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Urban segregation and infrastructure in Latin America: A neighborhood typology for Bariloche, Argentina

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ABSTRACT

The problem of urban segregation has been extensively studied among developed and developing countries. However, in Latin America this phenomenon presents some particularities, such as the role of access to urban infrastructure. Based on data from the latest population census and multivariate analysis techniques, we provide a neighborhood typology for Bariloche, Argentina, which, among other things, enables us to reveal a complex relationship between the socioeconomic level of the population, its residential location, and infrastructure availability. Unlike previous research on Latin American cities, in this case the lowest correlation between these issues seems to indicate that, although urban infrastructure and equipment are important to address urban segregation, public policies should not be limited to only such dimensions.

1. Introduction

The discussion about urban segregation goes back to the origins of urban studies, revealing a historical concern about how the different socioeconomic classes have been located within the city (Castells, 1977; Ellis, Wright, Holloway, & Fiorio, 2018). Although this is a long-standing problem in developed countries (Wacquant, 1993), in the last few decades it has also earned an important place in the research on Latin American cities (Kaztman & Retamoso, 2005, 2007; Roberts & Wilson, 2009; Ruiz-Rivera & van Lindert, 2016; Smets & Salman, 2016) and the evidence shows that this phenomenon presents some particular characteristics in the region (García-Ayllón, 2016).

The socioeconomic and housing inequalities reflected in urban segregation processes have raised the interest of a great variety of authors who have generally sought to analyze and classify different spatial units within the cities, such as neighborhoods or wards, through multivariate analysis techniques. The definition of this kind of typologies has been a frequent objective throughout urban studies in developed countries (Chow, 1998; Delmelle, 2016; Mikelbank, 2004; Reibel & Regelson, 2007; Wei & Knox, 2014), as well as in some Latin American cities (Burgos, Koifman, Montaño Espinoza, & Atria Curi, 2011; Link, Valenzuela, & Fuentes, 2015; Marmolejo-Duarte & Batista-Dória de Souza, 2011; Mateos & Aguilar, 2013) and, particularly, in Argentina (Di Virgilio, Marcos, and Mera, 2016; Marcos, Mera, and Di Virgilio, 2015; Molinatti, 2013; Sánchez, Sassone, & Matossian, 2007). Another close field of research in Argentina has been the analysis of regional and territorial inequalities in quality of life (Celemín & Velázquez, 2017; Velázquez, 2016; Velázquez & Celemín, 2019; 2020), a topic that has been also studied in the case of Bariloche (Abaleron, 2009; 2016).

Within this framework and based on data from the 2010 population census, we aim to conduct a classification exercise of the neighborhoods of San Carlos de Bariloche city, a case that presents several particularities in advance. Located in Argentine North Patagonia, Bariloche is a recognized tourist destination, both at a national and international level (Vejsbjerg, Núñez, & Matossian, 2014), but also an intermediate city with regional relevance, since it functions as a political, administrative, and services hub. All this has led to sustained population growth during the past twenty years, becoming the most populated city in Río Negro Province and the third in Argentine Patagonia. However, the accelerated and disordered urban and demographic growth, combined with insufficient or wrong planning policies –which were many times subordinated to particular economic interests–, have implied diverse problems in Bariloche. As we will see later, this is demonstrated, for example, in the provision of urban services and infrastructure, in the territorial distribution of the population, and in the unequal social and housing conditions –in line with some of the Latin American pathologies

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highlighted by García-Ayllón (2016)–.

In this sense, the methodology and the exercise proposed in this paper, like in some of the aforementioned studies, seek to provide a multidimensional perspective on the nature of urban segregation processes, instead of focussing on only one or a few dimensions of analysis, like some of the most traditional –even contemporary– approaches or segregation indexes. As Yao, Wong, Bailey, and Minton (2018) state, quantitative studies of segregation are powerful tools for summarizing the relationship between population and space, but sometimes they can lead to over-simplification and over-reduction. Instead, this paper tries to offer more complex results and discussions, particularly, leaving aside binary or dualist positions on these phenomena. In the case of Bariloche but also of other cities, especially tourist ones, it is common to find expressions about urban segregation that are limited to contrasting two realities, the tourist and elite city versus the marginal or popular city, in a north-south or center-periphery analogy (Baños Francia, 2012; González-Pérez, 2013). We will see that there are other realities beyond these two stereotypes, as well as that these *two cities* hide heterogeneous realities within them.

On the other hand, based on this multidimensional approach, we will also see that the link between socioeconomic level and access to urban infrastructure can be much more complex than the one that supposes a direct and positive relationship between these dimensions. In other words, the fact that higher socioeconomic classes usually live in neighborhoods with better urban infrastructure, and vice versa, is an aspect that will be partially questioned in the case of Bariloche, and that should be considered in the study of other Latin American cities, particularly tourist cities.

After this introduction, the theoretical and empirical backgrounds are briefly revised. Then, we offer a brief overview of the study area and describe the methodology and data used. In the next section, the results are analyzed, beginning with the determination of the number of clusters and ending with their characterization and definition of a neighborhood typology. Finally, we conclude with some discussions in light of previous evidence on Latin American cities.

2. Theoretical and empirical background

From the origins of the reflections about the capitalist city, authors like Engels and Booth revealed the inherent inequalities in the way that the different social classes were located within the city. This discussion was resumed in the first decades of the 20th century, with the analysis of urban segregation in the context of the fast industrialization process in the USA (Park, Burgess, & McKenzie, 1925; Wirth, 1938).

More recently and in the context of globalization, several authors (Dear, 2002; Janoschka, 2002; Janoschka & Sequera, 2016; Soja, 2000) highlighted the growing heterogeneity within the cities, based on a set of complex and related phenomena such as socioeconomic inequalities, residential segregation, social unrest, delinquency, among others (De Mattos, 2002). Within this framework, numerous authors sought to analyze the differences between neighborhoods through empirical typologies, based on socioeconomic, housing, and demographic variables (Ellis et al., 2018; Mikelbank, 2011; Reibel & Regelson, 2007; Vicino, Hanlon, & Short, 2011).

In line with the aim of multivariate analysis techniques –especially, of cluster analysis– and apart from the extensive discussions about the ways of measuring and quantifying segregation (Smets & Salman, 2016), there is a rather simple definition of urban segregation behind these typologies. Above all, the objective is to identify spatial units that are relatively homogeneous inwards and heterogeneous outwards, which is the approach we also adopt here. According to Sabatini, Cáceres, and Cerda (2001), segregation has three main dimensions: i) the tendency of a group with similar socioeconomic characteristics to concentrate in some areas, ii) the conformation of socially homogeneous areas, and iii) the subjective perception that people have about the objective dimensions. Therefore, in this paper we especially deal with the objective dimensions of this phenomenon.

In the case of Latin America, we can find some segregation studies in the 1970s and 1980s (Rodríguez, Riofrío, & Welsh, 1973; Scarpaci, Infante, & Caete, 1988), although the discussion in these decades was mostly focused on the development models of the region and the particular problems of dependence and marginality (Nun, 1969; Quijano, 1972). On the other hand, some authors analyzed the segregation of the native population as a result of the Spanish and Portuguese colonial domination (Sánchez Molina, 2002; Wilde, 1999). From the 1990s onwards, the discussion about urban segregation has increased because of the urban transformations under the neoliberal policies of Washington Consensus (Calderón, 1999; Telles, 1995). For example, Kaztman and Retamoso (2005, 2007) reveal some negative consequences of the segregated environments in Latin American cities in terms of intergenerational reproduction of poverty.[1] Brain, Cubillos, and Sabatini (2007) state that segregation is a more critical problem in Latin America than it was thought some years ago, since it promotes the social disintegration of popular neighborhoods, with the consequent expansion of problems like drug dealing, crime, school drop-outs, or chronic unemployment. In general, this is close to what is known as *neighborhood effects* in urban studies, which implies that the structure of opportunities of the individuals is directly and indirectly conditioned by the characteristics of the neighborhood where they live (Sampson, Morenoff, & Gannon-Rowley, 2002; Sharkey & Faber, 2014; Wu, He, & Webster, 2010).

On the other hand, several quantitative studies of segregation in Latin American cities usually employ segregation indexes, such as Duncan's Dissimilarity Index or Massey's Isolation Index (Krüger, 2019; Murillo, Duk, & Martínez Garrido, 2018). Instead, Rodríguez and Arriagada (2004) postulate that such methods are not suitable for socioeconomic segregation and propose the Residential Segregation Index.

Unlike in Europe or the USA, where segregation studies usually focus on racial segregation (Massey & Denton, 1993), access to urban infrastructure and services are key issues in the development and analysis of segregation in Latin America (Griffin & Ford, 1980), much more than the age of the housing stock. This is related to some particularities of urbanization processes in the region and the rise of urban informality. Likewise, the issue of the access to different infrastructures is seen with clarity in several studies on Latin American cities (Burgos et al., 2011; García-Ayllón, 2016; Marmolejo-Duarte & Batista-Dória de Souza, 2011; Marmolejo-Duarte, Fitch-Osuna, & Batista-Dória de Souza, 2012; Roy, Bernal, & Lees, 2020; Vásquez, Peña, & Cardona, 2008). In most of these cases, it is found that higher socioeconomic classes tend to live in neighborhoods with better access to urban infrastructure, and vice versa.

Currently, two opposite phenomena deepen urban segregation. On the one hand, the large social housing complexes or the informal settlements, and on the other hand, the gated communities. These transformations are changing the traditional patterns of residential segregation, promoting a more fragmented urban structure (Borsdorf, Hildalgo, & Vidal-Koppmann, 2016; Janoschka, 2002; Janoschka & Salinas Arreortua, 2017; Janoschka & Sequera, 2016). Nevertheless, in the middle of these extreme ways of insertion within the city, there are multiple heterogeneities between the open neighborhoods. Indeed, far from the dualization of urban structure, several authors find diffuse and discontinuous urban patterns when analyzing or classifying the neighborhoods of different cities in developing countries (Patel, Koizumi, & Crooks, 2014; Patel, Shah, & Beauregard, 2020; Weeks, Hill, Stow, Getis, & Fugate, 2007) and especially in Latin America (Aguilar & Mateos, 2011; de Córdova, Fernández-Maldonado, & del Pozo, 2016; Di Virgilio, M. M., Marcos, & Mera, 2016; Link et al., 2015; Marcos, Mera, Virgilio,

[1] There is also evidence of this situation in the context of European cities, as Salom and Fajardo (2017) analyzed, because of the changes associated to migration patterns.

& M. M, 2015; Mateos & Aguilar, 2013; Molinatti, 2013; Roy et al., 2020). Meanwhile, the self-production of neighborhoods based on land occupations can be understood not only as a last resource for the vulnerable population, but also as a localization strategy to improve the conditions of integration in the context of growing peripheralization of social housing (Brain, Prieto, & Sabatini, 2010; Ferguson & Navarrete, 2003; Janoschka & Salinas Arreortua, 2017).

3. Study area, methodology, and data

3.1. A brief overview of Bariloche

As we mentioned, Bariloche is located in Argentine North Patagonia, in the west of Río Negro province, surrounded and crossed by mountains (*Cerros*), lakes, lagoons, rivers, and streams (Fig. 1). In fact, the landscape has been one of the most significant factors in its consolidation as a recognized tourist destination (Vejsbjerg et al., 2014). However, the most valued natural conditions and tourist attractions are located from the city center to the west, while toward the south and southwest the increasing altitude and distance to Nahuel Huapi Lake produce unfavorable climatic and environmental conditions. This geographic description coincides with the traditional stereotypes of the tourist city and the popular city.

The city area limits with –and is totally surrounded by– the Nahuel Huapi National Park, which was created in 1934 within a nationalist policy of territorial control, especially emphasizing the conformation of a tourist region. Furthermore, the National Parks Administration played a fundamental role in the initial provision of infrastructure, in the urbanization process, in lands policies, and in the expansion of the city area (Vejsbjerg et al., 2014). From that moment, the tourist profile of Bariloche has intertwined with a gradual increase in land prices and the activation of real estate speculation, often with the participation of foreign actors. The landscape and the proximity to lakes and mountains have exercised a differential weight on land prices, not only for housing but also for economic uses, which has an impact on the urban structure and socio-spatial inequalities (Medina, 2017).

In addition to its natural attractions –and the attraction of amenity migrations–, the distance to other urban centers also explains the increasing centrality and population growth of Bariloche. This has also gone hand in hand with a fast urban expansion (Abaleron, 1995; Matossian, 2016), although the city still shows low population densities in big portions of its territory, which is also one of the largest in the country.

Tourism activities have a considerable weight in the production and labor structure and important multiplier effects over the rest of the economy (Kozulj, 2016). However, the local economy faces the typical seasonality of tourism and also the impact of exogenous shocks –such as eruptions of nearby volcanoes, or epidemics like COVID-19–, which usually mean temporary and vulnerable jobs. Labor insertion –or the lack of it– and the quality of jobs not only are common determinants of the socioeconomic level of households but also of residential and housing inequalities (Niembro, Guevara, & Cavanagh, 2019).

3.2. Building the database

As is common in the empirical literature, and in previous studies in Argentina (Di Virgilio et al., 2016; Marcos et al., 2015; Molinatti, 2013; Sánchez, Sassone, & Matossian, 2007), population censuses are usually the main sources of information. However, one of the difficulties that the censuses present is the geographical unit in which data are collected, especially when we want to analyze within the cities. Traditionally, the most reduced scale for which the information is made public is the census radius, but the definition of its territorial scope is mainly governed by methodological and practical criteria that facilitate data collection, and it does not necessarily coincide with neighborhoods' limits (Di Virgilio et al., 2016; Marcos et al., 2015). This raises an important difference between this paper and the previous study of Sánchez et al. (2007), who defined a first classification of Bariloche's neighborhoods based on data from the 2001 census, which had been previously grouped by neighborhoods by Río Negro's General Directorate of Statistics. This statistical work, which dates from 2005, was carried out based on restricted data corresponding to census blocks. Conversely, nobody has classified the 2010 census by neighborhoods, along with the impossibility to access to data at the level of census blocks.

In this sense, the first contribution of this paper is the grouping by neighborhoods of the 2010 census data, based on the 159 census radii that form the urban area of Bariloche. We prioritized the use of an official and easy access source, the Dynamic Tables of the 2010 Census that were elaborated and published in 2016 by the National Ministry of Energy[2] for each of the Argentine provinces. In our case, we filtered and kept only the radii corresponding to Bariloche. Then, through a cartographic work that consisted in checking, overlaying, and contrasting the layers of Bariloche's neighborhoods and its census radii, we could define 77 original neighborhoods or groups of neighborhoods (for more details, see Appendix A).

Working with neighborhoods instead of census radii presents several benefits. On the one hand, it is analytically richer and facilitates a better interpretation of the results, since we can tell a story based on the different neighborhood realities. Moreover, we can make some comparisons with the previous contribution by Sánchez et al. (2007). On the other hand, the neighborhood is the spatial unit in which both the offer of urban policies and the demand for them are traditionally expressed. Local, provincial, and national governments usually direct their policies to attend specific neighborhoods and not census radii –an example was the national Neighborhood Improvement Program, known as PROMEBA, in Spanish. Meanwhile, people know in which neighborhood they live but not in which census radius, and they usually discuss and transmit their problems and needs through the Neighborhood Boards (*Juntas Vecinales*), civil associations with municipal legal status in Bariloche (Matossian, 2016). Neighborhood Boards not only act as a space of interaction between the neighbors and the local government, but also they reinforce the identity of each neighborhood. Finally, it is worth mentioning that some of the first Neighborhood Boards arose from the need to provide urban services to the neighbors, such as the water network, and infrastructure demands remain as the most common requests to the local government.

Another general characteristic of population censuses in Argentina is the application of two different questionnaires. The basic questionnaire contains, as its name implies, a reduced number of questions, but it is applied to all households and, therefore, this information is available at the level of census radii. Instead, the extended questionnaire, which covers a bigger number of questions (for example, about migration, labor situation, access to health and social security, among other dimensions), is applied only to a sample of the population and, therefore, these data are not available for census radii (Marcos et al., 2015). The information obtained from the extended questionnaire is only published at the level of departments, an intermediate geographical scale between the cities and Argentine provinces, which can cover different cities and dispersed rural villages. For example, the department also called Bariloche includes the city (of Bariloche) as a whole but also the city of El Bolsón and different rural settlements.

Despite these limitations of population censuses, the variables collected by the basic questionnaire allow us to cover several socioeconomic and housing dimensions, in line with indicators traditionally used in the empirical literature (Burgos et al., 2011; García-Ayllón, 2016; Marcos et al., 2015; Marmolejo-Duarte & Batista-Dória de Souza, 2011; Mateos & Aguilar, 2013; Molinatti, 2013; Roy et al., 2020; Zhou, Xu, Radke, & Mu, 2004). As can be seen in Table 1, variables are

[2] Currently, Secretariat of Energy, under the National Ministry of Production.

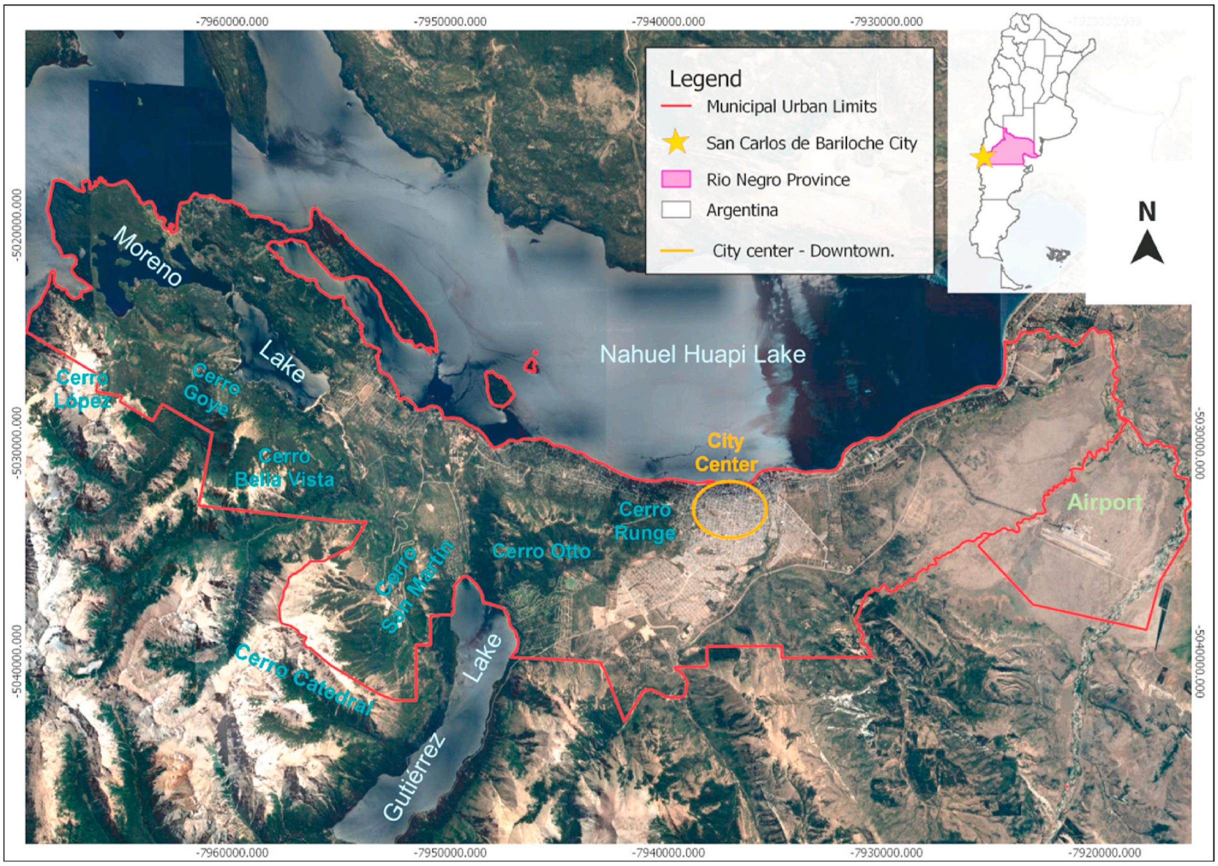

Fig. 1. Localization and geographical characteristics of Bariloche.
Source: Own elaboration based on Google Satellite Image - SRC: EPSG: 3857 - WGS 84 - Pseudo Mercator.

Table 1
Variables description (percentage of total neighborhood households).

	Mean	Standard deviation	Minimum	Maximum
UBN				
Absence of UBN	90.1	11.5	46.7	100
Infrastructure				
Access to gas network	85.6	20.2	21.2	100
Access to sewage network	53.0	40.6	0	100
Access to water network	89.7	21.2	12.4	100
Land tenure regime				
Owner of the house and land	60.7	13.4	**2.5**	85.0
Tenant	20.0	13.4	0.5	55.0
Other forms of land tenure (e.g. occupation, loan, owner of the house but not the land)	19.2	11.7	4.3	**71.8**
Housing characteristics				
Bathroom inside the house	97.0	3.9	82.7	100
Water pipe inside the house	94.6	8.0	59.2	100
Less than two people per room (no overcrowding)	84.7	12.0	40.8	98.8
Goods possession				
Refrigerator	95.2	5.2	75.1	100
Computer	62.4	17.4	11.4	92.0
Fixed-line phone	59.7	18.1	12.5	86.4
Education of the head of household				
Complete primary school	88.4	9.6	59.8	100
Complete secondary school	51.3	24.6	7.1	89.8
Complete or incomplete higher education	30.6	22.0	1.6	73.2

Source: Own elaboration.

organized in different analysis axes, as in Sánchez et al. (2007): unsatisfied basic needs (UBN),[3] infrastructure, land tenure regime, housing characteristics, goods possession –a proxy of purchasing power-, and education of the head of household.[4] To make a clearer and easier interpretation of the results, variables are expressed in a positive sense –e.g. absence of UBN and access to infrastructure or goods–, except for the land tenure regime, where three alternative types are presented, without a previous value judgment. Table 1 also shows that there are considerable levels of variability in most of the indicators, which gives us a first sign of the heterogeneities among Bariloche's neighborhoods. As we will discuss later, the two extreme values highlighted in bold, regarding the land tenure regime, correspond to a very particular neighborhood that, after cluster analysis, will be identified as a unique

[3] UBN is a widely used method to account for situations of structural poverty in Latin America, instead of traditional measures of income poverty. In Argentina, households with UBN are those that meet at least one of the following conditions: overcrowding (more than three people per room), inconvenient housing (rented room, precarious housing, or another type), sanitary conditions (not having any kind of toilet), school attendance (presence of a school-age child not attending school), subsistence capacity (four or more people per occupied member and the head of household has not completed third grade of primary school). In contrast, households without UBN are those that do not meet any of these conditions.

[4] Given the dimensions covered by the UBN indicator, a certain degree of relationship with other analysis axes and variables could be presupposed beforehand. However, both the evidence from previous studies (Marcos et al., 2015; Rodríguez, 2001; Rodríguez & Arriagada, 2004; -Sánchez et al. (2007)) and our results show that this is not necessarily the case. We will see that several clusters have similar levels of UBN but different values in the other dimensions.

case.

3.3. Multivariate analysis methods

The methodology adopted here is consistent with the multivariate analysis techniques generally used in the empirical literature, especially the combination of principal component analysis (PCA) and cluster analysis (Chow, 1998; Hanlon, 2009; Manaugh, Miranda-Moreno, & El-Geneidy, 2010; Owens, 2012; Song & Knaap, 2007; Vicino et al., 2011). PCA can help us to convert a set of correlated variables in a lower number of uncorrelated factors (Hair, Black, Babin, & Anderson, 2010; Johnson & Wichern, 2008). Therefore, factorial analysis is many times a means to an end more than an end in itself (Johnson & Wichern, 2008), since the results can be used as intermediate inputs for other techniques, such as cluster analysis.

When analyzing the variables included in each axis, we found high levels of correlation between the variables that describe, respectively, housing characteristics, goods possession, and education of the head of household. Accordingly, we resorted to PCA in order to obtain in each case a component that synthesizes the information or variability shared by these correlated indicators. In addition to the analysis of the correlations matrix, the use of PCA is consistent with other statistics criteria that are also satisfied, like Bartlett's test of sphericity, Kaiser-Meyer-Olkin measure of sampling adequacy (KMO), and the evaluation of commonalities (Hair et al., 2010). In the three axes, it is appropriate to retain only the first principal component according to the Kaiser criterion, which consists in keeping the components with eigenvalues higher than one. These three new indicators synthesize the information contained in the housing, goods, and education axes, and account for 85%, 89%, and 95% of the total variance, respectively.

It should be noted that PCA and cluster analysis are sensitive to the use of different measures or scales, so it is initially necessary to standardize the variables (Hair et al., 2010; Johnson & Wichern, 2008). This is generally performed with Z scores –i.e. the original variable or score, minus the mean, divided by the standard deviation–, so once standardized they have mean zero and deviation one. On the other hand, the three components previously derived from PCA already have these characteristics. Before proceeding with cluster analysis, we convert into Z scores the seven indicators corresponding to the axes of UBN, infrastructure, and land tenure regime, and we add to the database the tree principal components that account for housing characteristics, goods possession, and education of the head of household (for a visual inspection of this 10 indicators, see the maps in Appendix B).

In line with our segregation criterion, cluster analysis seeks to maximize the homogeneity among the cases included within each cluster, at the same time that the heterogeneity between clusters is maximized. This allows us to describe the characteristics of each group and, consequently, to define an empirical typology. Within the different alternatives to carry out a cluster analysis, in this paper we resorted to one of the most commonly used hierarchical techniques, the Ward method, together with the proximity measure recommended for this method, the squared Euclidean distance (Hair et al., 2010; Johnson & Wichern, 2008). It is worth noting that the same technique has been used by several authors (Marcos et al., 2015; Mikelbank, 2004, 2011; Pallas-González, Martínez-Roget, & Miranda-Torrado, 2000; Sánchez et al., 2007), while others have resorted to alternative hierarchical methods (Aguirre et al., 2013; Bingham, Bowen, & Kimble, 1997; Link et al., 2015; Salom & Fajardo, 2017; Webber & Craig, 1978).

Graphically, hierarchical methods take the form of a tree diagram or, more technically, a dendrogram, which enables us to visually inspect how the clusters are created. In fact, hierarchical techniques usually imply an agglomerative process. In the beginning, each case or object is considered as a cluster in itself. In each stage of the process, the two closest or most similar clusters are joined, until in the end only one cluster is formed. In this sense, the key is to define at what intermediate stage it would be convenient to stop the agglomerative process. Although this decision may be conditioned by the judgment of each analyst, hierarchical techniques offer some practical criteria –or stopping rules– that can be useful when defining the final number of clusters. Here we followed one of the simplest and most used stopping rules, which consists in analyzing the percentage change in heterogeneity in each stage of the agglomerative process (Hair et al., 2010). When combining step by step different cases and reducing the number of clusters, the heterogeneity inside these clusters –or intra-cluster sum of squared errors, provided by Ward method– tends to increase. If this heterogeneity measure shows a sudden increase when combining two clusters, we can decide not to take that step and keep the previous number of clusters as a final solution.

4. Results

4.1. Determination of the number of clusters

As can be seen in Fig. 2, a first increase in intra-cluster heterogeneity is produced when passing from 11 groups to 10, so 11 clusters could be a possible solution. The same criterion could make us consider eight or six clusters as alternative solutions. Although other strong increases are common in the last stages of the agglomeration process, as it happens around three and two clusters, usually these solutions are not analytically interesting, since some cases that are very different from each other have been brought together.

One of the advantages of the dendrogram is the possibility to compare and evaluate the different alternative solutions, analyzing which cases are combined when reducing the number of clusters and whether or not they refer to neighborhoods that should be kept separate. Fig. 3 shows that the differences between 8 and 11 clusters lie in the division of branch B into three subgroups (B1, B2, and B3) and of branch F into two (F1 and F2). As we will see, these more disaggregated clusters present some characteristics that are different from each other, so the solution of 11 clusters is analytically richer and allows us to look inside the traditional stereotypes –or the *two faces of the city*. The same argument is stressed if we compare with the solution of six clusters, since three of the previous eight groups (C, D, and E) would be integrated into a single cluster, but we will see that they have some marked differences. Statistically, working with 11 clusters is also supported by the analysis of variance (ANOVA), since it is verified that the means of each variable are significantly different between the 11 clusters (Table 2). Finally, although someone could consider 11 clusters as a numerous solution, it is worth noting that, based on data from the 2001 census, Sánchez et al. (2007) defined 16 clusters. This is also a reflection of the marked heterogeneities between Bariloche's neighborhoods, as well as of the greater simplicity and richness of our results.

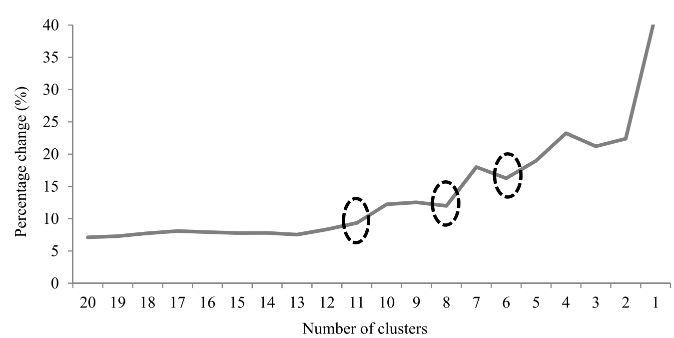

Fig. 2. Percentage change in heterogeneity (intra-cluster sum of squared errors).
Source: Own elaboration.

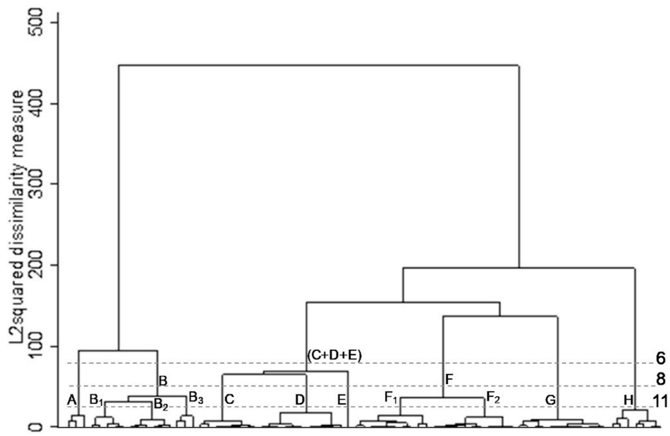

Fig. 3. Hierarchical clustering dendrogram.
Source: Own elaboration.

Table 2
Analysis of variance (ANOVA).

	Sum of squares	Degrees of freedom	Mean of squares	F
UBN (absence)	68.285	10	6.829	58.412***
Water network	68.858	10	6.886	63.630***
Sewage network	65.102	10	6.510	39.425***
Gas network	61.419	10	6.142	27.799***
Housing	64.998	10	6.500	38.988***
Goods	65.554	10	6.555	41.419***
Education	66.692	10	6.669	47.289***
Owner	57.777	10	5.778	20.925***
Tenant	64.251	10	6.425	36.090***
Other land tenure	49.903	10	4.990	12.620***

Significance level: *p < 0,05; **p < 0,01; ***p < 0,001.
Source: Own elaboration.

4.2. *Definition of a neighborhood typology*

The characteristics of these types of neighborhoods in Bariloche can be analyzed in Table 3, which shows the average of each variable for the 11 clusters. Based on the standardization process, the values respond to the following question: How many standard deviations below or above the mean of all Bariloche's neighborhoods is each cluster average? Given that all the socioeconomic and housing variables –from UBN to Education in Table 3– are expressed in a positive sense, negative values account for situations of scarcity or vulnerability. To make it even more visual, a scale of reds and greens is used to distinguish between disadvantageous and favorable situations. The color scale responds to the following criteria: dark when the cluster average is higher or lower than ±1, intermediate for values between ±0.5 and ± 0.99, and pale between ±0.49 and 0. The same coloring is applied to the different variables that characterize the land tenure regime. Since there is not a previous value judgment about these alternative situations, the colors do not imply favorable or unfavorable cases in advance, but they only show the distance between the cluster average and the general mean.

The following map (Fig. 4) allows us to visualize the geographical location of the neighborhoods that make up the 11 clusters. Although this dimension has not been part of cluster analysis –since it is not a variable defined by the census–, we consider the location when interpreting the results obtained, schematically distinguishing whether they are central, suburban, or periurban neighborhoods. In other words, we cross the information in Table 3 with this map to characterize the different types of neighborhoods in Bariloche and to derive an empirical typology.

A first particular case that is isolated by cluster analysis is cluster E, which covers only one unit of analysis, formed by the Military neighborhood and the Bariloche Atomic Center. The outstanding characteristic of this agglomeration is that the inhabitants –who, on average, have high education and purchasing levels– are occupants for working reasons of state homes that belong to different public agencies and have good housing conditions and access to infrastructure. The other side of this particular type of occupation is the practically null percentage of owners. This case had already been identified as a cluster in itself by Sánchez et al. (2007), based on data from the 2001 census. However, while Sánchez et al. (2007) got six clusters composed of a single neighborhood, cluster E is the only one here, which allows us to develop an analytically richer neighborhood typology.

If we lay aside cluster E, since it represents a very specific and isolated case, 10 types of neighborhoods can be identified in Bariloche. For a matter of simplicity in ordering and discussing the results, some of these 10 clusters will appear under a general category that follows the logic of the main branches of the dendrogram. Moreover, we will see that the first categories correspond to the (center-periphery) stereotypes that this article seeks to break, showing the heterogeneity within them. Meanwhile, the remaining clusters will show other particular realities beyond these traditional stereotypes. Although the following typology naturally responds to the case of Bariloche, we will mention other studies that suggest that some aspects are also shared with other Latin American cities. Lastly, despite some differences in the methodology and data, we will also highlight some clusters that are similar to the ones

Table 3
Cluster averages in each variable.

Cluster	Socioeconomic and housing variables							Land tenure regime		
	UBN (absence	Water	Sewage	Gas	Housing	Goods	Educa-tion	Owner	Tenant	Other
A	-3.52	0.26	-0.79	-2.62	-2.97	-3.05	-1.64	0.36	-1.36	1.13
B1	-1.46	0.45	0.41	-0.33	-1.78	-1.24	-1.42	0.36	-1.07	0.81
B2	-0.52	0.43	-1.09	-0.24	-0.65	-0.50	-0.89	0.41	-0.65	0.27
B3	-0.64	-0.75	-1.02	-2.47	-1.15	-1.48	-0.75	-0.21	-0.91	1.28
C	-0.53	0.47	0.77	0.17	-0.17	-0.30	-0.61	-0.66	0.23	0.49
D	0.47	0.48	1.02	0.61	0.49	0.38	0.54	-1.25	1.70	-0.50
E	0.80	0.25	0.66	0.44	0.91	1.19	1.26	-4.34	0.43	4.49
F1	0.45	-0.15	-1.01	0.18	0.38	0.56	0.75	0.39	-0.14	-0.29
F2	0.75	0.28	-0.19	0.64	0.85	1.15	1.31	0.08	0.77	-0.97
G	0.53	0.47	1.07	0.66	0.48	0.20	-0.76	1.10	-0.84	-0.30
H	0.29	-2.85	-1.27	-0.99	0.20	-0.12	0.64	0.10	-0.27	0.19

Source: Own elaboration.

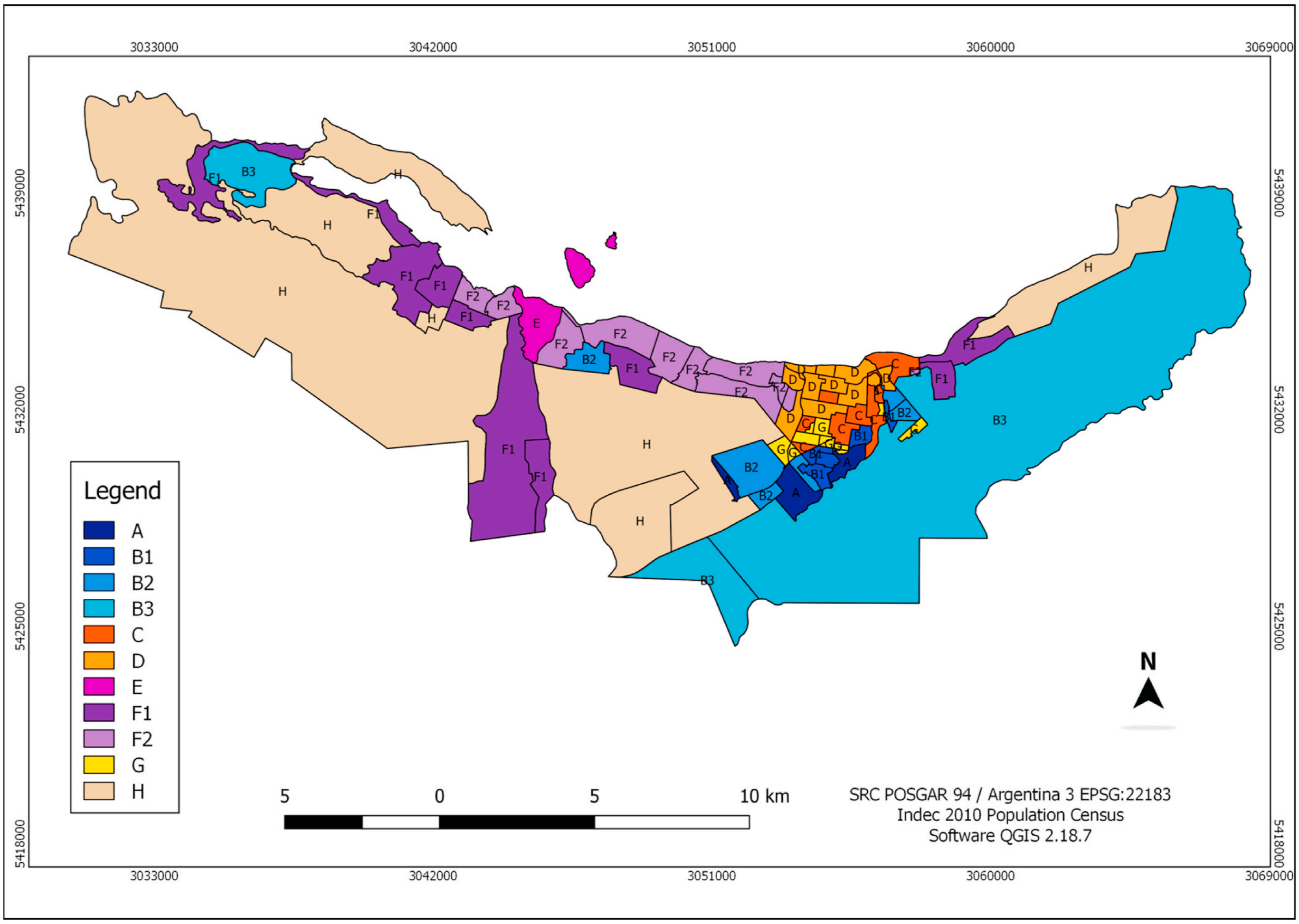

Fig. 4. Map of the different clusters of neighborhoods in Bariloche.
Source: Own elaboration based on the cartography of the National Institute of Statistics and Censuses (INDEC).

identified by Sánchez et al. (2007), based on the 2001 census. This reflects the stability of some socio-spatial inequalities throughout the 2000s.

Suburban popular neighborhoods: A and Bs (B1, B2, B3).

In general, all these neighborhoods are located in suburban areas –or in the margins of the city center– and are popular neighborhoods in the sense that lower-middle and lower classes live there, mainly salaried –formal or informal–, unemployed, or workers of the popular economy. In a simplistic and a bit stereotyped way, these neighborhoods are traditionally called *el Alto*, because of the altitude of these areas. However, there are some differences between the four groups of neighborhoods identified by cluster analysis, not only in socioeconomic levels but also in the access to infrastructure (López, Cukier, and Sánchez López, 2006; Silveira & Rodrigues, 2015).

In cluster A we find *suburban popular neighborhoods with restrictions in infrastructure and very low socioeconomic level* (e.g. Unión, 2 de Abril, Nahuel Hue, Vivero, similar to Sánchez et al., 2007).[5] They show the worst conditions in terms of UBN, education, goods possession –purchasing power–, and housing characteristics, in addition to reduced access to sewage and gas networks. In general, these are recently formed neighborhoods, mainly by informal occupations of lands, which impacts in their lack of urban consolidation (Enríquez Acosta, 2008; González-Pérez, Remond, Rullan, & Vives, 2016; Torres & Momsen, 2005). This group shares some similar characteristics with cluster B3, which we called *peri-urban popular neighborhoods with great restrictions in infrastructure and low socioeconomic level* (e.g. Llanquihue, Pilar 1 and 2, peri-urban radius). Along with the reduced purchasing power and irregular land tenure, the remoteness of these neighborhoods also explains the deprivations in terms of urban infrastructure –e.g. a marked lack of water network.

In contrast, clusters B1 and B2 correspond to relatively consolidated popular neighborhoods, based on their greater access to infrastructure and urban services. However, the socioeconomic level of B1 is more like B3, so we talk about *suburban relatively consolidated popular neighborhoods with low socioeconomic level* (e.g. Arrayanes, Eva Perón, Mutisias, Progreso, similar to Sánchez et al., 2007). Although cluster B2 presents, on average, some limitations in the access to sewage network –in part for being a little bit further from the city center–, we can talk about *suburban relatively consolidated popular neighborhoods with better socioeconomic conditions* (e.g. Frutillar, Omega, San Francisco 2 and 3, Virgen Misionera). In comparative terms, cluster B2 shows higher values of housing, education, and purchasing power.

Consolidated central neighborhoods: C and D

These neighborhoods are very consolidated in terms of infrastructure and urban services, but they present some socioeconomic and location differences (Baños Francia, 2012; Everitt, Massam, Chávez-Dagostino, Espinosa Sánchez, & Andrade Romo, 2008; Torres & Momsen, 2005; Valenzuela Valdivieso & Coll-Hurtado, 2010). While cluster D includes spatial units in the core of the city center –or downtown–, the neighborhoods in cluster C are generally located in the first ring around downtown. Cluster D also shows high education and purchasing power

[5] In Appendix C we present a complete list of the neighborhoods that form each cluster.

levels, so we talk about *downtown consolidated neighborhoods of upper-middle classes* (e.g. downtown radius, Belgrano, Anasagasti, El Mallín). Moreover, in cluster D we find the highest percentages of tenants or renters in the city, due to verticalization and densification processes. On the other hand, there is a smaller proportion of owners living there. Instead, cluster C includes *(macro-) central consolidated neighborhoods of lower-middle classes*, with more precarious homes, UBN, and lower education levels (e.g. Lera, San Francisco 1, Ceferino, Nueva Esperanza).

Suburban neighborhoods of upper-middle classes: Fs (F1 and F2).

In search of the landscape, Bariloche city has grown in extension along the Nahuel Huapi Lake, following Bustillo and Pioneros Avenues to the West and Route 237 to the East. That is why the neighborhoods in this expansion axes, particularly the ones to the West, are generically known as *los kilómetros* –i.e. the kilometers, as a measure of distance to the city center–. This is the preferred location for the middle and upper-middle classes, who live in neighborhoods with relatively good infrastructure and urban services (Celemín, 2012; Everitt et al., 2008; López, Cukier, & Sánchez, 2006; Torres & Momsen, 2005; Valenzuela Valdivieso & Coll-Hurtado, 2010), with the particular exception of the access to sewage network, which is restricted due to the distance to the city center or the lower age of some of these neighborhoods (Silveira & Rodrigues, 2015). The latter is more evident in cluster F1, which we call *suburban relatively consolidated neighborhoods of upper-middle classes* (e.g. Lago Moreno, Casa de Piedra, Playa Serena, Los Coihues). On the other hand, these limitations are much more isolated in cluster F2, which not only is closer to the city center but also presents higher levels of education and purchasing power, as well as a higher proportion of tenants –only behind cluster D–. In this case, we talk about *suburban consolidated neighborhoods of upper-middle classes* (e.g. Cipresales, Las Vertientes, Maitenes, Melipal, Pinares, similar to Sánchez et al., 2007).

Neighborhoods of social housing and infrastructure for lower-middle classes (between the city center and the suburbs): G.

These are neighborhoods where lower-middle and lower classes live, with an also low education level but with very good urban infrastructure conditions –practically the same as cluster D– and the highest proportion of homeowners in the city. These characteristics are mostly explained by the fact of being social housing complexes built by the State (e.g. 40, 84, 112, 154, 204, 218, 400 houses, similar to Sánchez et al., 2007), in many cases several decades ago and in the margins of the city center or near suburban areas (Matossian, 2016), given the higher availability of lands at that moment.

Suburban neighborhoods of middle classes with infrastructure restrictions: H.

In cluster H, we find middle classes –and some upper-middle sectors as well– with a good education level. However, in search of the natural environment, the proximity with the forest or the lake, they live in neighborhoods far from the city center and with some physical barriers in-between, like hills or mountains (e.g. Colonia Suiza, Península, El Trébol, Lago Gutiérrez). For these reasons, some infrastructures and urban services are still scarce (Celemín, 2012; López et al., 2006).

5. Discussion and conclusions

Practically from the beginnings of the reflection about the capitalist city, there was a concern for analyzing the location of the different social classes within the city and the level of urban and social segregation they experience. Throughout this paper, we appreciate that Bariloche is a heterogeneous, fragmented, and segregated city. However, the neighborhood typology that we propose transcends traditional stereotypes –the city center, *el Alto*, or *the kilometers*– and gives a much more complex perspective. It is clear that this heterogeneity is not limited to a comparison of the clusters, but we could also find differences between the neighborhoods that form each cluster or within the neighborhoods themselves. In this sense, although cluster analysis facilitates a general overview that can be useful for urban planning and management, the study of urban inequalities could be deepened in future research.

Despite these possible limitations, as well as not being able to account for the subjective dimension of segregation –as we do not have data on this issue–, this paper provides a multidimensional and complex perspective on the nature of urban segregation. Many quantitative and segregation indexes that only focus on a few dimensions or variables, usually arrive at binary or dualist results –e.g. center-periphery–. Instead, we show that the traditional *two faces of the city* hide heterogeneous realities within them, as well as that there are other realities beyond these two simplistic stereotypes. This is an interesting result that naturally responds to the case of Bariloche, but that could also be taken into account in the analysis of other Latin American cities, especially tourist ones.

A remarkable aspect of Bariloche is that urban fragmentation and segregation are not directly associated with the well-studied phenomenon of gated communities, since there are few and exceptional cases of closed or private neighborhoods, but rather with inequalities between open neighborhoods. Another distinctive issue, which also contributes to the discontinuity and dispersion of the urban area, is the physical environment itself and the presence of natural barriers that condition the urbanization patterns. For example, the *Cerro* Otto –whose radius integrates cluster H– is a geographic element that blocks the continuous development of the urban structure, separating some upper-middle-class neighborhoods (cluster F2) from the popular neighborhoods toward the South (A and Bs). Obviously, these characteristics impact on urban segregation, or have been even functional to these processes as a way of *hiding* some portions of the population (Pérez, 2004).

Bariloche presents a disperse and extensive urban area, with fuzzy limits and discontinuous urbanized spots in some places. Some examples are the popular neighborhoods of clusters A, B2, and B3, but also some middle-class neighborhoods, such as clusters F1 and H, each one with their particularities and differences. These last cases –F1 and especially H– represent a counterexample to the previous Latin American evidence that have usually shown a direct relationship between the access to urban infrastructure and the socioeconomic level of the population. In Bariloche, it seems that some people consider that the availability of natural amenities compensates the lack of certain services, which on the other hand can be obtained from the same physical environment –like water streams– or can be remedied somehow –e.g. through a correct treatment of residential effluents–. Another counterexample, but on the contrary, is cluster G of social housing complexes built by the State and destined to lower-middle and lower classes. Due to the characteristics of these housing policies of several decades ago and the proximity to the city center, urban infrastructure and services are guaranteed. A similar relationship between relatively good infrastructure and popular classes is seen near the margins of the city center, in clusters C and B1. Consequently, only in the core of the city center and the near upper-middle-class neighborhoods (groups D and F2), there is a direct link between urban services and favorable socioeconomic conditions.

In turn, some clusters also reflect different stages or models of urban and housing policies. Cluster G shows this clearly, since it concentrates the social housing complexes typical of past decades, which were mainly the product of the eradication and relocation of precarious settlements (Pérez, 2004). Meanwhile, clusters A and B show, with different degrees of maturation, the evolution of informal urbanization processes from the 1980s onwards, which consist of lands occupations and later policies of housing regularization (Ferguson & Navarrete, 2003). These policies have sought to keep the population in their settlement place, based on progressively improving their homes, regularizing the housing tenure, and supplying these neighborhoods with community equipment and urban services.

As a corollary, the lack of correlation observed in some Bariloche's neighborhoods between the socioeconomic level of the population and the access to urban services allows us to reflect on the different dimensions of urban segregation and urban policies. In Bariloche –and other Latin American tourist cities–, the social valuation of the natural environment not only conditions the direction of urban growth but also tends to complicate the provision of urban infrastructure. This represents a particular challenge for urban planning and management in increasingly diffuse tourist cities.

Beyond urban infrastructure and equipment, which naturally are central aspects of urban integration, it is clear that there are other dimensions linked to socioeconomic integration and a more symbolic component that has to do with the sense of being connected to a community. Urban disintegration, low population densities, long distances, and geographical accidents contribute to the urban problems in Bariloche –and many Latin American tourist cities–. Therefore, it is important to guide the future growth of the city and promote an urban structure more compact and densified, balancing or limiting the market forces that usually tend to urban diffusion. Finally, urban integration may require better and more intelligent forms –and spaces– of urban connectivity. As suggested by Liu et al. (2019), the aggregation of urban functions and services in established or emerging secondary centers, and increasing their functional linkages and connectivity as urban hubs, could be an interesting strategy.

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CRediT authorship contribution statement

Andrés Niembro: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Supervision, Project administration. **Tomás Guevara:** Conceptualization, Investigation, Writing - original draft, Writing - review & editing, Funding acquisition. **Eugenia Cavanagh:** Software, Resources, Data curation, Visualization.

Declaration of competing interest

No potential conflict of interest is reported by the authors.

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Appendix A. Description of conversion from census radii to neighborhoods

As we mentioned before, the limits of census radii do not necessarily coincide with neighborhoods limits. Nevertheless, in some cases, a radius matches relatively well the limits of a neighborhood (e.g. San Francisco 1, Jardín Botánico) or of a group of adjacent neighborhoods less populated in 2010 (e.g. San Francisco 2 and 3, or the East, which covers Villa Verde, INTA, La Colina, Aldea del Este, and Las Marías). On other occasions, it was necessary to put together two or more radii to approximate the scale of a bigger and more populated neighborhood (e.g. Frutillar, Las Victorias) or, given the changing limits of the radii, to cover an area close to a group of adjacent neighborhoods (e.g. Unión and 2 de Abril, denominated 34 ha, Arrayanes and Eva Perón, or the group that we call Pinares, from Pinar del Lago to Pinar de Festa). Based on the union of census radii, a new cartography (reflected in Fig. 4) was developed, which helps us to incorporate the territorial dimension when describing the clusters.

In all the cases in which the comparison between cartographies indicated the need of joining two or more census radii, we also followed the criterion of ensuring certain homogeneity among them, particularly comparing the percentage of homes with at least one indicator of unsatisfied basic needs (UBN). Furthermore, this criterion was essential to settle some complex cases where the radii did not adjust to the limits of a neighborhood or a group of adjacent neighborhoods and constantly crossed from one neighborhood to another (e.g. in Las Quintas, Nueva Esperanza, Lera, Las Mutisias, and Perito Moreno). In these cases, we identified a core radius for each neighborhood and the remaining radii were distributed combining the geographical criterion and the homogeneity in UBN. On other occasions (e.g. in Lomas de Monteverde), the homogeneity criterion led us to divide the neighborhood into two fractions (North and South), since their respective radii presented different levels of UBN. Finally, it is worth noting that, instead of working with the city center as a unique big area that would integrate more than ten radii, it was divided into smaller subsections, in line with the rest of the identified units. The next table of correspondences (Table A1) shows how the 159 census radii were distributed among the 77 neighborhoods –or groups of neighborhoods– defined, which allows other researchers or policymakers to replicate or improve the work done.

Table A.1Neighborhoods or groups of neighborhoods defined

ID	Neighborhoods	Census radii
10DIC	10 de Diciembre	620210903
112_84V	112-84 viv	620211808
120V	120 viv.	620211408
154_204_218V	154-204-218 viv	620211603 + 11604+11605
181V	181 viv	620211009
34HAS	Unión-2 de Abril	620210203 + 10212
3LAGOS_MORENO	3 Lagos-Lago Moreno	620210107 + 10111
400_40V	400-40 viv Movitur	620210207 + 10208
80VCOVI	80 viv Covitur	620211412
96_144V	Amancay 96-Güemes 144 viv	620211608
ABED_VURI	Abedules-Vuriloche	620211701
ALBOR_BV	Alborada-Bella Vista	620211607
ANASAG	Anasagasti	620210801 + 10802+10803 + 11506+11507
ANTU170V	Antu Hue 170 viv	620211011
ARRAY_EVA	Arrayanes-Eva Perón	620211705 + 11706
BELGRANO	Belgrano	620210311 + 10312+10313
BONITA_SIC	Playa Bonita-San Ignacio del Cerro	620211102 + 11113
BOTANICO	Jardín Botánico	620210907
CAB_MILITAR	Centro Atómico Bariloche-Barrio Militar	620211101

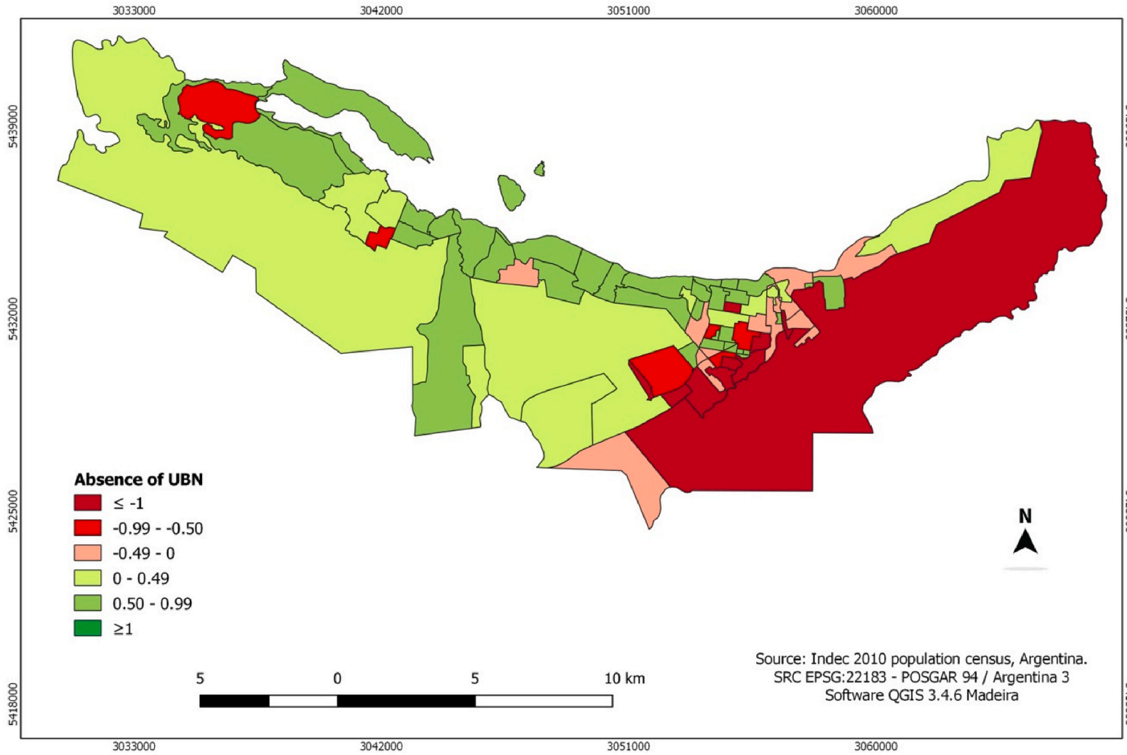
(continued on next page)

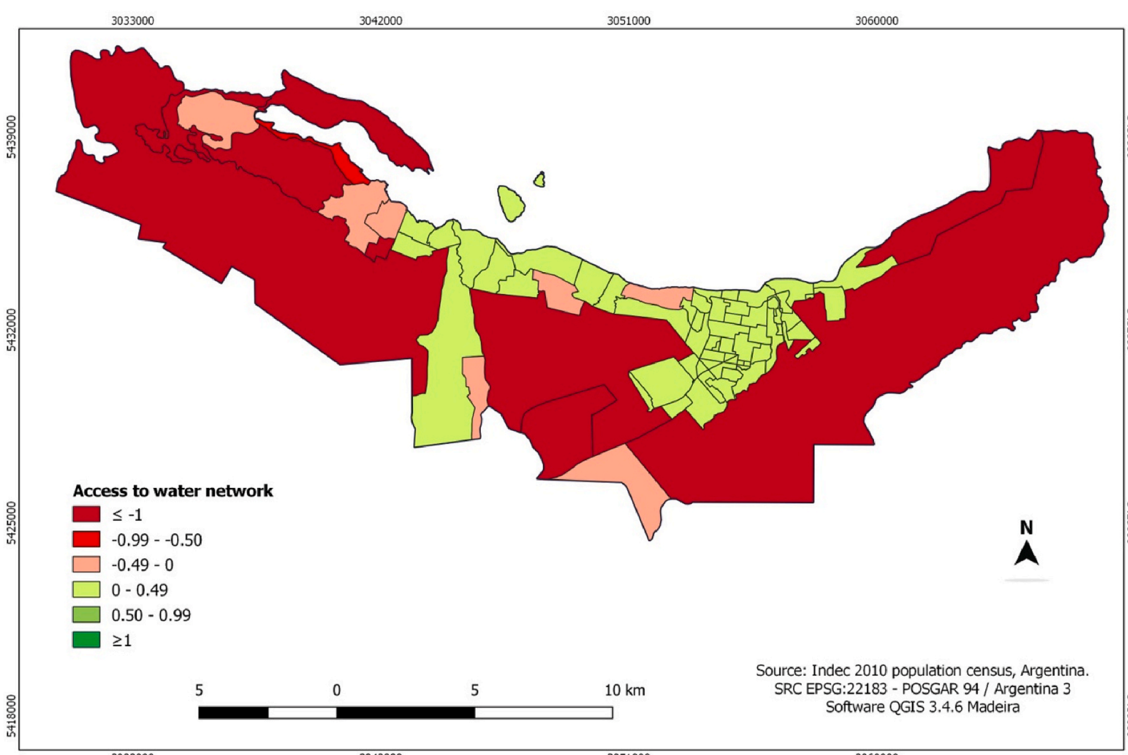
(*continued*)

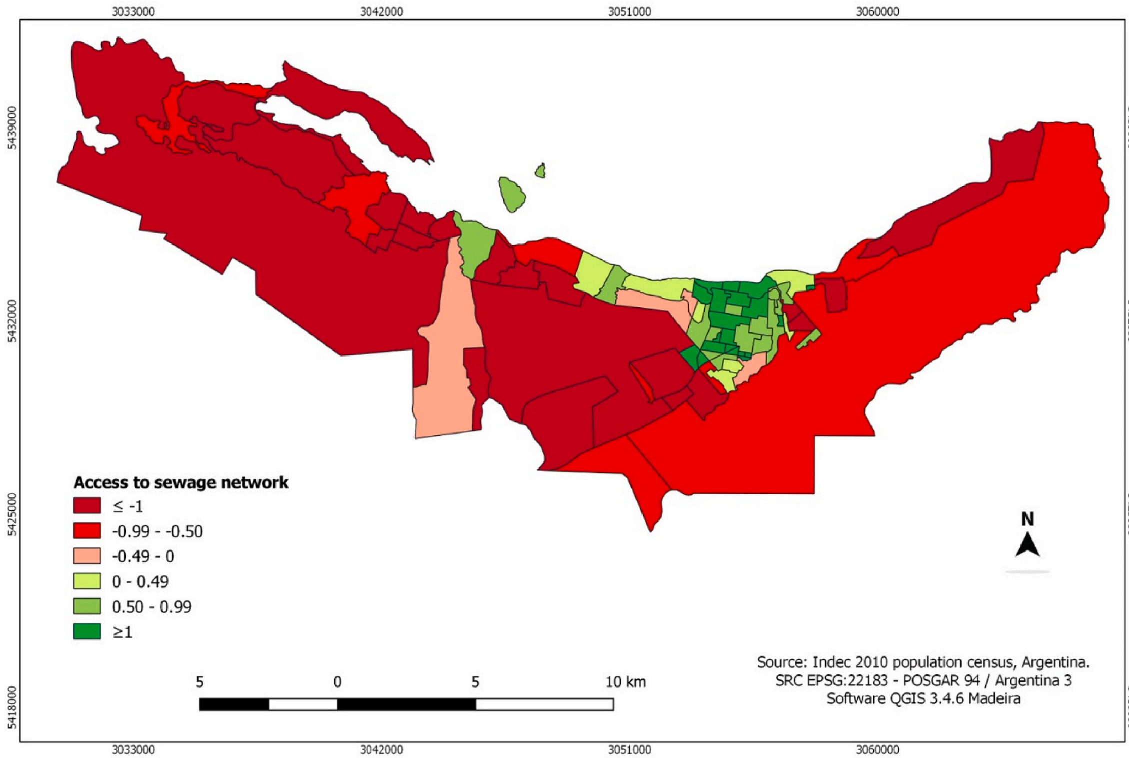
ID	Neighborhoods	Census radii
CANTERA_OMEGA	Toma Cantera y parte de Omega (Sur)	620211710
CASAPIEDRA	Casa de Piedra	620211205 + 11206
CATEDRAL	Villa Catedral	620211209
CENTRO_NE	Centro-Noreste	620210306 + 10307+10308 + 10309+11503 + 11504+11505
CENTRO_NIRE_O	Centro-Ñireco Oeste	620211804 + 11805
CENTRO_NO	Centro-Noroeste	620210301 + 10302+10310
CENTRO_S	Centro-Sur	6202111502 + 11508+11509 + 11511+11512
CENTRO_SO	Centro-Sudoeste	620210901 + 10902+11501 + 11510
COIHUES	Los Coihues	620211207 + 11208
COLSUIZA	Colonia Suiza	620210112
CONDOR_NIRE_NE	Ñireco Noreste-El Cóndor	620211801
COOP258	Coop. 258-El Maitén	620211402
CSOL_CHACRAS	Costa del Sol-Las Chacras	620211417
CUMBRE	La Cumbre-Alto Jardín	620210906 + 10908+10909
ELFL300V	Elflein 300 viv	620211606
ESTE	Villa Verde-INTA-La Colina-Aldea del Este-Las Marías	620211416
FALDEO_RANCHO	Faldeo-Rancho Grande-Ladera Norte	620211109 + 11110+11114
FRUTI	Frutillar	620210204 + 10205+10206 + 10209+10210 + 10211
GUTIER_ARELAU	Lago Gutiérrez-Arelauquen	620210202
JAMAI_COVI	Villa Jamaica-Covibar	620210110
KM4_5	Carihue-El Prado-Rayen Mapu (incl. parte de El Faldeo)	620211301 + 11302+11310 + 11311
LERA	Lera	620210804 + 10805+11806 + 11809
LEVA266V	Levalle 266 viv	620211609
LLANQUIH	Llanquihue (y Don Bosco)	620210102
LLAO_CAMPAN	Llao Llao-Campanario	620210101 + 10103
MAITEN_CIPRES	Maitenes-Cipresales-Runge Superior	620211304 + 11305
MALLIN_FURMAN	Mallín-Furman-Santo Cristo	620210904 + 10905+11601 + 11602
MARGARIT	Las Margaritas	620211306
MELIPAL	Melipal	620211303 + 11308+11309
MICROCENTRO	Microcentro	620210303 + 10304+10305
MONTEV_NORTE	Monteverde (Norte)	620211802
MONTEV_SUR	Monteverde (Sur)	620211807
MUTI_PM	Las Mutisias-Perito Moreno	620211005 + 11006+10810
NAH_MALV	Nahuel Hue-Malvinas	620211403 + 11404+11406 + 11407
NMALAL	Nahuel Malal	620211201 + 11202
NVAESPER	Nueva Esperanza	620210806 + 10807+10808 + 10809
OMEGA	Omega (Norte)	620211405 + 11709
ORIONE_VESCOND	Don Orione-Valle Escondido	620210105
OTTO_LADERAS	Cerro Otto: Laderas superiores	620210201
PAJAZUL	Pájaro Azul	620211203 + 11204
PENINS	Península San Pedro	620210104
PERIURB	Periurbano	620211418
PEUMA153V	Peumayén 153 viv	620211703
PILAR	Pilar	620211401
PINARES	Pinar del Lago-Pehuen-La Cascada-Montelindo-Pinar de Festa	620211103 + 11104+11105 + 11106+11107 + 11108
PROGR_ARG	Progreso-Argentino-28 de Abril	620211702 + 11707
QUIMEY	Quimey Hue	620211708
QUINTAS_CEFE	Las Quintas-San Ceferino-6 Manzanas	620211001 + 11002+11003 + 11004+11007 + 11008
SANFRAN1	San Francisco I	620211803
SANFRAN2_3	San Francisco II y III	620211409 + 11410
SANFRAN4	San Francisco IV-130-40-20 viv	620211411
SANMA169V	San Martín 169 viv	620211010
SERENA_JOCK	Playa Serena-Jockey	620210108 + 10109
TREBOL	El Trébol	620210106
VERTIENT	Las Vertientes	620211307
VICTORIAS	Las Victorias	620211413 + 11414+11415
VIRGEN	Virgen Misionera	620211111 + 11112
VIVERO	Vivero	620211704

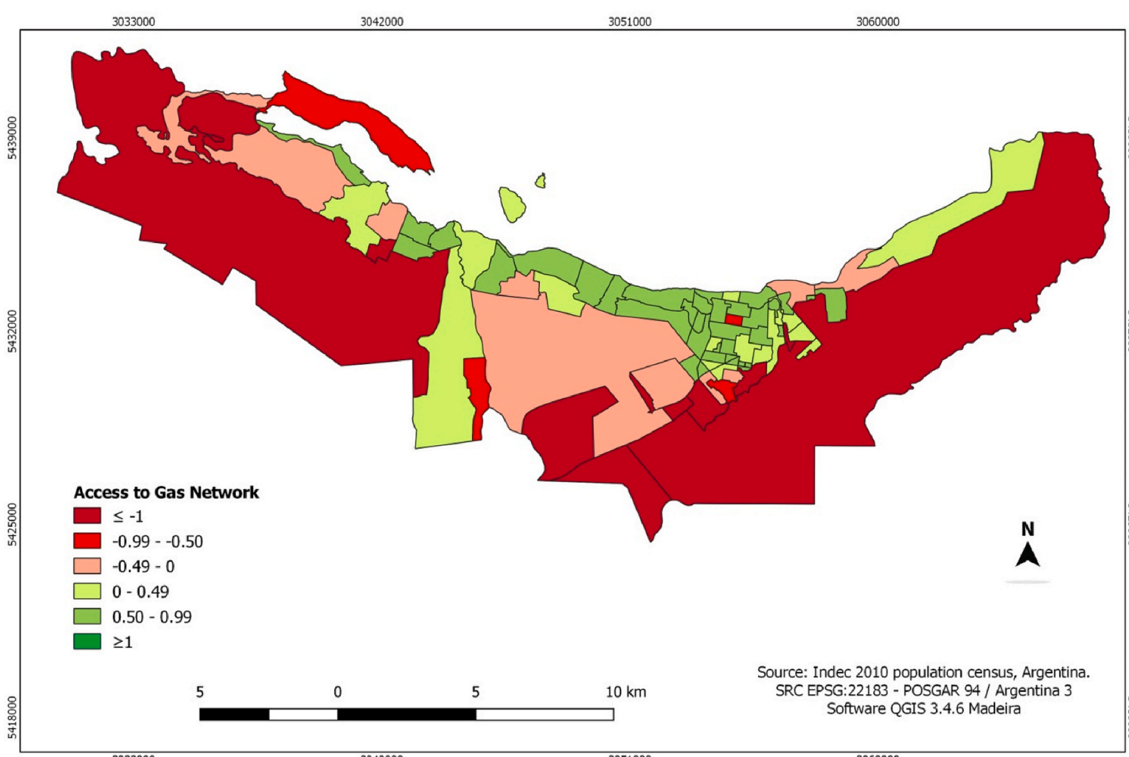
Appendix B. Maps of the ten indicators employed in cluster analysis[6]

[6] The color scale in the maps is the same as in Table 3.

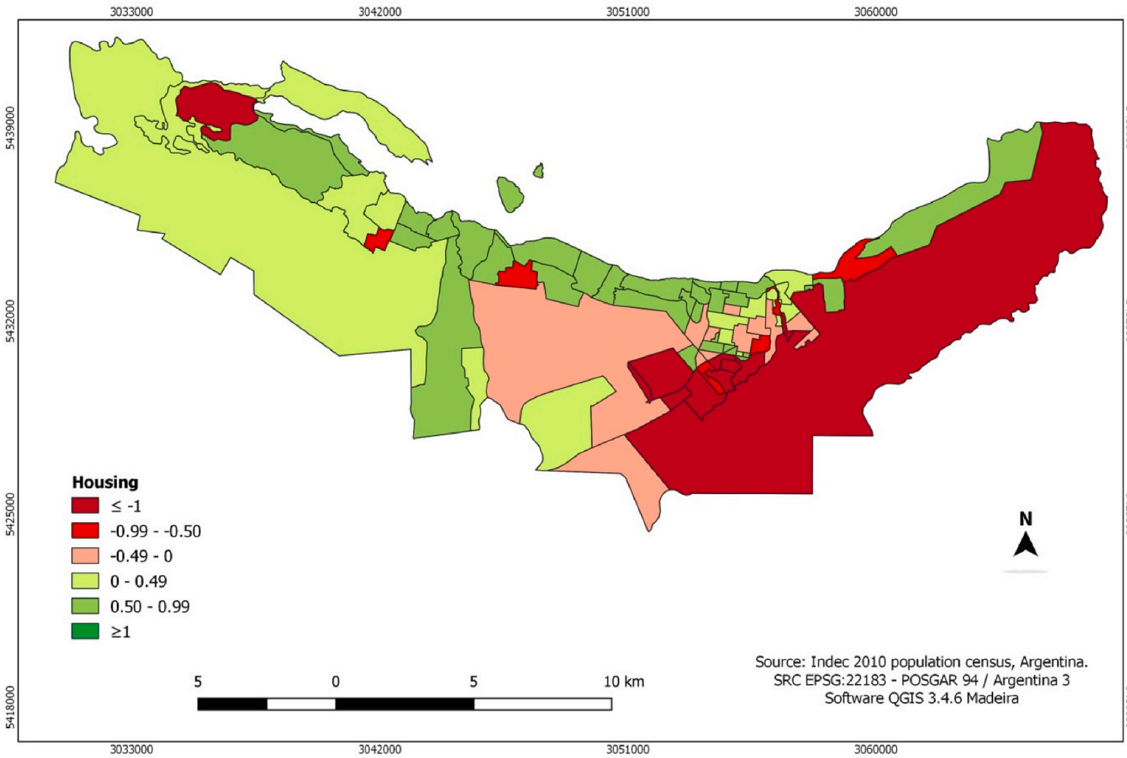

3033000
3042000
3051000
3060000
5439000
5432000
5425000
5418000
Absence of UBN
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5 0 5 10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira

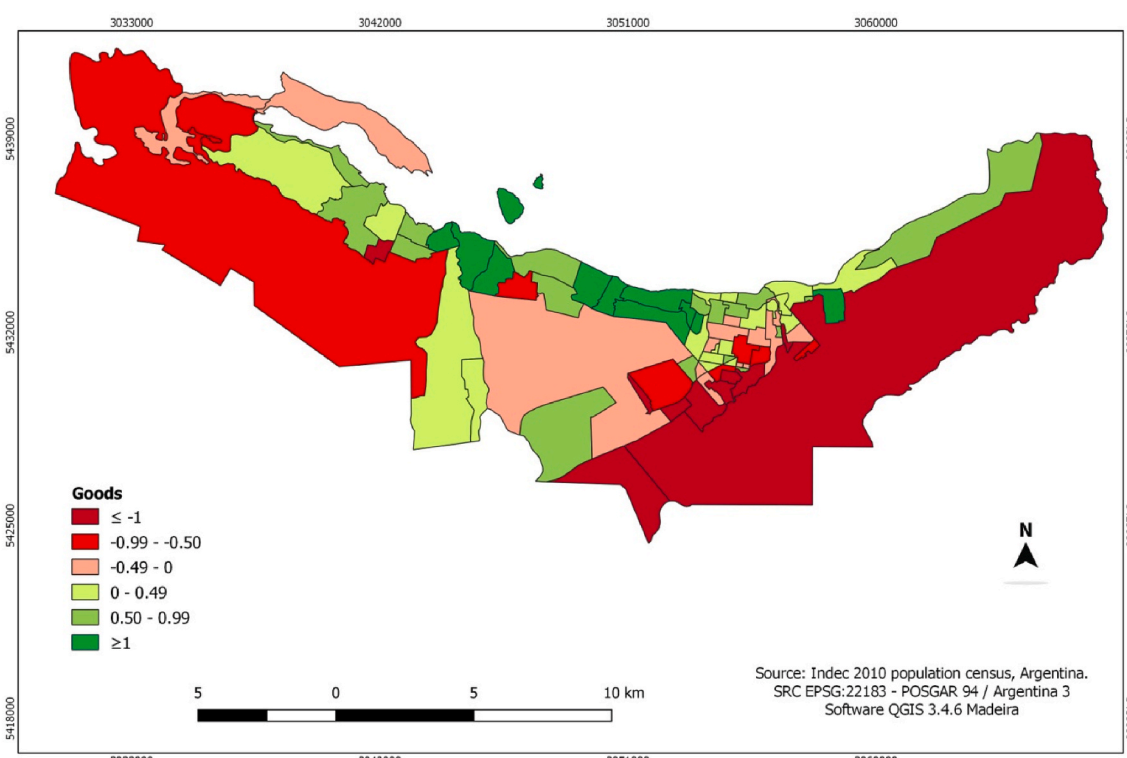

3033000
3042000
3051000
3060000
5439000
5432000
5425000
5418000
Access to water network
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5 0 5 10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira


3033000
3042000
3051000
3060000
5439000
5432000
5425000
5418000
Access to sewage network
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira


3033000
3042000
3051000
3060000
5439000
5432000
5425000
5418000
Access to Gas Network
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira

. (*continued*).


3033000
3042000
3051000
3060000
5439000
5432000
5425000
5418000
Housing
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira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3042000
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Goods
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
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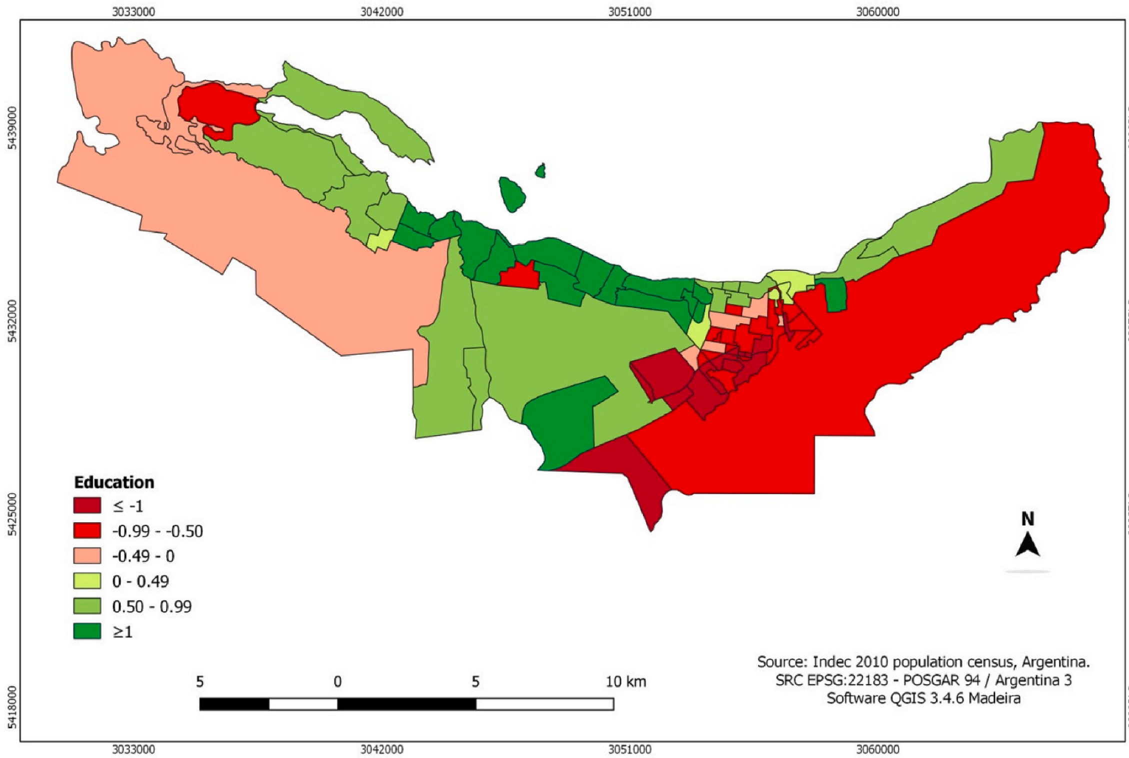
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira

. (*continued*).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Education
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-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
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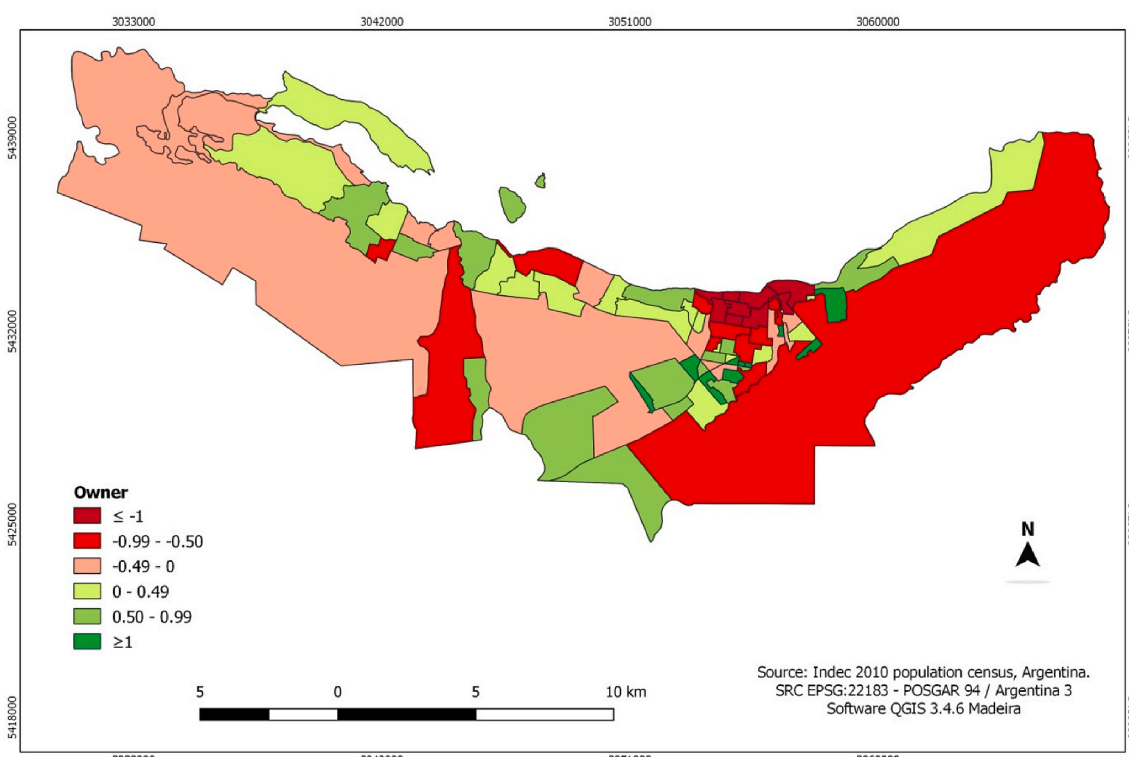
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira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Owner
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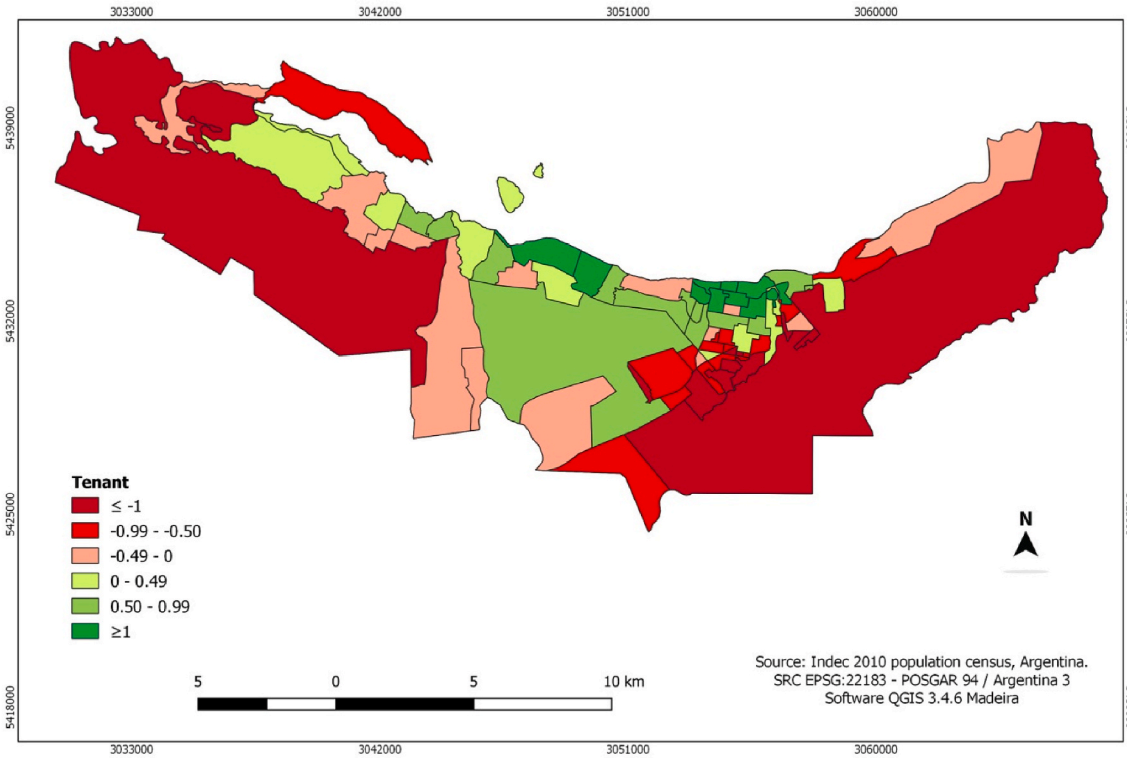
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira

. (*continued*).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3042000
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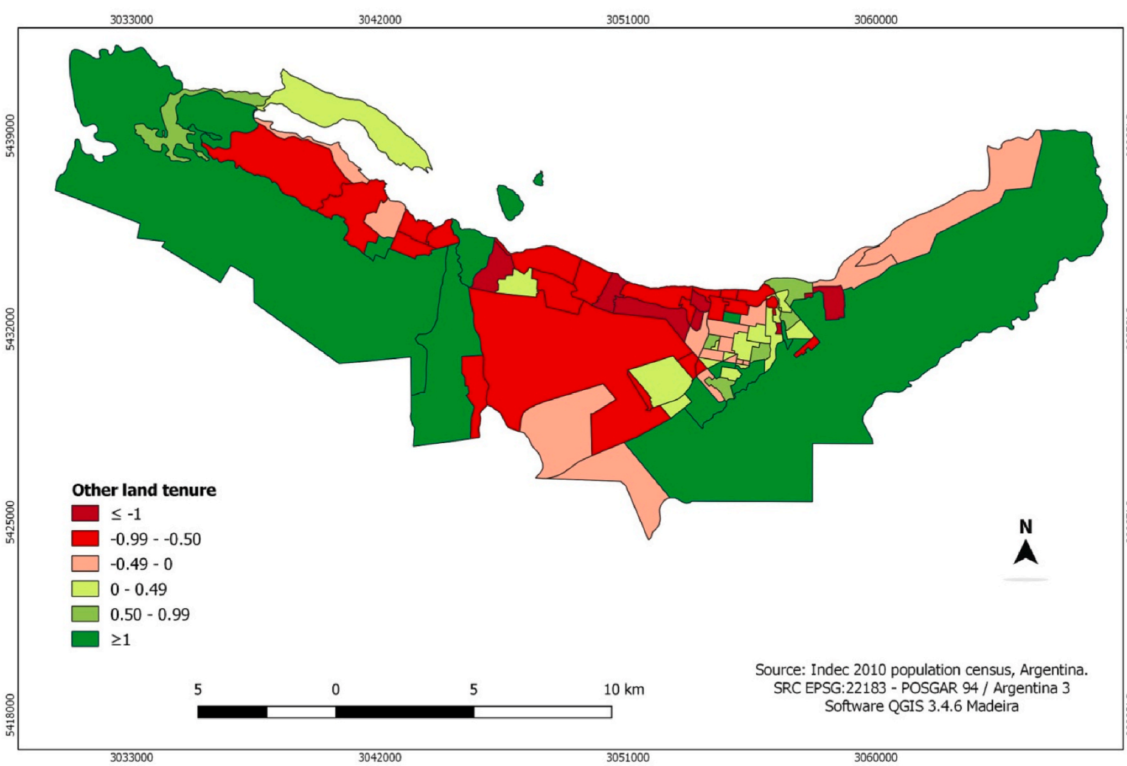
Tenant
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira


3033000
3042000
3051000
3060000
5439000
5432000
5425000
5418000
Other land tenure
≤ -1
-0.99 - -0.50
-0.49 - 0
0 - 0.49
0.50 - 0.99
≥1
N
5
0
5
10 km
Source: Indec 2010 population census, Argentina.
SRC EPSG:22183 - POSGAR 94 / Argentina 3
Software QGIS 3.4.6 Madeira

. (*continued*).

Appendix C. Neighborhoods (ID) by cluster

Cluster	Neighborhood (ID)
A	34HAS
	NAH_MALV
	VIVERO
B1	120V
	ARRAY_EVA
	CANTERA_OMEGA
	MUTI_PM
	PROGR_ARG
B2	COOP258
	FRUTI
	MONTEV_SUR
	OMEGA
	SANFRAN2_3
	VIRGEN
B3	LLANQUIH
	PERIURB
	PILAR
C	10DIC
	ABED_VURI
	ALBOR_BV
	CONDOR_NIRE_NE
	LERA
	NVAESPER
	QUINTAS_CEFE
	SANFRAN1
D	ANASAG
	BELGRANO
	CENTRO_NE
	CENTRO_NIRE_O
	CENTRO_NO
	CENTRO_S
	CENTRO_SO
	CUMBRE
	MALLIN_FURMAN
	MICROCENTRO
	MONTEV_NORTE
E	CAB_MILITAR
F1	3LAGOS_MORENO
	CASAPIEDRA
	CATEDRAL
	COIHUES
	ESTE
	FALDEO_RANCHO
	LLAO_CAMPAN
	ORIONE_VESCOND
	SERENA_JOCK
	VICTORIAS
F2	80VCOVI
	BONITA_SIC
	BOTANICO
	KM4_5
	MAITEN_CIPRES
	MARGARIT
	MELIPAL
	NMALAL
	PAJAZUL
	PINARES
	VERTIENT
G	112_84V
	154_204_218V
	181V
	400_40V
	96_144V
	ANTU170V
	ELFL300V
	LEVA266V
	PEUMA153V
	QUIMEY
	SANFRAN4_VIV
	SANMA169V
H	COLSUIZA
	CSOL_CHACRAS
	GUTIER_ARELAU
	JAMAI_COVI
	OTTO_LADERAS
	PENINS
	TREBOL

Source: Own elaboration.

Appendix D. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.habitatint.2020.102294.

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