

Mapping method for the integrated analysis of gentrification and touristification: the case of Málaga (Spain)

Método cartográfico para el análisis integrado de la gentrificación y la turistificación: el caso de Málaga (España)

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Abstract

Since the 1960s, the productive model of Málaga has been pointed toward tourism. The redevelopment of the historic centre of the city and the increasing specialization of some areas in services linked to tourism have created several negative consequences on the habitability and the identity of those areas. This work aims at developing a methodology that allows measuring, individually, the spatial influence and intensity of gentrification and touristification. The final goal is join together both urban processes in a map, also including the evolution of their variables over time. The method allows delimiting areas where both processes overlap. The results show a strong gentrification and touristification in the historic centre of Málaga, also observed along the main road axis and the coastline. In addition, touristification is higher in the areas adjacent to the historic centre whereas gentrification is observed in squares with special architectural characteristics.

Keywords: gentrification; touristification; cartographic analysis; demographic evolution; residential segregation.

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Resumen

La ciudad de Málaga ha ido orientando su modelo productivo hacia el turismo durante algo más de un siglo. La remodelación del centro histórico y la creciente especialización de parte de la ciudad en los servicios vinculados al turismo han generado una serie de externalidades negativas en la habitabilidad y la identidad de determinados espacios urbanos de la ciudad. Por ello, el presente estudio tiene como objetivo principal elaborar una metodología que permita medir por separado la distribución espacial e intensidad de los procesos de gentrificación y turistificación, para trasladarlo finalmente a una cartografía que integre ambos fenómenos urbanos, considerando la evolución temporal en muchas de las variables. Los resultados permiten identificar dónde se solapan ambos procesos y, además, posibilita el diagnóstico de su evolución espacial. La metodología permite concluir que ha habido un proceso de gentrificación y turistificación intensos en el centro de Málaga, con una expansión de forma continua hacia los principales ejes viarios y el litoral, distinguiéndose una mayor prevalencia de la turistificación en las coronas que rodean al centro histórico y un proceso de gentrificación en núcleos con un carácter arquitectónico particular.

Palabras clave: evolución demográfica; análisis multivariable; segregación residencial; densidad turística; procesos urbanos.

1. Introduction

Urban processes such as gentrification and touristification are usually independently analyzed, although they are related and, frequently, hard to distinguish. During the 70s, when facing the crisis of the fordist production model and the Keynesian welfare society, the cities began an empowerment process at a local scale, as well as a global rivalry, as their main economic driver (Brenner, 2004). Consequently, urban processes such as gentrification and touristification have been highly relevant in the urban development of many cities across the world.

Gentrification is a vague and flexible term, used to describe a series of processes related to changes in land use and building purposes in urban areas: actions for increasing land profitability through reinvestment and redevelopment; planning and economic development projects (both public and privates) addressed to increase the tax base through revitalization, renovation and/or restoration of buildings and infrastructures; demographic changes aimed at increasing middle and high-class population (usually white people); transformation of social and cultural activities addressed to those classes (especially leisure and consumer culture); removal or displacement of working classes shops and dwellings; decreasing in the number of affordable dwellings and commercial premises; removal of poor people, immigrant or minority communities; consumer landscapes with symbols and images with cosmopolitan connotations; actions addressed to promote the appearance of safe and desirable areas; and the fetishisation of some types of cultural diversity.

On the other hand, touristification refers to the complex sum of territorial transformation processes driven by tourism in a certain area (Ojeda & Kieffer, 2020). The main parameters of this process are the number of short-term rental housing, the number of visitors and overnight stays, economic indicators such as the weight of tourism in the GDP or the number of people whose job are linked to this sector. Additional parameters are qualitative analyses based on the perception of social actors (De la Calle-Vaquero *et al.*, 2020). Sequera & Nofre (2020) define a series of key categories in order to evaluate the Airbnb impact over the urban fabric of the neighborhoods: (1) The spatial distribution of the Airbnb accommodations (Gil & Sequera, 2022); (2) its spatial-temporal

distribution; (3) the incomes obtained by hosts (Wachsmuth *et al.*, 2018); and (4) the number of houses that change its residential use to be exclusively used as rental houses at the short-term.

Although gentrification and touristification share effects such as the expulsion of population from urban centres, there are some substantial epistemological differences between both phenomena, since the expansion of urban tourism in a central urban area is not always a first step for gentrification (Sequera & Nofre, 2018), and vice versa. Despite of this, in the last years, many studies have thought about the relation between both urban processes, supporting different approaches:

1. Touristification as the source of gentrification (Barata-Salgueiro, Mendes & Guimarães, 2017). This is the so-called “touristic gentrification” (Gotham, 2005). The historic centre of Málaga could be considered as an example, according to Chamizo-Nieto, Nebot-Gómez de Salazar & Rosa-Jiménez (2020);
2. There is a correlation between both processes, but they are not directly determined nor generated by each other (Vollmer, 2019);
3. Touristification is a consequence of gentrification, so it should be considered as a parameter of the latter (Janoschka, Sequera & Salinas, 2014; Cocola-Gant, 2018);
4. Both processes are concurrent, especially regarding to the origins of the urban transformation instead of its effects (De la Calle-Vaquero, 2019);
5. They are two independent processes, which can be complementary and/or simultaneous, but not antagonist (Gravari-Barbas & Guinand, 2017); Sequera & Nofre, 2018; Sequera & Nofre, 2020). Tourism is attracted by middle-class neighborhoods, and, at the same time, tourism may eventually attract residential gentrification (Gravari-Barbas & Guinand, 2017).

When both processes are spatially concurrent, they reinforce each other no matter the study case and the relation between them, which leads to a conflict of interest between residents and temporal visitors. According to Vollmer (2019), it is the way in which the touristic demand affects to the commercial and hotel offer, since products and prices are addressed to visitors instead to residents. Thus, it also means a lower dwelling offer due to the touristic use of residential buildings -residential gentrification-, which enhances a higher social vulnerability of the people who live in the historic centres of touristic cities. In addition, the negative consequences of the presence of visitors in residential areas, which causes coexistence problems, may also be considered (De la Calle-Vaquero, 2019).

In the case of Málaga (Spain), since the creation of the Propagandist Society of Climate and Beautification in 1897, which was promoted by the middle-class as a way of avoiding the economic crisis at the end of the nineteenth century, the city has gone through a long path as a touristic centre. During the first half of the twentieth century, it was a winter destination for the upper classes, it became into a prominent place in summer for working classes since the 60s, and suffered a deep transformation as a cultural touristic site by the end of the century. In 2018, Málaga was the sixth municipality with the largest supply of rental housing in Spain, whereas the whole province led the Airbnb rooms and houses per 100 hotel rooms' rate (Gutiérrez & Domènech, 2020). The tourism and the efforts made by local stakeholders for its developing have enhanced gentrification and touristification processes. There are studies that detect both processes in the study area (López-Padilla, 2020; Vázquez-de la Rosa, 2021; Almeida-García, Cortés-Macías & Parzych, 2021; Castro-Noblejas, Sortino-Barrionuevo & Reyes-Corredera, 2022). However, they are not analyzed from an integrated approach and, therefore, there is no certain as to how they have been related in space and how they have evolved.

In order to carry out an objective and clear analysis, some previous studies that identify the best mapping methods (Preis *et al.*, 2020), and the most appropriate mapping techniques for displaying results (Yonto & Schuch, 2020) have been taken into account. Regarding the study area, Castro-Noblejas, Sortino-Barrionuevo & Reyes-Corredera (2022) confirmed gentrification processes in the historic centre of Málaga, whereas Almeida-García, Cortés-Macías & Parzych, (2021) identified quantitative variables related to touristification in the city. Additionally, the General Direction of Quality, Innovation and Tourism Promotion, and the Department of Tourism, Regeneration, Justice and Local Administration of Andalucía published an official report in 2020 in which the presence of Homes for Tourist Use (HTU) in Málaga and other Andalusian cities is analyzed.

The HTU are those located in residential buildings, recurrently used as tourist accommodations. In order to be defined as an HTU, it is considered the recurrent use of the house for tourist purposed and its sale in standard tourist accommodation channels. The regional law compels to legalize the house by registering it in the Andalusian Tourism Registry

Thus, the main objective of this research is to assess the spatial pattern of two processes with a great impact on the productive model and the way of life of a city, which may be used as a tool that enables a better understanding of the relationship between both urban alterations.

2. Case study

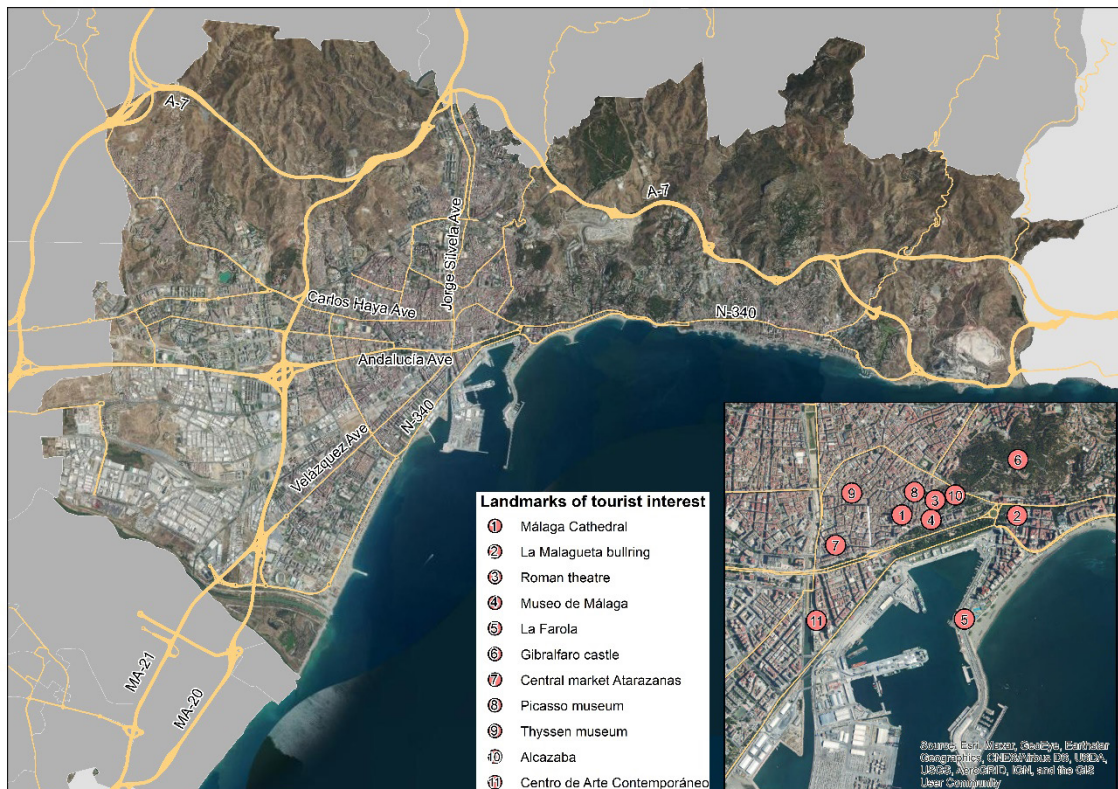
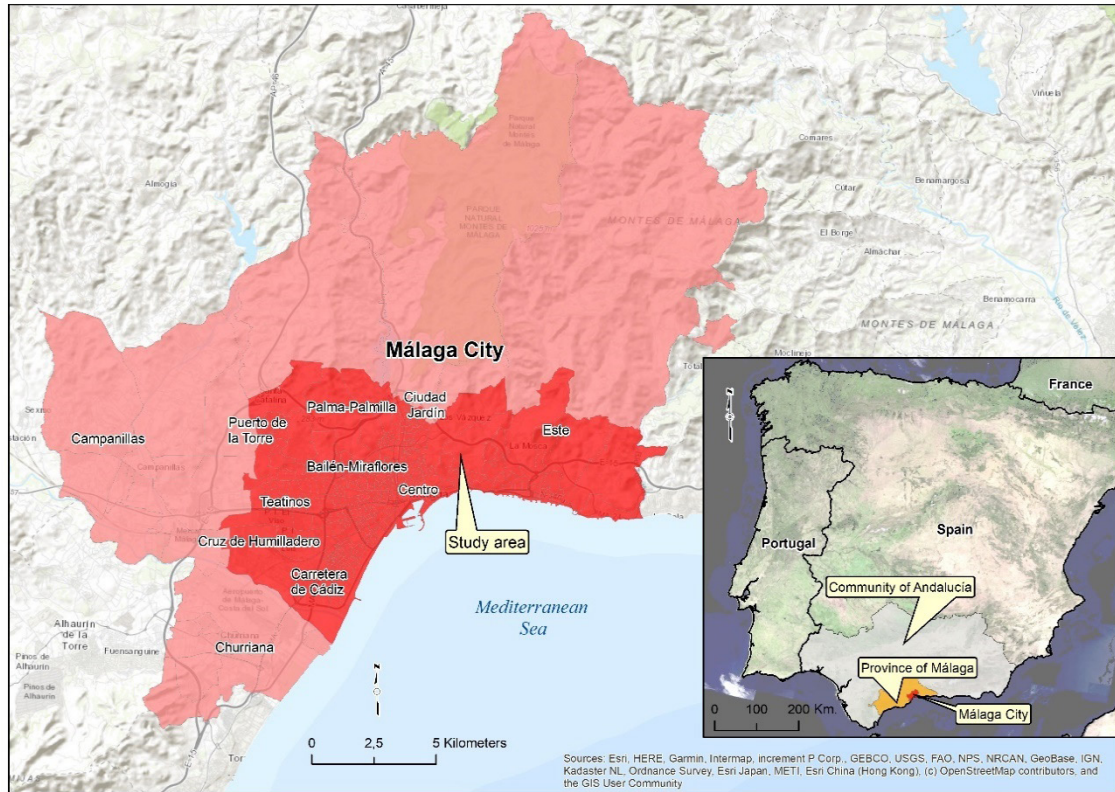
Based on data of the Spanish Statistical Office (INE from its Spanish acronym), Málaga is the fifth largest city in Spain (578,000 inhabitants in 2020). It is located in the western Mediterranean coast (Figure 1), and it gathered all the requirements for being a highly demanded tourist destination (De la Calle-Vaquero, 2019).

It is internationally well-connected thanks to low-cost air companies. The increase in the touristic flow is evident when analyzing the number of tourists that arrived by plane (according to data published by Spanish Airports and Air Navigation (AENA from its Spanish Acronym), 41 % more in 2019 than in 2007), which means that 19,858,656 passengers arrived by plane in 2019, and 70 % used low-cost companies (AENA, 2019).

The city also has a great socio-cultural appeal, including historical monuments, such as the Alcazaba, the Gibralfaro Castle, the Roman Theatre or the cathedral, and a wide range of museums opened in the last years. The number of museums increase from 22 in 2007 (Ramos-Lizana, 2008), to 40 in 2020 (Málaga City Council, 2020). All of them were supported by the “Málaga, City of Museums: Where art lives” brand, and allowed the city to be the fourth Spanish city with the best and most innovative cultural offer (Observatorio de la Cultura, 2009). Not in vain, Málaga became in one of the cities with a greater density of museums in its historic centre.

Additionally, the Port of Málaga has a cruise terminal that allowed the city to be one of the leaders in Spain in the number of passengers, only behind Barcelona and Baleares. The number of passengers reported between 2007 and 2019 increased by 34.5 %, which is a significant increase if it is considered that the renovation of the port started in 1998 (De la Calle-Vaquero, 2019).

Figure 1. Location of area of study. Presentation of the main communication routes and tourist landmarks.



Source: authors' own elaboration.

To this touristic model it should be added some urban regeneration plans, which has contributed to a greater residential -residential gentrification- (Castro-Noblejas, Sortino-Barrionuevo & Reyes-Corredera, 2022), and touristic appeal-touristification- (De la Calle-Vaquero, 2019). Thus, the city has experienced an intensification and concentration of urban uses in the historic centre as a consequence of the distortion of the urban regeneration strategy launched in 1994 (Rubio, 2003; Rein-Lorenzale, 2013). According to a report published by the Bank of Spain, these processes have entailed an increase in the average price of renting houses between December 2013 and May 2019, slightly above 45 % -only behind Barcelona and Palma- (López-Rodríguez & Llanos-Matea, 2019). This increase is enhanced by the lack of renting houses at a long-term and the increasing demand of vacation rentals. As it can be seen on the Airbnb platform, through its subsidiary AirDNA, according to data recorded by Inside Airbnb (Cox, 2018), more than half of the rentals are in the centre, especially in the historic centre (24%), this is, 4,833 places (OMAU, 2018). Based on these data, in 2018, Málaga became in one of the Spanish cities with a greater concentration of the vacation rental offer (Gutiérrez & Domènech, 2020), only behind Barcelona, Madrid, Valencia, Sevilla and Marbella. The main effect of this situation is the fall in the number of residents in the historic centre (5,247 residents in 2020), around 17 % less than in 2008. As a consequence, the historic centre has undergone a deep change, from a residential neighborhood to a touristic area focuses on touristic activities (García-Bujalance, Barrera-Fernández & Scalici, 2019).

3. Methodological procedure

Data from Málaga has been analyzed at a census section scale, but some of the peripheral census section has been removed from the analysis since they are not part of the urban fabric. For the analysis of gentrification processes, data from the last two decades have been used, since it is necessary to calculate trends, to observe its temporal evolution, and to distinguish gentrification and other similar processes. As part of the analysis, demographic variables and variables related to building characteristics have been considered. For the demographic variables, data for the 2001-2020 period were used, both for annual analyses (residential segregation index), and temporal analyses (changes in population rate).

Regarding touristification, only official touristic accommodations are measured, since there is not trustful data about unofficial vacation rentals. Based on the tourist accommodation density, the HTU pressure over residential dwellings, and the intensity of touristic accommodations, touristification in urban areas is assessed, and its effects on the city are estimated.

Data were obtained from the Spanish Statistical Office (2001 and 2011 National Census, and annual register of inhabitants), the General Directorate of the Spanish Cadastre (cartographic and alphanumeric data of properties and plots), the Tourism Registry of Andalucía (number of HTU), and the National Plan of Aerial Orthophotography (aerial images). The classification of the variables is explained below:

3.1. Gentrification

A. Demographic variables

- Changes in population rate

The main evidence of gentrification is the intense fluctuation of the house occupancy in residential areas, which is caused by several factors. Data were classified following a binary criterion, depending on the increasing/decreasing population trend (+/-) in each of the periods. The magnitude of the trend was not taken into account for a better understanding of the map and to facilitate methodological replication to other case studies. On the map, data were displayed on a univariate yellow color scale (Figure 2).

Table 1. Classification of changes in population rate.

| URBAN PROCESS. GENTRIFICATION | | 2001-2007 | 2007-2014 | 2014-2020 | SCORE |
|---|---|-----------|-----------|-----------|-------|
| Constant increasing or decreasing trend | No gentrification | + | + | + | 0 |
| | | - | - | - | |
| Recent increasing trend | Restoration and new construction | - | - | + | 1 |
| Fluctuation between decreasing and increasing periods | Last stage of gentrification | - | + | + | 2 |
| | | - | + | - | |
| | | + | - | + | |
| Depopulation after an increasing period | Gentrified and touristification processes | + | - | - | 3 |
| | | + | + | - | |

Source: authors' own elaboration.

The demographic trend fluctuations related to gentrification are:

- Constant increasing or decreasing trend: the increasing or decreasing sustained trend of population over a 20-year period is considered to be a sign that the area is not undergoing a clear process of gentrification.
- Recent increasing trend: after a process of expulsion of the original population and transformation of the urban area, this begins to be repopulated by new residents.
- Fluctuation between decreasing and increasing periods: these are a series of cases in which the evolution is interpreted as a continuous growth of the population in the last decade or a fluctuation caused by the fact that the transformation of the territorial unit has taken place progressively but not simultaneously.
- Depopulation after an increasing period: after a complete process of gentrification, the development and the increase of the aesthetic appeal enhance touristification, which started a new process of depopulation of permanent residents in favor of a temporary occupation mainly for tourist purposes (Janoschka *et al.*, 2014; Cocola-Gant, 2018).
- Residential segregation of immigrant workers

The analysis has focused on people from the Global South (Latin America, Asia and Africa), who has similar socio-economic characteristics, easing the interpretation of the gentrification index. People from those regions are usually immigrant workers with low purchasing power, so they live in gentrified areas during the first stage, when the neighborhood is deteriorated and buildings are depreciated. Eventually, they are forced to move out by the restoration and renovation of the buildings, when the dwellings are acquired by people with higher purchasing power.

The calculation is based on two indicators: the change of population from the Global South between the 2001-2011 and 2011-2020 periods, and the Duncan Segregation Index (1955), which calculate the spatial distribution of a group in an urban area compared to the whole population (Martori & Hoberg, 2004). The criterion for delimiting the thresholds in the application of the Segregation Index has been statistically adjusted to the characteristics of Málaga, so that for its replication these thresholds should be adapted to the demographic circumstances of the study case. On the map, it has been displayed on an orange color scale (Fig. 1).

Table 2. Change of population from the Global South and residential segregation trend.

| URBAN PROCESS | CHANGE OF POPULATION FROM THE GLOBAL SOUTH | | RESIDENTIAL SEGREGATION TREND | | | STAGE OF GENTRIFICATION | GENTRIFICATION SCORE |
|--|--|-----------|-------------------------------|-----------------|---------------|---|----------------------|
| | 2001-2011 | 2011-2020 | 2001 | 2011 | 2020 | | |
| Increasing or stable proportion of foreigners and low residential concentration | + | + | (0.00001-0.01) | <0.007 | <0.01 | No gentrification | 0 |
| | - | - | | | | | |
| | - | + | | | | | |
| Increasing or stable proportion of foreigners and variable residential concentration | + | - | (0.00001-0.01) | (0.0001-0.006) | <0.09 | Moderate gentrification or touristification | 1 |
| Fluctuating proportion of foreigners and moderate residential concentration | + | - | (0.001-0.006) | (0.00007-0.005) | <0.003 | Last stage of gentrification | 2 |
| Fluctuation proportion of foreigners and emerging residential segregation | + | - | >0.1* | (0.003-0.006) | (0.001-0.003) | Gentrified and with touristification | 3 |

Source: authors' own elaboration.

B. Construction variables: restoration and renovation

This variable measures the ratio between the number of restorations per census section, and the extension of the census section in each period. Only the wholesale renovation and restorations of buildings have been considered, since they are the most common ones in historic buildings, and they also have the greater impact on historic centres. A spatial statistical analysis was performed, and areas were classified above (+) and below (-) the median number of restorations and renovations. Information has been displayed at a census section scale, and it gathers data about all the buildings within the section.

Table 3. Codification of the intensity of wholesale restoration and renovation in each period.

| URBAN PROCESS | 1990-2020 | 2000-2010 | 2010-2020 | STAGE OF GENTRIFICATION | GENTRIFICATION SCORE |
|---|-----------|-----------|-----------|------------------------------|----------------------|
| Intense restoration and renovation | + | + | + | Last stage of gentrification | 3 |
| Decreasing intense restoration and renovation | + | + | - | Gentrification completed | 2 |
| | + | - | - | | |
| Increasing renovation processes interrupted by the 2008 Global Crisis | - | + | + | Incipient gentrification | 1 |
| | - | - | + | | |
| | - | + | - | | |
| | + | - | + | | |

Source: authors' own elaboration.

When mapping gentrification, the variables have been weighted. The weight of each demographic variable was 25%, whereas it was 50% for the construction variable, since its influence is higher and it is statistically more robust (lower risk of wrong patterns).

3.2. Touristification

The three variables explained below aim at assessing the invasion of tourism in residential areas by allowing the relative comparison of the spatial pressure they are exposed to. They have been selected because the baseline data on which they are based provide high spatial accuracy for a census section scale and because, unlike other indicators such as land use changes, they practically and unequivocally lead to a process of touristification. The thresholds of the variables were established according to the report published by the General Direction of Quality, Innovation and Tourism Promotion, and the Department of Tourism, Regeneration, Justice and Local Administration of Andalucía (2020). The three variables have the same weight when calculating the touristification degree.

A. Density index

It is the total number of places in touristic accommodations per hectare, considering hotels, hostels and HTU (Fig.2, Upper)

B. HTU pressure over residential dwellings

Number of dwellings for tourist purposes divided by the number of residential houses at the census section (Fig. 2, Middle).

C. Intensity of official tourist accommodation (hotels, hostels, HTU).

Number of places divided by the whole population at the census section (Fig. 2, Bottom)

Table 4. Classification of the variables used to detect touristification.

| URBAN PROCESS | DENSITY OF ACCOMMODATIONS / HA | PROPORTION OF HTU PER RESIDENTIAL HOMES (%) | NUMBER OF PLACES IN TOURISTIC ACCOMMODATIONS / 100 INHABITANT | TOURISTIFICATION SCORE |
|----------------------------|--------------------------------|---|---|------------------------|
| No touristification | ≤ 10 | ≤ 5 | ≤ 10 | 0 |
| Incipient touristification | $>10-\leq 25$ | $>5-\leq 10$ | $>10-\leq 25$ | 1 |
| Moderate touristification | $>25-\leq 50$ | $>10-\leq 15$ | $>25-\leq 50$ | 2 |
| High touristification | >50 | >15 | >50 | 3 |

Source: authors' own elaboration.

3.3. Final map and presentation of the color selection criteria in the cartographic series.

A. Creation of the final map

The final maps displays both gentrification and touristification processes (Fig. 3 and 4, respectively) by overlapping processes (Fig. 5). Gentrification is shown on a blue scale (2-4), whereas touristification is represented in pink (B-D).

The final score for both phenomena is calculated by summing the three variables and then calculating the arithmetic mean. The scores have been classified into the four categories displayed in the table below.

Table 5. Combination of scores to integrate gentrification and touristification processes in the final map.

| | | Touristification degree | | | |
|-----------------------|-----------------------------|-------------------------|-------------------------------|------------------------------|--------------------------|
| | | A. No touristification | B. Incipient touristification | C. Moderate touristification | D. High touristification |
| Gentrification stage: | 1. No gentrification | 0 | 1 | 2 | 3 |
| | 2. Incipient gentrification | $>0-\leq 1$ | $>0-\leq 1$ | $>0-\leq 1$ | $>0-\leq 1$ |
| | 3. Gentrification completed | $>1-\leq 2$ | $>1-\leq 2$ | $>1-\leq 2$ | $>1-\leq 2$ |
| | 4. Gentrified área | $>2-\leq 3$ | $>2-\leq 3$ | $>2-\leq 3$ | $>2-\leq 3$ |

Source: authors' own elaboration.

B. Color range of the maps

The selection of the color range is key for the map quality since it may improve data visualization and spatial analysis. All the maps in this paper follow a monotonic sequential color range based on bright variation. Regarding the final map, which combine both variables (Table 6), the following guidelines were followed:

1) The order of the colors. Which is essential in a sequential color range. It can be considered as a progressive color palette based on bright and saturation of two colors. In this case, given the data

are sequential, the color range is monotonic. The changes in brightness are the most relevant in these ranges, representing high values with dark colors (Brewer, 1994). Therefore, the darker the color, the higher the value

2) The process being represented. In this case, the processes are not related to color, so blue colors represent gentrification and pink represent touristification. The differences among them ease map interpretation.

3) The harmony, since it improves the quality of the map ease to distinguish patterns (Ou *et al.*, 2018).

4) The ease to distinguish colors, following the guidelines proposed by Brychtová & Çöltekin (2017).

5) The uniformity of the selected colors. The uniformity describes if changes in adjacent colors are similar. In this case, in order to easily read a bivariate map with sixteen tones, two different color ranges with changes in brightness were used, increasing saturation for extreme values.

Table 6. Color Ranges and CIELAB codes.

| | | Touristification degree | | | |
|----------------------|-----------------------------|-------------------------|-------------------------------|------------------------------|--------------------------|
| | | A. No touristification | B. Incipient touristification | C. Moderate touristification | D. High touristification |
| Gentrification stage | 1.No gentrification | 99,5; 0,8; -0,3 | 94,2; 12,3; -8,6 | 85,3; 32,1; -21,9 | 72,3; 64,5; -41,8 |
| | 2. Incipient gentrification | 97,7; -11,1; -3,2 | 88,4; 7,00; -17,5 | 77,5; 38,0; -33,5 | 62,3; 68,4; -58,0 |
| | 3. Gentrification completed | 94,1; -27,8; -8,8 | 79,4; -2,7; -31,6 | 60,5; 39,1; -60,8 | 54,0; 49,3; -70,1 |
| | 4. Gentrified área | 91,1; -48,0; -14,1 | 72,9; -20,4; -39,3 | 53,3; 31,6; -73,2 | 43,5; 54,6; -87,5 |

Source: authors' own elaboration.

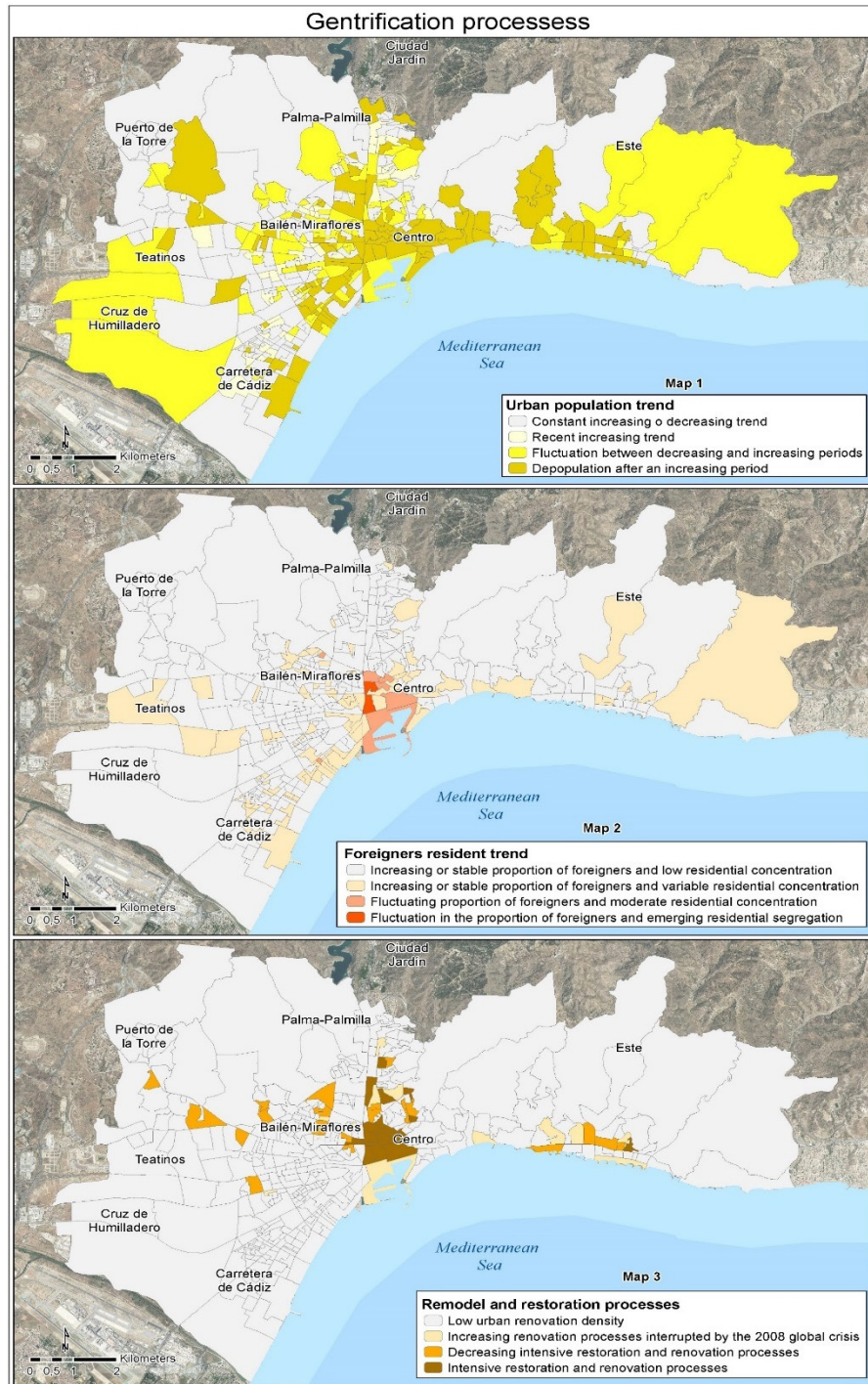
4. Results

Figure 1 includes the maps of the variables related to gentrification. Map 1 and 2 display a scattered spatial pattern, since there are underlying urban processes that can be observed in demographic dynamics. In Fig. 2, Map 1, it can be observed a demographic centrifugal pattern in Málaga: population decreases in the historic centre and in the eastern coast sector whereas it increases in many parts of the areas surrounding the city centre, which may be caused by a recent and unfinished gentrification dynamic. Additionally, these demographic patterns can also be linked to a recent touristification process still in progress.

Figure 2, Map 2 also displays results that led to infer gentrification in the historic centre, given this area includes fluctuating proportion of foreigners, moderate residential concentration, and emerging residential segregation. Across the rest of the city, it can also be observed some areas with an increasing and stable proportion of foreigners and variable residential concentration, which are related to low-developed gentrification processes.

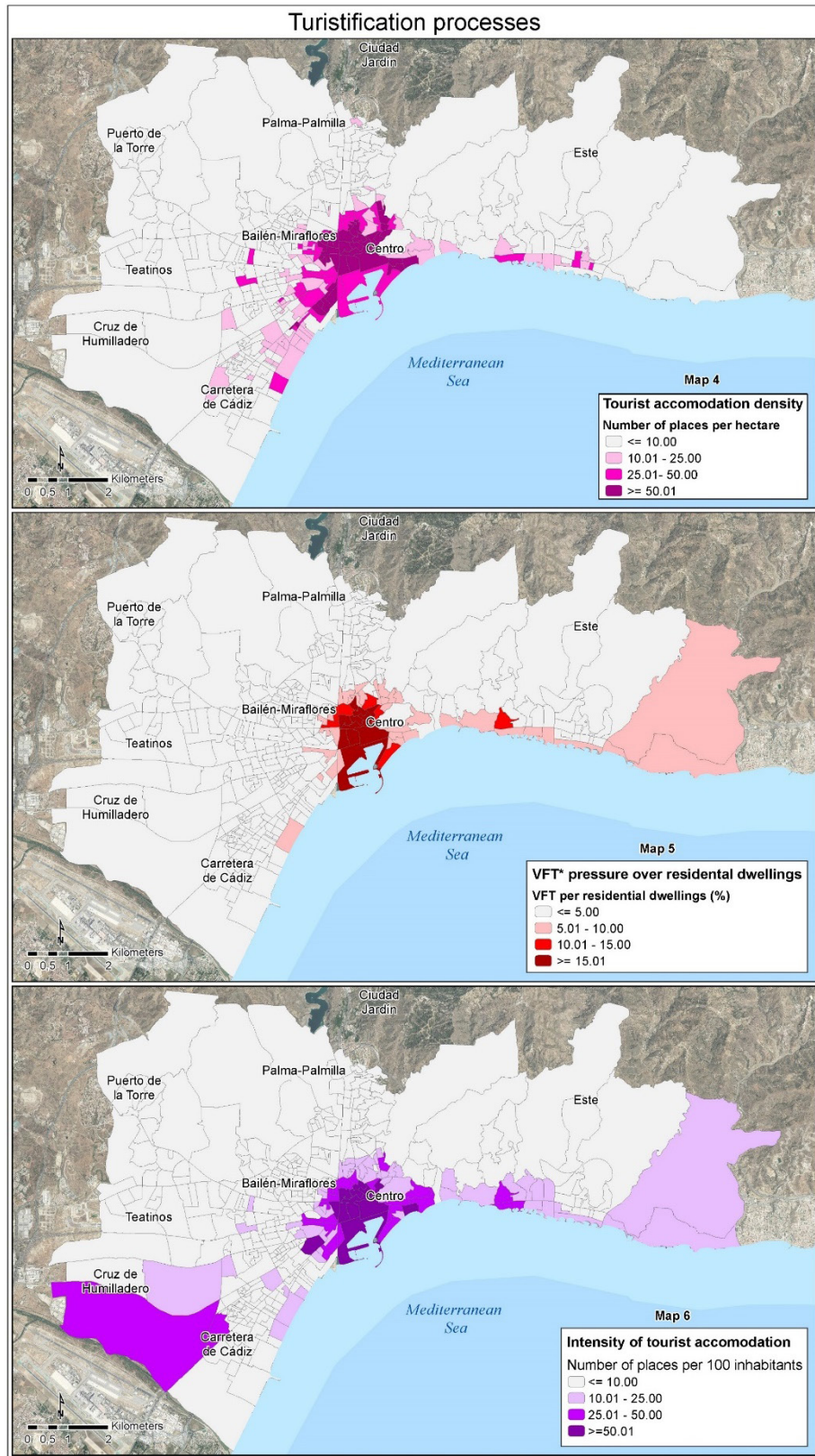
Regarding the spatial pattern of restoration and renovation processes (Fig.2, Map 3), they are mainly gathered in the historic centre, where most of the buildings are old but well-valued from an architectonic perspective. Not in vain, these processes also extend along the northern and eastern part of the city, in areas with traditional architecture. Whereas the eastern coast of Málaga has remained as a fishing neighborhood, the northern sector has kept an urban landscape related to nineteenth-century industrial colonies.

Figure 2. Processes related to gentrification in Málaga.



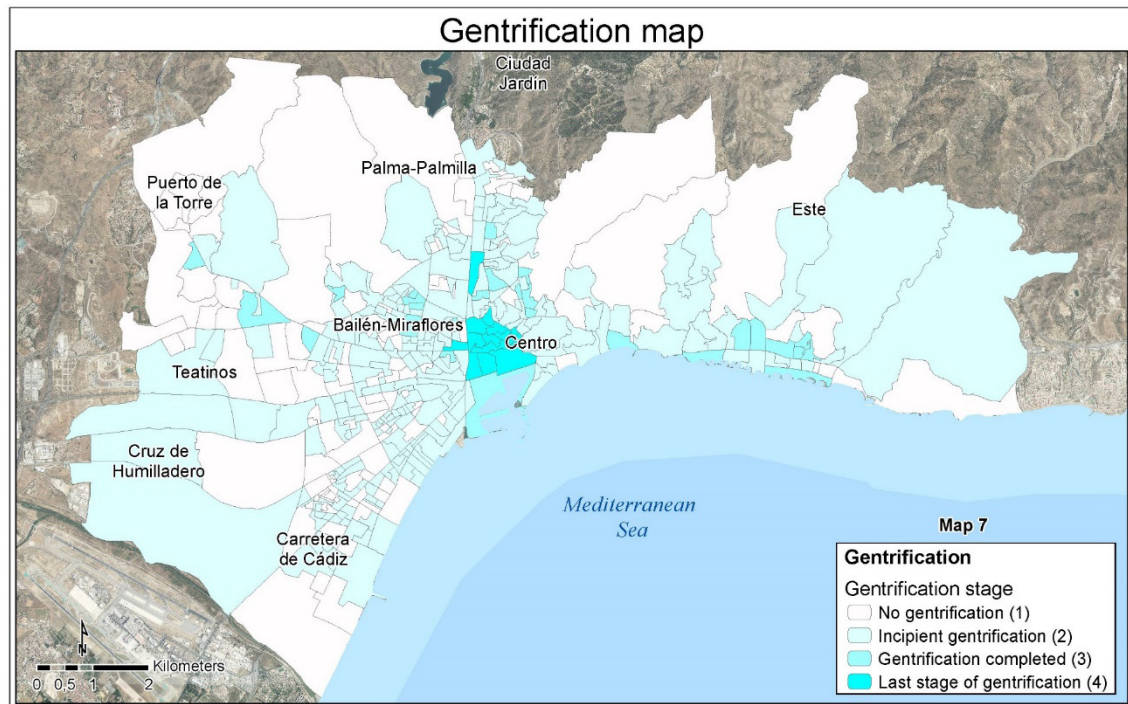
Source: authors' own elaboration.

Figure 3. Touristification processes in Málaga.



Source: authors' own elaboration.

Figure 4. Stages of gentrification in Málaga.



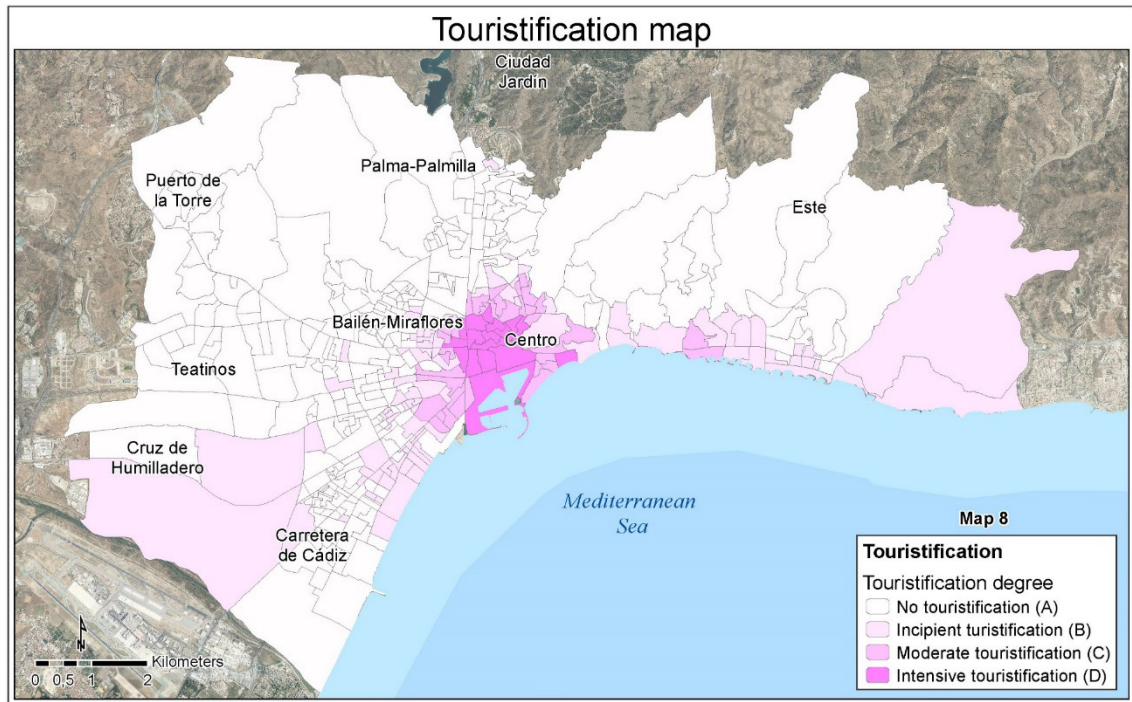
Source: authors' own elaboration.

Figure 3 displays the results of the processes related to touristification. Tourist accommodation density (Figure 3, Map 4) shows an evident concentration in the city centre, from where it is expanded to other directions. One of the most relevant areas of expansion is the eastern part of the city, divided in neighborhoods with a Mediterranean appearance and environment that attract tourists. This is also observed along the western coast of the city, a modern urban residential area where the number of hotels has significantly increase after the metro line was opened and the communication with the city centre and the airport improved. Additionally, there are also hotels close to the limit of the city, in industrial areas next to the International Málaga Airport, which cannot be related to touristification processes.

Figure 3, Map 5 displays the HTU pressure over residential dwellings. It shows a remarkable concentration of high values in the city centre, and moderate values in the surroundings (adjacent neighborhoods to the city centre) and the coast (mainly the east coast). This may be explained by the change from traditional dwellings to private tourist accommodations. All of them are residential areas, with many restaurants and services, and close to the beach. The intensity of tourist accommodations is shown in Fig. 3, Map 6. It has similar spatial patterns than the rest of the touristification processes (i.e. higher intensity in the city centre, moderate intensity in the surroundings and along the coast). Whereas the intensity is spatially continuous along the eastern coast, the pattern is scattered in the western part of the city, mainly due to the presence of low-cost hotels in industrial areas next to the airport.

The final map gathering all the gentrification variables (Figure 4, Map 7) shows an evident and intense gentrification in the centre of the city, to the north and east, beyond the historic city centre. It must be highlighted the role of the main E-W road axis, parallel to the coast, in the gentrification process. Some of the areas in the eastern sector of the city shows emerging signs of gentrification, whereas other are already in the last stage. All those areas where gentrification is already complete in the eastern and northern sectors are urban areas where traditional architecture of the buildings have been preserved, increasing its value and leading to a change in the type of resident.

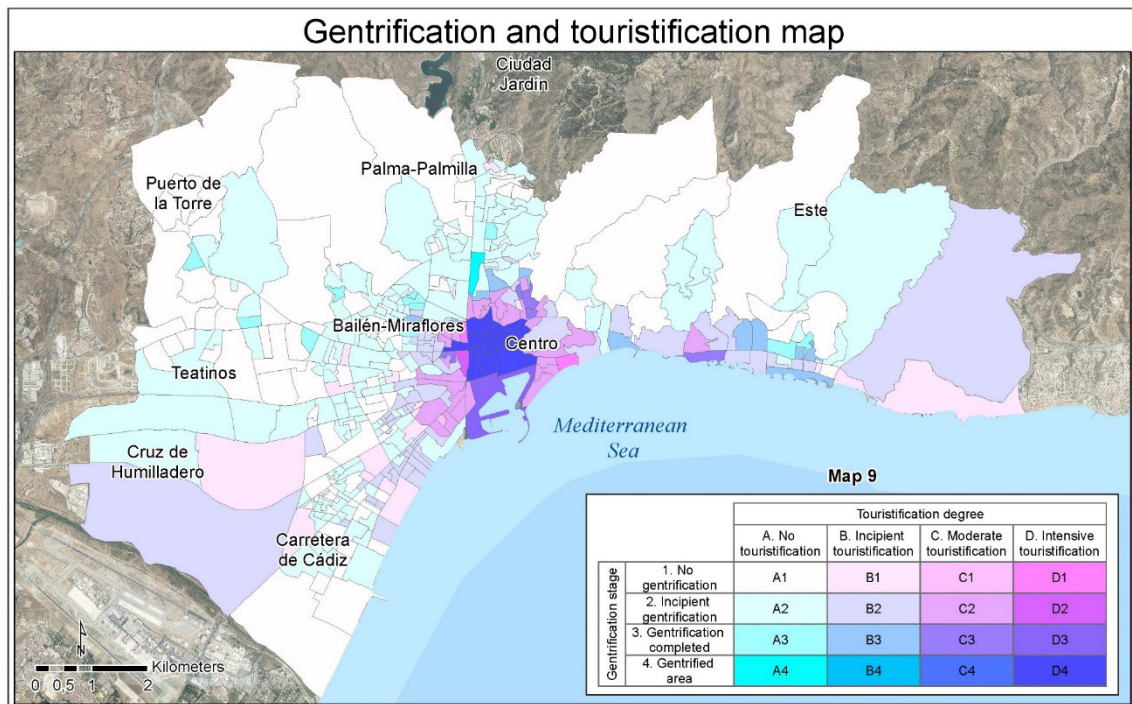
Figure 5. Touristification degree in Málaga.



Source: authors' own elaboration.

The map resulting from merging touristification variables (Fig. 5, Map 8) is similar to the gentrification map, and both shares common territorial patterns. The magnitude of the processes is higher in the historic centre and the coast (mainly the eastern coast). Touristification is moderate in the surroundings of the city centre, which may show an emerging process already in progress. Once the process is complete in the city centre, it expands from that area on too many directions. However, there are some exceptions in the eastern and western sectors, where the urban model is scattered and the population density is lower, hindering touristification. Regarding the eastern part, low touristification is explained by the presence of second residences and agricultural areas, whereas the western part is also affected by urban dynamics related to the proximity of the airport and the presence of low-cost accommodations in industrial areas.

Figure 6. Gentrification and touristification map in Málaga.



Source: authors' own elaboration.

Finally, Figure 6, Map 9, shows the overlapping of gentrification and touristification. An advanced gentrification stage and a very intense touristification process (D4) can be observed in the city centre. The same status is also observed in the south part of the city and in some areas of the eastern coast. In both sectors, gentrification went before touristification. In the surroundings of the city centre, touristification is moderate, but gentrification is still emergent (C2-C3-D2). Those areas are adjacent to the city centre and are very well connected to the train station and the airport. Regarding the eastern sector, touristification is moderate in residential neighborhoods where houses have been restored and included as private tourist accommodations.

Emerging touristification and gentrification (B1-B2-B3) is also observed along the main road axis (E-W), although gentrification also expands to most of the parts of the city, especially to the north and west (A2-A3-A4). In those areas, gentrification is slightly higher in areas where traditional houses from S. XIX have been restored and renovated.

5. Discussion

Overall, the spatial patterns observed in the maps are similar to those reported in other national and international cities. Most of the areas surrounding the historic centre of Málaga, which is already highly gentrified and touristified, are in risk of touristification in the near future. Apart from the natural expansion of the process, four different dynamics can be observed.

First, the areas where risk of touristification is higher are located to the west and the north of the historic centre (classified as C2 in the map). These areas are lower class neighborhoods, with an increasing number of rented accommodations, low and middle-income population and high unemployment rates. Population is extremely vulnerable and people may be forced to move out

to another neighborhoods in the near future. This dynamic has been already observed both in similar cities, as Sevilla (Mínguez, Piñeira & Fernández-Tabales, 2019), or larger cities, as Berlin (Holm, 2013).

The second pattern observed is related to the spread of touristification along the main road axis of the city, as well around the train and bus stations, all of them connected to the airport. It can be highlighted how the sections to the east and the west of the historic centre, along road axis are classified as B1, B2, C1 and C2. The spreading touristification reaches the western part of the historic centre, where the train station, the bus station, and the transfer train to the airport are located. This pattern follows the model developed by Deboosere *et al.*, (2019), who concluded that location aspects have a great impact both in the average price of Airbnb rentals, and in its average monthly income. The authors also highlighted that the accessibility to workplaces is more important than the Euclidean distance to the historic centre. The price that tourist pay for accessible rentals, and the economic profitability for the owners and hosts allow inferring that residents of these highly accessible areas will face an increasing pressure and a higher risk to be moved out to areas with lower accessibility.

The third dynamic is observed in urban areas nearby historic centre (classified as B3 and C3). After the renovation of the buildings, which were deteriorated, they became into new areas devoted to traditional touristic accommodations, and lately, also to new vacation rentals. This has been already studied in European touristic cities as Berlin (Holm, 2013), or Utrecht (Ioannides, Röslmaier & Van Der Zee, 2019).

Finally, the development of the process along the eastern coast (also classified as B3 and C3), attracted by the traditional architecture of the houses towards an area where those houses, either middle or high class villas, and poor fisher houses, have been restored. The process in this area may be considered a touristic gentrification, combining a high proportion of foreigners that lives in the area, a hybrid process between migration and residential tourism (Janoschka & Haas, 2013), and the creation of a high number of vacation rentals due to the ousting of traditional population.

The methodology shows its usefulness to interpret complex urban processes such as gentrification and touristification. The main problem lay on that the higher the number of variables, the more complex the resulting maps. At the same time, an oversimplification of the processes, basing the analysis in only a few variables, may lead to inaccurate results, *e.g.*, some explanatory factors of gentrification may also explain a different urban process. Therefore, it is essential to iteratively parametrize, adjust and supervise the processes by an expert technician.

6. Conclusions

Results allow to perform a comparative analysis of gentrification and touristification, which are usually hard to distinguish due to its connections. A spatial overlapping of both processes in the historic centre can be observed, and the stage and the intensity of the processes can be also identified. Given the temporal dimension of the processes, an expansion of the touristification along the coast, and the main road axis of the city can be detected.

From a methodological perspective, the combination of variables takes advantage of the information published by official sources, which increase robustness of the data. The variables are com-

bined without including other urban processes in the final map. The codification and grouping of processes follow the aim of obtaining logical and understandable results. The method is easily replicable in other territories at a similar scale, as long as they have alike information at the proper scale. On the other hand, the main limitation of the study is the lack of detailed socio-economic information, as well as the high number of illegal HTU, which are not registered in the official databases. It also requires an important mastery of geoprocessing data by researchers or developers, such as data provided by the Cadastre or the tourist registry from the public administration.

The fact that gentrification and touristification can generate different effects in the “urban metabolism” (Jover & Díaz-Parra, 2020), gives an additional character to the methodology as a tool, whose potential is still unknown. This type of analysis provides basic information to local and regional authorities at the short-term, during planning urban projects, as well as allow including population in the decision-making process when designing the development of the city. As the proposal provided by Chamizo-Nieto, Nebot-Gómez de Salazar & Rosa-Jiménez (2020), this methodological tool is intuitive thanks to the way that results are displayed, and it can contribute to new participative strategies to manage touristification, since local groups and associations usually struggle with their low autonomy and representation when facing this process. One of the future improvements of the methodology is to include a temporal analysis of the official tourist accommodations, once information from a larger time period could be compiled. One of the future improvements of the methodology is to include a temporal analysis of official tourist accommodations once information from a longer period of time can be collected. Other challenges include the analysis of the evolution of changes in the use of built-up land. It may also be interesting to introduce information related to the perception of the resident population and other social actors in the study area. However, since this is a cartographic methodology, based on the combination of variables and processes, the use of an excess of variables can generate some confusing results, which do not represent the existence of these phenomena, but rather the sum of several of these processes. Therefore, excessive complexity can be detrimental to find a cartographic language that facilitates the integrated analysis of the phenomena of gentrification and touristification.

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