 Spatial Analyst Module. Kernel density estimation is "a non-parametric way of estimating the probability density function of a random variable" (URL-2, 2019). In this method, the area where the points (buildings) or polylines (streets) are located is divided by cells and the density is determined by the histogram depending on the number of points in each cell. In the analysis, the distribution of points is tested by comparing the observed frequency distribution of the cells with the expected value. Line density estimation is similar to the kernel density method; however, this tool works only with polylines (streets) (URL-3, 2020; URL-4, 2019).

First, we produced density maps using the building, road and population datasets and re-produced the data for analysis. For instance, to estimate the kernel density of mixed-use, we produced new data using the addresses of each building. If the addresses indicated that there were

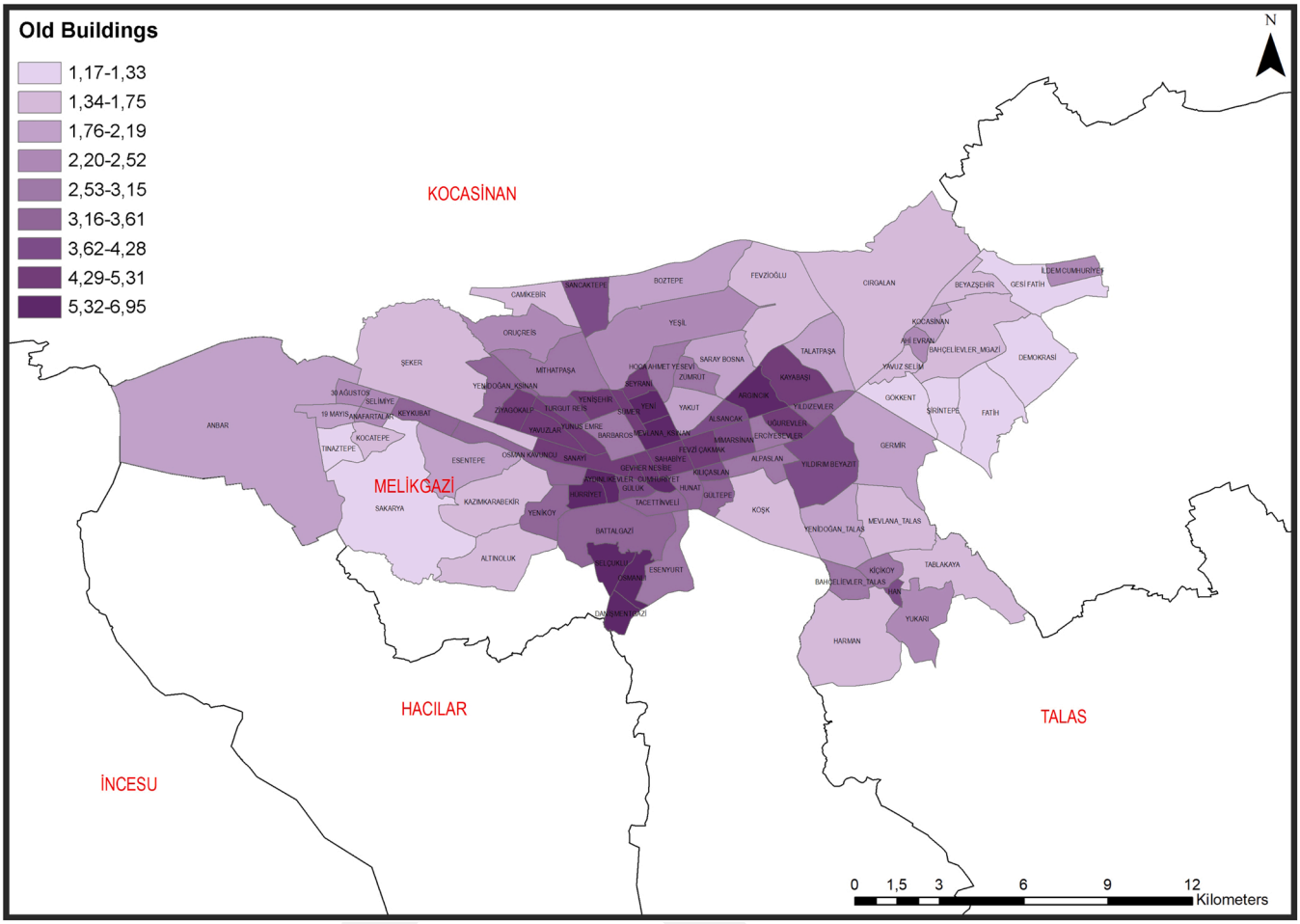

Fig. 19. The map of old building (Neighborhood Level).

Fig. 20. Selçuklu neighborhood: One of the highest values for old building density.

both residential and non-residential units in the same building, we marked that building as mixed-use. (See Table 1 for the re-produced data for each density analysis).

We used buildings older than 10 years (by the year 2019) in the density analysis to be able to understand to what extent the neighborhoods can provide affordable housing as Jacobs cares about the presence of aged buildings for providing affordability. There are two main reasons for selecting buildings older than 10 years in the density analysis. Firstly, after 2009, building regulations have been changed in Turkey such as the necessity of adding fire escape to new buildings, compulsory elevator, and ramp systems for disabled people. These amendments increased the building costs so the apartment prices. Secondly, As of January 2019, when we conducted our analysis, the real estate index values (square meter price) of (3 + 1) middle floors of apartment houses in Kayseri decrease dramatically for the buildings older than ten years (URL-5, 2021). There is no significant change in prices apart from this. We have also clustered building age groups according to the mean difference of prices using K-means clustering method via SPSS program. According to the results of the cluster analysis, two groups were formed: buildings aged 10 and below and buildings over 10 years old (ANOVA: $F = 70{,}423$ sig $= 0004$). So, we can say that a-ten-year threshold is valid for this case. It is also in parallel with the previous studies (Sung et al., 2015; De Nadai et al., 2016) and our observations in the city. Therefore, we chose ten-year-criteria as a threshold for relatively affordable houses in the neighborhoods. The reason why we used the offered price is that there is no data about the change in actual prices in Turkey. This is the

Fig. 21. Sakarya neighborhood: One of the lowest values for old building density.

limitation of our study because offered prices do not fully represent actual prices.

We also selected "buildings with less than 8 stories" to define short buildings. For this selection, we based on the classification and definitions in the regulation entitled "Planned Areas Zoning Regulation (No:30113)" in Turkey.

After we produced density maps for each variable, we reclassified the density values of each cell according to natural breaks from 1 (the lowest value interval) to 9 (the highest value interval) to be able to evaluate the maps together. As a further step, we merged these five raster datasets into a new dataset by evaluating the value of each cell in this new dataset as an arithmetic mean of five cells in the merging datasets. Thus, we evaluated the final value (urban vitality value) of each cell.

We also evaluated the values of each neighborhood in the study area (87 neighborhoods) for each variable using the weighted average (weighted arithmetic mean) formula (URL-1, 2020):

$$V_i = \frac{\sum_{1}^{9} a_{c_n} \times n}{a_i}$$

V_i: Value of neighborhood i for selected variablea_i : Total area of neighborhood ia_{cn} : Total area of cells with a value of 'n'n: Cell value (from '1' to '9').

Thus, we obtained five different values (population density, mixed-use, street density, short buildings, old buildings) for each neighborhood. Finally, we assigned an urban vitality value to each neighborhood by calculating the arithmetic mean of these five values.

To be able to classify 87 neighborhoods based on the urban vitality value, we used the K-Means Clustering Method. Using this clustering method, it is possible to divide "n" observations into "k" clusters, where each observation is assigned to the cluster with the nearest mean (URL-6, 2020). Thus, we divided 87 neighborhoods into 4 categories that represent high, moderate, low and non-urban characteristics.

5. Results and discussion

5.1. Concentration and mixed-use

Jacobs' tools can be considered together with her urban theory. In this context, population density (PD) values overlap with housing density (HD) values (Figs. 2 and 3). A neighborhood must have a sufficiently dense population including residents (Jacobs, 1961).

Most of the neighborhoods in cities are made of residences. The parks, commercial areas and public spaces in neighborhoods are used mostly by the people who live in them. If the population density and diversity are too low, the commercial areas in neighborhoods cannot survive. Areas with high population density and diversity require more urban and commercial activities. Thus, the demand for cultural and commercial activities contributes to urban life and urban vitality. Kayseri's population density map shows that the population density values of the Kılıçarslan, Fevzi Çakmak, Aydınlıkevler and Mimarsinan neighborhoods are high (Fig. 4). The population density values are low for Harman, Anbar, Cırgalan and Fevzioğlu neighborhoods, which are all far from the city center (Fig. 5).

The neighborhood must have more than one primary function, preferably more than two (Jacobs, 1961) so that people can go out during the day and use areas for different purposes. People use streets in different ways at different times. This affects both the security and economy of cities. For example, there is excess population density during working hours in areas with lots of businesses, but it decreases considerably outside of working hours. Adding secondary uses to these areas for non-work hours positively affects their security and economy.

Kayseri's mixed-use maps (Figs. 6 and 7) show the highest mixed-use values for the Sahabiye, Kılıçaslan and Mimarsinan neighborhoods (Fig. 8). These high-value neighborhoods are located in the city center where primary and secondary uses are prominent. Tınaztepe, Boztepe, Danişmentgazi neighborhoods have the lowest mixed-use values (Fig. 9). These neighborhoods need to add secondary functions for different times of the day.

5.2. Opportunities for interaction and the need for aged buildings

This paper examines Jane Jacobs' principle of the need for small blocks using street density analysis (Figs. 10 and 11). The street density map shows that the streets and roads divide the city blocks into many parts where the number of streets (secondary urban roads) is high, and the small city blocks create the short block effect that increases street interactions. This interaction is not only theoretical. It actually occurs in areas with short blocks and many streets. Important corners at road intersection also form city landmarks. Jacobs emphasizes the effect of short blocks and corners in city centers for urban vitality. The neighborhoods of Cumhuriyet, Osmanlı, Gülük and Yunus Emre have high street density values (Fig. 12). Sakarya, Cırgalan, Fevzioğlu and Tınaztepe have low street density values (Fig. 13). The latter neighborhoods were built up along the main roads that connect the city's districts and do not have much of small block effect formed by secondary streets. Overlapping the maps of Kayseri's short buildings and street density verified one of Jacobs' ideas: the interaction was, in fact, low in places with lots of tall buildings (Figs. 14 and 15). In other words, the density of short buildings is high in the streets and areas where the number of secondary urban roads are high. However, as Jacobs mentioned, if the number of tall buildings increases, the interaction between the streets will be reduced by decreasing building density. Neighborhoods that consist of high-rise buildings cannot be observed well, which create security risks. The neighborhoods with the highest densities of short buildings are Cumhuriyet, Osmanlı, Selçuklu and Danişmentgazi (Fig. 16). Sakarya, Gökkent, Gesi and Fatih have the lowest densities of short buildings (Fig. 17).

According to Jacobs, all enterprises emerge due to new buildings. On the other hand, rents, profit rates and business expenses are high in areas with no old buildings. Old buildings thus balance housing prices in cities. A mix of new and old buildings is ideal for the financial well-being

Table 3
The Urban Character Values of Neighborhoods.

Neighborhood Name	Population (person)*	Street Density	Population Density	Short Buildings	Old Buildings	Mixed Use	Urban Character	Degree of Vitality
AYDINLIKEVLER	6458	7,13	6,69	4,88	5,59	6,20	**6,10**	1
CUMHURİYET	115	7,82	1,80	8,23	5,71	6,58	**6,03**	1
SAHABİYE	3956	6,16	5,92	4,30	4,72	7,76	**5,77**	1
OSMANLI	19203	7,54	5,74	7,10	6,95	1,16	**5,70**	1
KILIÇASLAN	10676	5,01	7,60	3,58	4,28	7,72	**5,64**	1
HÜRRİYET	16132	6,58	5,61	5,18	5,78	4,48	**5,52**	1
ARGINCIK	2743	7,19	2,98	6,75	6,43	4,19	**5,51**	1
SELÇUKLU	23300	6,88	5,46	6,77	6,53	1,15	**5,36**	1
GÜLÜK	1054	7,42	4,53	3,97	4,03	6,62	**5,31**	2
DANİŞMENTGAZİ	12870	6,65	4,99	6,72	6,58	1,01	**5,19**	2
HACI SAKİ	968	6,91	3,34	4,86	4,98	5,65	**5,15**	2
YENİ	9304	7,25	4,21	5,50	5,97	2,74	**5,13**	2
MİMARSİNAN	22808	5,02	6,07	3,41	3,94	7,22	**5,13**	2
FEVZİ ÇAKMAK	21304	4,79	6,98	3,90	4,56	5,35	**5,12**	2
GEVHER NESİBE	1754	6,13	3,86	4,85	4,57	6,02	**5,08**	2
YUNUS EMRE	5177	7,74	3,61	5,80	5,31	2,79	**5,05**	2
MEVLANA_KSİNAN	11906	5,70	4,93	5,27	5,72	3,61	**5,05**	2
UĞUREVLER	8290	6,98	3,40	4,73	5,10	3,93	**4,83**	2
YENİŞEHİR	6634	7,15	4,55	4,90	4,78	2,34	**4,74**	2
YAVUZLAR	10943	7,21	3,46	5,47	5,10	2,05	**4,66**	2
TURGUT REİS	14418	6,80	5,02	3,58	3,79	2,65	**4,37**	2
ZİYAGÖKALP	14621	6,41	4,77	4,10	4,48	1,77	**4,30**	2
ERCİYESEVLER	14895	5,26	5,67	2,36	3,04	4,67	**4,20**	3
KEYKUBAT	18638	4,75	4,80	3,90	3,54	3,94	**4,19**	3
SÜMER	2455	6,20	3,04	4,68	4,92	2,00	**4,17**	3
BAHÇELİEVLER_TALAS	23446	5,99	5,43	2,85	3,07	3,45	**4,16**	3
TACETTİNVELİ	2304	6,26	2,73	3,96	3,41	4,33	**4,14**	3
HUNAT	1581	4,77	2,79	3,22	3,27	6,11	**4,03**	3
SEYRANİ	3410	5,97	2,69	4,32	4,90	1,88	**3,95**	3
ALPASLAN	14028	4,29	5,55	1,96	2,68	4,85	**3,87**	3
SANAYİ	1190	5,06	2,06	4,62	4,60	2,62	**3,79**	3
KAYABAŞI	7345	5,64	2,00	4,89	4,55	1,88	**3,79**	3
ALSANCAK	3226	4,83	2,08	3,83	3,89	3,72	**3,67**	3
GÜLTEPE	10485	4,29	3,91	2,94	3,46	3,49	**3,62**	3
YILDIRIM BEYAZIT	22223	4,79	2,66	3,67	3,93	2,76	**3,56**	3
YENİKÖY	16805	4,79	3,37	3,38	3,48	2,67	**3,54**	3
İLDEM CUMHURİYET	23186	5,66	5,79	1,76	2,35	1,96	**3,50**	3
BARBAROS	14549	5,35	3,66	3,02	3,12	2,28	**3,49**	3
OSMAN KAVUNCU	10158	4,53	2,59	4,23	3,54	2,50	**3,48**	3
ANAFARTALAR	8010	4,08	6,35	2,02	2,25	2,11	**3,36**	3
HAN	602	5,44	1,73	4,10	4,19	1,32	**3,35**	3
ESENYURT	17248	4,58	3,41	2,95	3,11	2,66	**3,34**	3
YILDIZEVLER	5438	4,70	2,31	3,58	3,37	2,46	**3,28**	3
KİÇİKÖY	6078	4,88	2,92	2,97	2,73	2,40	**3,18**	3
BATTALGAZİ	10472	4,23	2,40	3,55	3,61	1,90	**3,14**	3
ZÜMRÜT	7165	4,73	2,72	2,72	2,74	2,74	**3,13**	3
HOCA AHMET YESEVİ	8614	4,22	2,42	3,12	3,15	2,54	**3,09**	3
SELİMİYE	10221	3,35	5,60	2,05	2,41	1,95	**3,07**	3
30 AĞUSTOS	8012	3,90	3,88	2,37	2,33	2,70	**3,04**	3
YENİDOĞAN_KSİNAN	9361	4,28	2,30	3,81	3,29	1,15	**2,97**	3
MEVLANA_TALAS	71972	3,91	4,23	1,54	1,75	3,28	**2,94**	3
SANCAKTEPE	7779	3,35	1,85	3,79	3,94	1,22	**2,83**	3
YENİDOĞAN_TALAS	29863	3,85	3,05	1,85	2,02	2,10	**2,57**	4
BEYAZŞEHİR	17148	4,53	3,72	1,62	1,57	1,13	**2,51**	4
YAKUT	8361	3,71	1,96	2,13	2,04	2,67	**2,50**	4
AHİ EVRAN	4134	3,43	2,92	2,56	2,52	1,01	**2,49**	4
MİTHATPAŞA	14262	3,34	1,88	2,62	2,68	1,68	**2,44**	4
19 MAYIS	10282	3,48	3,06	2,18	2,02	1,43	**2,44**	4
ŞİRİNTEPE	17278	4,49	2,54	1,30	1,25	2,19	**2,35**	4
KOCATEPE	11008	2,89	3,64	1,53	1,67	1,88	**2,32**	4
KOCASİNAN	3643	3,35	2,64	2,04	2,04	1,41	**2,30**	4
YUKARI	277	4,58	1,01	2,43	2,43	1,01	**2,29**	4
ESENTEPE	17001	3,19	2,03	2,28	2,19	1,69	**2,27**	4
GESİ FATİH	28024	3,93	2,75	1,15	1,19	1,94	**2,19**	4
KAZIMKARABEKİR	8408	3,10	1,54	2,95	1,63	1,40	**2,12**	4
BAHÇELİEVLER_MGAZİ	11681	4,40	1,66	1,47	1,44	1,61	**2,12**	4
GERMİR	4218	2,96	1,54	2,12	2,05	1,24	**1,98**	4
KÖŞK	24026	2,76	2,02	1,49	1,58	1,68	**1,91**	4
ORUÇREİS	2881	2,43	1,26	2,49	2,26	1,01	**1,89**	4
YEŞİL	3810	2,22	1,30	2,22	2,28	1,27	**1,86**	4
TALATPAŞA	2202	2,70	1,17	2,26	2,10	1,02	**1,85**	4
YAVUZ SELİM	3160	2,63	1,95	1,72	1,44	1,39	**1,82**	4
GÖKKENT	6200	3,26	2,01	1,29	1,31	1,21	**1,82**	4
SARAY BOSNA	2027	2,40	1,25	2,01	2,03	1,29	**1,80**	4
DEMOKRASİ	28347	2,23	2,69	1,50	1,17	1,34	**1,79**	4
ALTINOLUK	9698	2,77	1,54	1,90	1,47	1,23	**1,78**	4
TINAZTEPE	12238	1,90	3,27	1,38	1,32	1,01	**1,78**	4
BOZTEPE	3779	2,19	1,19	2,08	1,99	1,01	**1,69**	4
ANBAR	3893	2,34	1,04	1,96	1,98	1,02	**1,67**	4
ŞEKER	2485	1,99	1,13	1,75	1,73	1,20	**1,56**	4
FATİH	2590	2,66	1,14	1,35	1,33	1,15	**1,53**	4
CAMİKEBİR	6403	1,97	1,68	1,34	1,47	1,09	**1,51**	4
HARMAN	2885	2,26	0,95	1,46	1,46	1,07	**1,44**	4
TABLAKAYA	2007	1,91	1,09	1,44	1,41	1,22	**1,41**	4
FEVZİOĞLU	1840	1,74	1,11	1,50	1,46	1,06	**1,37**	4
CIRGALAN	3144	1,49	1,03	1,51	1,43	1,04	**1,30**	4
SAKARYA	8642	1,42	1,19	1,22	1,19	1,11	**1,23**	4

*Source for neighborhood populations: TURKSTAT, 2017.

*Source for neighborhood populations: Turkish Statistical Institute (TURKSTAT), 2017.

Table 4
Descriptive statistics of urban vitality categories.

Degree of vitality (Urban Character)	Number of neighborhoods	Mean	Std. Dev.	Min	Max
High-Urban	8	5,70	0,26	5,36	6,10
Moderate-Urban	14	4,94	0,31	4,30	5,31
Low-Urban	30	3,53	0,42	2,83	4,20
Non-Urban	35	1,94	0,39	1,23	2,57
Total	**87**	**3,32**	**1,37**	**1,23**	**6,10**

of cities. The maps of Kayseri's old buildings (Figs. 18 and 19) show that the highest densities of buildings that are ten or more years old are in Osmanlı, Selçuklu, Argıncık and Danişment (Fig. 20). The neighborhoods with the lowest densities of old buildings are Sakarya, Gesi, Fatih and Demokrasi (Fig. 21), which are newly developing sites in Kayseri. All the enterprises in them have been created with new construction.

5.3. The synthesis: Urban character values

In the final part of the study, we synthesize the conditions for a vibrant urban environment as urban character (UC) by calculating the arithmetic mean of the five values (Table 2). Higher values indicate more urban character. The urban character table (Table 3) shows the relationship between Kayseri's center and its periphery. We classified the values as high, moderate, low UC and non-UC by using K-Means clustering method via SPSS (Table 4). It is seen that closer to its center and sub-centers there is more urban character. High UC characterizes central areas, whereas low UC and non-UC are found in the periphery.

22 of the total 87 neighborhoods have high or moderate UC values. Aydınlıkevler has the highest UC value, this is because it is located in the center of city, and also it has a mix of old and new buildings (Fig. 22). Along with several primary uses, it has secondary uses. Besides, as can be seen in this area, the most important condition that affects vibrant urban environments is high population density (Sung et al., 2015, 2013; De Nadai et al., 2016; Delclòs-Alio and Miralles-Guasch, 2018). Cumhuriyet's urban character is also high since it combines characteristics of both the old town and the new city. In Cumhuriyet, not only public spaces such as squares, boulevards and commercial enterprises are present, but there are also high-value conditions such as mixed uses (houses, offices and shops), a high density of short buildings and the presence of old buildings provide high UC. The old commercial districts including many old buildings scattered throughout their urban pattern

Fig. 22. Aydınlıkevler neighborhood: high urban character.

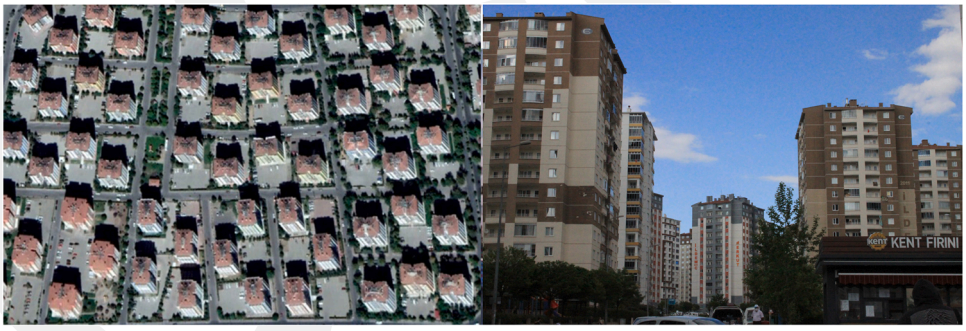

Fig. 23. . İldem neighborhood: Low urban character.

Fig. 24. Yenidoğan neighborhood: Low urban character.

Fig. 25. . Şeker neighborhood: Non-urban character.

Fig. 26. Altınoluk neighborhood: Non-urban character.

attract many users; therefore, it leads to increase urban vitality (Nathiwutthikun, 2012). However, Cumhuriyet has a low population density value because it has more non-residential buildings than other parts of the city. Sahabiye has the third highest urban character. This is because, it is in the city center and has its densest commercial areas, so its primary and secondary uses are sufficient. Mixed primary uses and secondary uses, thus, attract different users. This finding is also involved in previous studies (Nathiwutthikun, 2012; Manaugh and Kreider, 2013; Sung et al., 2015, 2013; De Nadai et al., 2016; Delclòs-Alio and Miralles-Guasch, 2018). Despite being in the city center, its real estate values are balanced by old buildings. There is also a mixed population in this neighborhood, where mostly Syrians and other immigrants live. The problem is that the character of this neighborhood is about to change due to the urban redevelopment project that was planned in 2015 and began to be implemented in 2018 by the Kayseri Metropolitan Municipality. The transformation in this neighborhood is a good example of how urban development projects, which Jacobs strongly opposed, can change the urban character and vitality of neighborhoods.

30 of the total 87 neighborhoods have low UC values. Yıldırım Beyazıt has a low UC value. It is a newly developing area with mostly high-income residents. This mostly residential area needs mixed uses, population density and population diversity. Although its number of old buildings is sufficient, the rapidly increasing number of new buildings has put its real estate values out of equilibrium. Hereby, a district with only new buildings would have only enterprises that could be the high costs, which it has negative implication in terms of urban vitality (King, 2013; Sung et al., 2015; De Nadai et al., 2016; Fuentes et. al, 2020). İldem Cumhuriyet is a satellite city of Kayseri. It has grown rapidly in the last 15 years. Although there are mostly commercial enterprises in the neighborhood, a large majority of its residents work in and around the city center during the day. In fact, as the findings of previous studies (Fuentes et. al, 2020; Yue et. al, 2021), the presence of housing estates in this area, which are characterized by high population and housing density, has a significant effect on the vibrant urban environment of İldem Cumhuriyet (Fig. 23). Yenidoğan is a neighborhood with new high-rise housing near Kayseri Erciyes University. It is also close to a sub-center of the city, which gives its vibrant urban environment an advantage (Fig. 24).

35 of the total 87 neighborhoods have non-UC values. According to the urban character calculations, the peripheral district of Belsin with neighborhoods that surrounded the city's northwest axis (30 Ağustos, 19 Mayıs, Anafartalar, Kocatepe, Tınaztepe, Anbar, Keykubat and Şeker) has least urban character. Housing began to be constructed there due to the presence of an organized industrial area, and the presence of a stadium, a bus terminal and a city hospital have been increasing development for decades, but the lack of mixed use and population density reduced Belsin's urban character (Fig. 25). Altınoluk was developed on the city's north-south axis and has one of the lowest values for short buildings and street density (Fig. 26). It seems to cause the lack of interaction along pedestrian path, which is supported by previous studies (Nathiwutthikun, 2012; Sung et al., 2013, 2015; De Nadai et al., 2016; Delclòs-Alio and Miralles-Guasch, 2018). In addition, its land values are constantly increasing due to clusters of new buildings. Gökkent and Yavuz Selim on the city's northeastern axis were created to provide cheap housing. Although population density in these neighborhoods is high, most of the residents' work in the city center and its surroundings during the day. Their urban character is negatively affected by a lack of secondary uses and the inability to provide most of the urban facilities that are in demand (Figs. 27 and 28).

6. Conclusion

This study identifies urban character in Kayseri using Jacobs' criteria for vibrant cities. It contributes to the research by focusing on her ideas from a practical point of view and providing a database for the city's planners. The conditions needed to ensure Kayseri's viability were mapped using GIS. The application of Jacobs' theoretical ideas to Kayseri, a rapidly developing medium-sized city in Anatolia, provided a detailed examination and interpretation of the dynamics of this city. This approach shows that the character of each district of the urban area may be different and that cities have different characteristics within themselves.

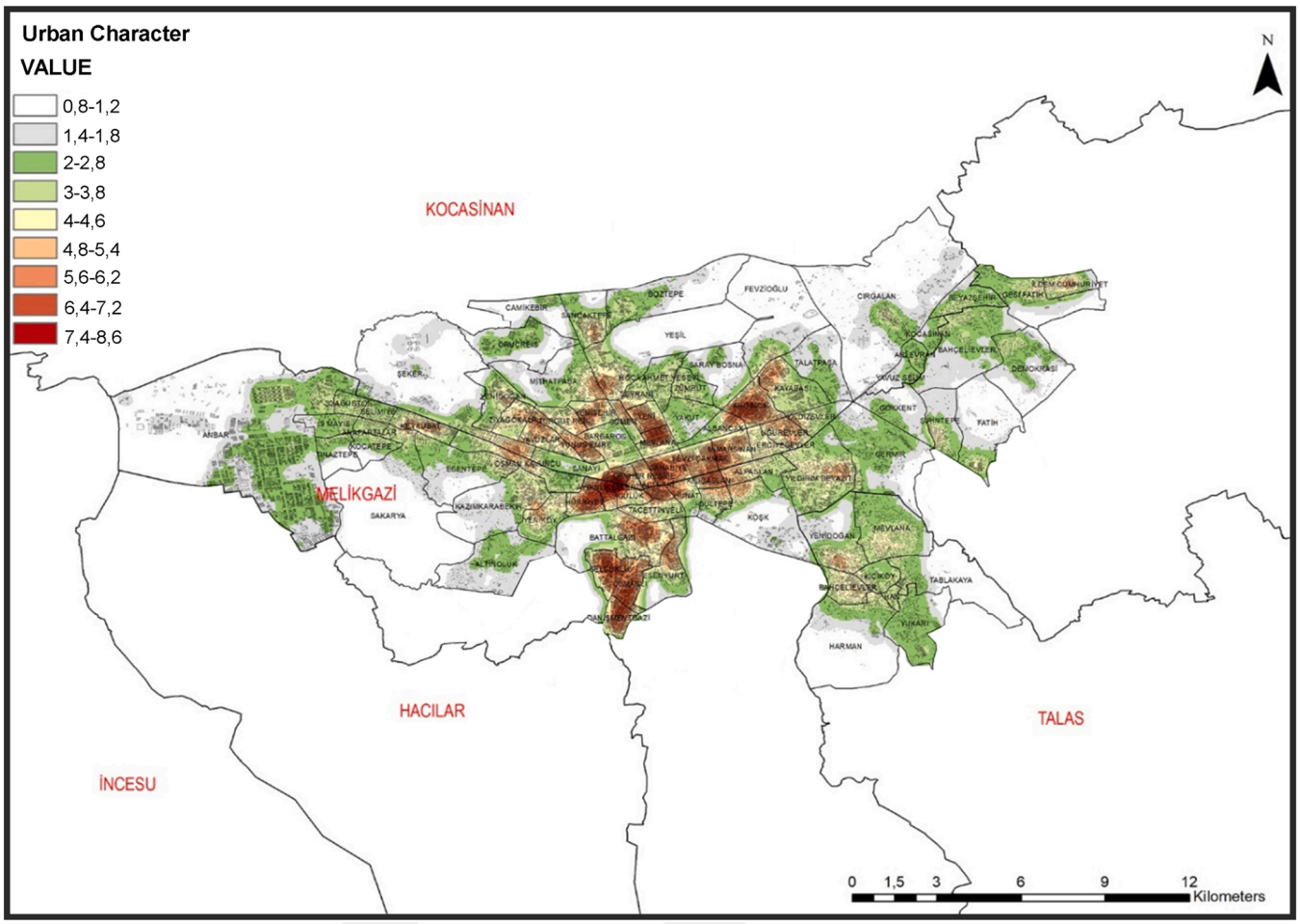

Fig. 27. The map of urban character (Building Level).

Considering all the conditions, it is possible to note that vitality could high in peripheral neighborhoods that do not include historical areas (Delclòs-Alio and Miralles-Guasch, 2018). Kayseri's historical centers and the parts where commercial activities have intensified were determined to be the areas where urban vitality is high. Several transformed and newly built areas in Kayseri also have high urban vitality values. In fact, this leads us to the conclusion that urban vitality can develop not only in the historical and commercial urban centers, but also in newly developing regions if the development process is managed logically. On the other hand, Jacobs' approach can also be used to identify the harmful effects of urban (re)development. For instance, isolated high-rise housing projects, which are a part of urban growth, negatively affect the viability of the streets in some parts of the city.

According to Jacobs' tools, we classified the urban character of Kayseri's neighborhoods as high, moderate, low or non-urban. As residents of Kayseri, as Jacobs did for Manhattan in NYC, it was possible for us to compare what the numerical data say with what an observer sees with the naked eye. Based on these observations, we can say that there are some neighborhoods where the urban character is high as a result of our observations, but the urban character value is low in the UC Table. For example, Yenidoğan and Mevlana in the Talas district are close to Erciyes University, which has more than 50,000 students and 3000 academics. The population of these neighborhoods is younger and more active than that of other neighborhoods. Thanks to the facilities that meet the demands of this young population, there is a vibrant urban environment in these neighborhoods every hour of the day. In other words, human activities affect the diversity of city life, as well as the vitality associated with it (Crestani and Pontes, 2016; Sung et al., 2013, 2015; Jin et al., 2017; Yue et al., 2021). However, due to the lack of short and old buildings and the low street density, the urban character of these two neighborhoods was found to be low. In Selçuklu, Osmanlı, Danişmentgazi neighborhoods which urban character value is classified as high UC, urban character is not based on mixed urban activities, but on the presence of short and old buildings, many streets and population density. These neighborhoods also host the highest number of Syrians in the city. Although the ratio of mixed-use buildings is almost zero here, there is a very vibrant street life in these neighborhoods. It is possible to suggest that population diversity and building and street relations can make a district vibrant even if it has only residential units. These findings are in line with the results of previous studies (Sung et al., 2015; Delclòs-Alio and Miralles-Guasch, 2018).

As an observer experiencing the city, Jacobs' approach is an important way to understand and improve the city with not from the top-down, but from the street level, from an insider's perspective. In this regard, it offers the opportunity to characterize streets or specific locations (Yue et al., 2021), as well as previous analyses conducted at the city scale (Sung et al., 2013, 2015). Besides, some of the Jacobs' conditions may not be completely effective since they were generated by observing metropolitan cities in America. However, considering today's conditions, especially in developing cities of the globalized world, it is possible to interpret her approach within their own dynamics.

This methodology provides useful information for both city planners and politicians about how and where to increase urban vitality in Kayseri. The results of this study may provide a useful layout for policymakers to encourage mixed-use, increase the street-building relationship, improve the diversity of the population, rethink building

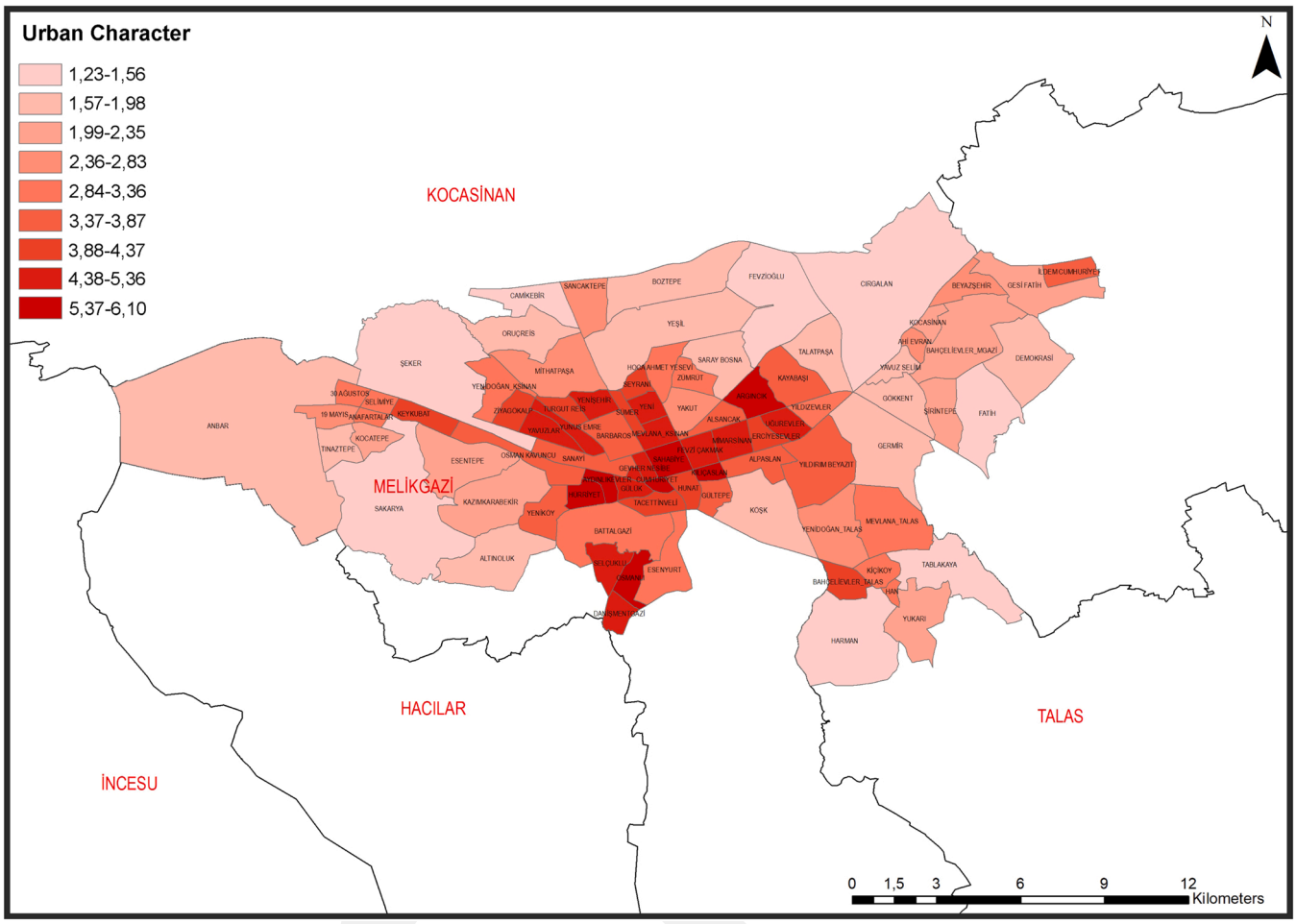

Fig. 28. The map of urban character (Neighborhood Level).

codes, and re-development projects. It is also expected to lead further studies in different urban settings in Turkey and other developing countries. The data included in this study can be used as a guide for urban projects to improve streets and neighborhoods and for new researches about growing cities. Further studies, which will be built upon this re-mapping study, should take into account the limitations of the study and improve the outcomes by adding a cultural perspective to the socio-spatial analysis that we made in this study. Based on the UC values and maps produced here, further studies may focus on the socio-cultural dynamics of different neighborhoods within the city and their relationship with urban vitality.

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