Instituto Nacional de Estadísticas · Chile

ONU-HABITAT

REPORT OF THE RESULTS FROM THE APPLICATION OF THE DEGREE OF URBANIZATION (DEGURBA) PILOT TEST IN CHILE AND THE CALCULATION OF PRIORITY INDICATORS OF SUSTAINABLE DEVELOPMENT GOALS

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INDICE

DEFINITIONS OF INTEREST

Acronyms

- **CNDU:** National Urban Development Council (Consejo Nacional de Desarrollo Urbano)
- **DANE:** National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística de Colombia)
- **DEGURBA:** Degree of Urbanization
- **FAO:** Food and Agriculture Organization of the United Nations
- **GIS:** Geographic information system
- **GTFS:** General Transit Feed Specification
- **INE:** National Statistics Institute of Chile (Instituto Nacional de Estadísticas)
- **JRC:** European Union Joint Research center
- **MBN:** Ministry of National Assets (Ministerio de Bienes Nacionales)
- **MDSF:** Ministry of Social Development and Family (Ministerio de Desarrollo Social y Familia)
- **MINECON:** Ministry of Economy, Development, and Tourism (Ministerio de Economía, Fomento y Turismo)
- **MINVU:** Ministry of Housing and Urban Planning (Ministerio de Vivienda y Urbanismo)
- **MTT:** Ministry of Transportation and Telecommunications (Ministerio de Transporte y Telecomunicaciones)
- **NAU:** New Urban Agenda (Nueva Agenda Urbana)
- **NSO:** National Statistical Office
- **OECD:** Organisation for Economic Co-operation and Development
- **SDG**: Sustainable Development Goal
- **SUBDERE:** Undersecretary of Regional Development and Administration (Subsecretaría de Desarrollo Regional y Administrativo)
- **UCB:** Urban Census Boundary (Límite Urbano Censal (LUC))
- **UN:** United Nations

Concepts

- **Abbreviated Census:** The 2017 Population and Housing Census was conducted in an abbreviated manner, which means that the traditional objectives of census projects were hierarchized and, consequently, the contents of the questionnaire were reduced. The smaller number of questions on the census form compared to previous censuses decreased the time needed for enumeration and data processing. However, the same preparation activities and quality controls of a regular census were maintained (INE, 2018d).
- **Census block:** Basic geographic unit used by INE for statistical purposes to establish census zones in urban areas and villages in rural areas. A census block consists of a group of contiguous or separate dwellings, buildings, establishments, and/or land, delimited by geographical, cultural, and natural features (INE, 2016).
- **Cluster:** With the delimitation of clusters through spatial analysis tools, the location of hot spots, cold spots, statistically significant spatial outliers, and similar entities can be identified. In addition, cluster analysis can be used to identify potential causes for the existence of clusters (ESRI, 2023).
- **Collective dwelling:** A dwelling that has been built and intended for the accommodation of large groups of people and/or households, who for various reasons live together, regardless of their kinship. These dwellings usually have common facilities, such as bathrooms, kitchens, and rest rooms. These dwellings may be classified as hotels or guesthouses, institutions, workers' housing, or another type of dwelling (INE, 2022).
- **Dwelling:** Any building constructed, converted, or arranged for the permanent or temporary housing of persons and/or households, as well as any kind of shelter, fixed or mobile, occupied as a place of residence (INE, 2022).
- **Entity category:** For census purposes, population entities are divided into urban and rural, and they are identified according to categories of human settlements in the national territory (INE, 2015c).
- **MANZENT:** A unique 14-character code that defines each of the census blocks in urban areas and entities in rural areas. The MANZENT is a combination of codes of the various geographic areas: the first five digits represent the region, province, and commune codes (SUBDERE, 2020); the next two digits represent the census district code and area code (1 if urban and 2 if rural); the last three digits identify the entity in rural areas or the block in urban areas (INE, 2015d).
- **Microdata:** Data on the characteristics associated with statistical units found in a database. They are non-aggregated observations or measurements of the characteristics of the statistical unit, and they the primary way in which data are stored and from which results are derived. The microdata set is one of the results of data collection and data processing (INE, 2022b).
- **National classification:** The census concepts used by INE, including urban and rural definitions (INE, 2018e), entity categories (INE, 2015c), and other concepts. (This concept was defined for this report.)
- **Population actually enumerated in the census:** All persons present at the time of census enumeration (INE, 2018b).

- **Precensus:** Registration of buildings, dwellings, and persons prior to the census. Its implementation precedes the census because its main objective is to divide the national territory into census sectors and reliably estimate the quantity of resources needed for the census process and then to provide a reference parameter for estimating census coverage (INE, 2017).
- **Private dwelling:** Any structurally separate and independent construction located within a site, intended or used, in whole or in part, for the habitation of persons and households (INE, 2022).
- **Raster:** Matrix of cells (or pixels) organized in rows and columns (or a grid) in which each cell contains a value representing information. Rasters are digital aerial photographs, satellite images, digital images, or scanned maps (ESRI, 2022).
- **Rural entity:** A human settlement with a population less than or equal to 1,000 inhabitants, or between 1,001 and 2,000 inhabitants if more than 50% of the population states that they engage in primary activities (INE, 2018e).
- **Service Area:** The region encompassing all accessible streets (i.e., streets that are within a specified range). For example, the five-minute service area for a point in a network includes the area that can be reached from that point within that time range; a 500-meter service area indicates the area covered by that range when the streets accessible from a point are considered (ESRI, 2022b).
- **Sustainable Development Goals:** Goals adopted by the United Nations in 2015 as a universal call to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity (Programa de las Naciones Unidas para el Desarrollo, s.f.).
- **UN-Habitat:** The United Nations Human Settlements Programme (UN-Habitat) is mandated by the United Nations General Assembly to promote socially and environmentally sustainable towns and cities. UN-Habitat is the focal point for all urbanization and human settlements issues within the United Nations system (ONU Hábitat, s.f.).
- **Urban Census Boundary (UCB):** An imaginary line that separates the urban area from the rural area. This boundary has a statistical census purpose, and its delimitation is done according to INE's own technical criteria. The main objective of UCB delimitation is to establish the methodological difference between the urban and rural areas of a commune, each of which will be treated in a particular way, for cartography and censuses (INE, 2015b).

INTRODUCTION

The degree of urbanization (DEGURBA)[1] methodology, proposed by UN-Habitat and the European Commission and subsequently validated and recommended by the UN Statistical Commission in March 2020 (European Commission, and Statistical Office of the European Union, 2021), has been presented as an opportunity to measure, compare, and analyze urban and rural areas of countries.

In January 2022, UN-Habitat invited INE Chile to participate in a pilot test for the application of DEGURBA methodology at the national level. INE is the agency responsible for the country's official statistics and the only institution that has statistical data (including population and housing data) associated with disaggregated cartographic products at the microdata level.

The invitation was also extended to other Chilean public institutions that have competence in this area, in order to contribute, support, and technically complement the implementation of the methodology. These institutions include the National Urban Development Council (CNDU), the Ministry of National Assets (MBN), the Ministry of Housing and Urban Planning (MINVU), the Ministry of Transportation and Telecommunications (MTT), and the Undersecretary of Regional and Administrative Development (SUBDERE). These agencies formed a working group to define the guidelines and inputs for the application of DEGURBA methodology in Chile and the calculation of priority SDG indicators.

In order to carry out the activities, face-to-face workshops were held in the country in May and October 2022. The topics were as follows:

- The presentation of DEGURBA methodology, its context, methodological phases, and available tools. The necessary guidance for its application and interpretation was obtained.
- Guidance on the calculation of priority SDG indicators (11.2.1, 11.3.1, and 11.7.1) through the analysis of available data provided by the relevant public institutions and through the application of methodologies proposed by UN-Habitat.

In January 2022, INE formally assumed the coordination of the SDG Indicators Sectoral Working Group for Chile. Since 2016, INE has been technical advisor to the Council for the Implementation of the Sustainable Development Goals in Chile and, in that capacity, INE provided technical support to the institutions for the calculation of Chile's SDG indicators.

This document presents the results of the pilot test of the application of DEGURBA methodology in Chile for the following priority SDG indicators: the proportion of population that has convenient access to public transportation, by sex, age, and persons with disabilities (11.2.1); the ratio of urban land consumption rate to population growth rate (11.3.1); and the average share of the built-up area of cities that is open space for public use for all, by sex, age, and persons with disabilities (11.7.1).

This document is divided into two sections. The first contains the methodological definitions, considerations, and results of the application of DEGURBA methodology; the second describes the process and analyzes the calculation of the priority SDG indicators.

1) For more information, visit: https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-02-20-499

1 Chapter

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CONTEXT FOR THE APPLICATION OF DEGURBA METHODOLOGY IN CHILE

1 Chapter

This chapter presents background to contextualize DEGURBA methodology by describing the elements necessary for arriving at the results through the use of the specific guidelines of DEGURBA methodology and of the concepts of national classification.

1.1. Definition and characteristics of DEGURBA methodology

DEGURBA is a methodology for classifying territory into classes by calculating the **population density of one-square-kilometer cells, population thresholds, and geospatial concepts of contiguity**[2] (Melchiorri, y otros, 2021). This methodology enables the comparison of data at the international level by establishing homogeneous parameters in its definition while acknowledging methodological nuances based on the type and scale of the geolocalized population information available in each country (European Commission, and Statistical Office of the European Union, 2021).

DEGURBA methodology does not seek to replace the conceptualization of urban and rural used by the statistical agencies of each country nor, in general, of any public agency; its objective is to complement these definitions and support the analysis of the territory (European Commission, and Statistical Office of the European Union, 2021).

The classification of one-square-kilometer grid cells (DEGURBA Level 1) is divided into three classes: high-density clusters (commonly referred to as "cities"), moderate-density clusters ("towns"), and areas composed of mostly low-density cells ("dispersed rural areas"). Each of these classes is subdivided into seven subclasses or categories corresponding to level 2 of DEGURBA classification[3], which is shown in Table 1[4].

Table 1: Technical terms used in the classification of grid cells in levels 1 and 2 (L1 and L2) of DEGURBA.

Level of Urbanization	Class code	Description
1 (L1)	3	High-density clusters
	2	Moderate-density clusters
	1	Mostly low-density cells
2 (L2)	30	Urban centre
	23	Dense Urban cluster
	22	Semi-dense, urban clusters
	21	Suburban / Peri-urban grid cell
	13	Rural clusters
	12	Low-density rural grid cells
	11	Very low-density rural grid cells

Source: Own elaboration, based on European Commission and Statistical Office of the European Union, 2021. INE, 2023.

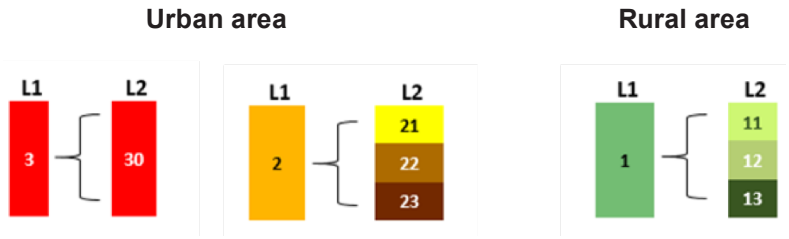
2) This contiguity depends on the spatial relationship between one-square-kilometer grids cells according to the parameters established by this methodology (four- or eight-point contiguity). The objective is to link cells that meet similar conditions in order to define clusters or settlements (Melchiorri, y otros, 2021).

3) UN-Habitat highlights the relevance of identifying these intermediate areas for understanding, studying, and making decisions about a territory that may be classified in a diverse manner and fall outside the dichotomous definitions of urban and rural. For this reason, the analysis of results mostly focusses on the level 2 classification.

4) Both in this document and in many international publications, classes are presented from the largest to the smallest number (3 to 1 in Level 1; 30 to 11 in level 2). This ordering is from highest to lowest density and from highest to lowest number of inhabitants per square kilometer, as appropriate.

The relationship between the classes of levels 1 and 2 are described in Figure 1. In practical terms, level 2 maintains the definition of class 3 of level 1, but changes the code number to 30; L2 divides urban class 2 clusters into classes 23, 22, and 21, and differentiates three subclasses from the rural cells of level 1 (13, 12, and 11).

Figure 1: Subdivision of Level 1 (L1) classes into level 2 (L2) classes according to DEGURBA urban and rural classification.



Source: Own elaboration, based on European Commission and Statistical Office of the European Union, 2021. INE, 2023.

The three DEGURBA level 1 classes are defined as follows (European Commission, and Statistical Office of the European Union, 2021):

- **Class 3:** Urban center (high-density cluster). This class is the grouping of contiguous cells of one square kilometer (four-point contiguity) with a population density of at least 1,500 inhabitants[5] per square kilometer and a minimum population of 50,000 inhabitants.
- **Class 2:** Urban cluster (moderate-density cluster). This class is the grouping of contiguous cells of one square kilometer (four-point contiguity) with a population density of at least 300 inhabitants per square kilometer and a minimum population of 5,000 inhabitants.
- **Class 1:** Rural grid cells (mostly low-density cells). This class refers to cells that are not found in any of the two previous classes.

The criteria for defining the classes of level 2 are shown in Table 2, which specifies the required levels of population and density per cell.

Table 2: Description of criteria (population thresholds and population density) for classification of DEGURBA level 2 classes.

		Population thresholds for cell clusters (size of settlement)			No population size criterion (not a settlement)
		≥ 50,000	≥ 5,000 a 49,999	500 a 4,999	
Population density of each grid cell (inhabitants/km²) ≥ 1,500	≥ 1,500	30: Urban center	23: Dense urban cluster		
	≥ 300		22: Semi-dense urban clusters	13: Rural cluster	21: Suburban / peri-urban area
	≥ 50				12: Low-density rural grid cells
	< 50				11: Very low-density rural grid cells

Source: European Comission and Statistical Office of the European Union, 2021.

5) The bibliography of the DEGURBA methodology uses the term "inhabitants", even though (as explained below) it is not the appropriate term to describe the population numbers according to the information available in Chile.

There are two types of criteria for defining the classes of level 2:

a. Classes defined according to thresholds of population size (settlement size) and population density in each grid cell (inhabitants/km^2). This type of settlement **consists of clusters** that are divided into the following classes:

- **Class 30:** Urban centers. This class consists of clusters with the same definition as mentioned in the description of class 3, level 1 of DEGURBA, which refers to settlements with a population density of at least 1,500 inhabitants per square kilometer and the cluster as a whole with a population of at least 50,000 inhabitants.
- **Class 23:** Dense urban clusters. DEGURBA level 1, class 2 subdivision. This class consists of clusters with 5,000 to 49,999 inhabitants in total and a population density of more than 1,500 inhabitants per square kilometer.
- **Class 22:** Semi-dense urban clusters. DEGURBA level 1, class 2 subdivision. This class consists of clusters with 5,000 to 49,999 inhabitants and a population density of more than 300 inhabitants per square kilometer but less than 1,500 inhabitants per square kilometer.
- **Class 13:** Rural clusters. Settlements with 500 to 4,999 inhabitants and with a density of 300 or more inhabitants per square kilometer.

b. Classes without a population-size criterion, which are limited to the analysis of population density per cell. This type of settlement does not consist of clusters. Its classes are as follows:

- **Class 21:** Suburban/peri-urban grid cell. This class corresponds to a subdivision of class 2, level 1 of DEGURBA; however, its level of population does not fall into any of the clusters described above, even though it is located around them. Class 21 consists of a portion of the urban area that is not counted as a settlement. Its density per cell is greater than or equal to 300 inhabitants per square kilometer, but less than 1,500.
- **Class 12:** Low-density rural grid cells. The characteristic of this class is a density greater than or equal to 50 inhabitants per square kilometer and less than 300. Class 12 is derived from DEGURBA class 1, level 1.
- **Class 11:** Very low-density rural grid cells. This class has less than 50 inhabitants per square kilometer, and it is derived from DEGURBA level 1, class 1.

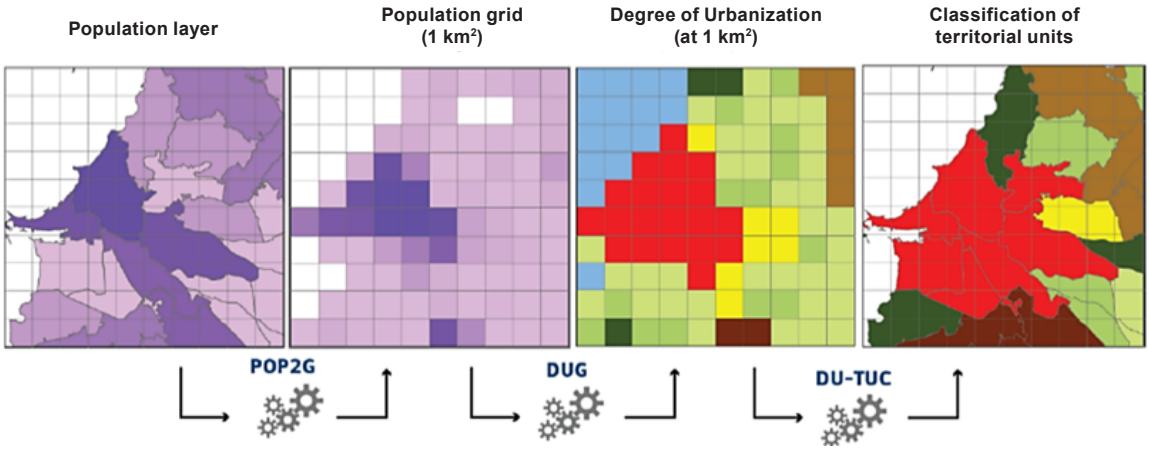
The implementation of DEGURBA methodology is divided into three main stages, which are applied sequentially and systematically (European Commission, and Statistical Office of the European Union, 2021):

1. Constructing a population grid
2. Grid classification according to degree of urbanization
3. Classification of territorial units according to the result of the grid-cell classification

Intermediate and final results are generated through tools[6] made available by JRC at UN-Habitat, which enable a sequential processing based on georeferenced population information (called "territorial units" according to the methodology[7]).

Figure 2 shows the workflow, which begins with territorial units associated with population data (first image on the left). These units are then reinterpreted into a one-square-kilometer population grid and classified in the grid into classes of levels 1 and 2. Finally, the classification of cells can be transferred to the same territorial units of the first step.

Figure 2: DEGURBA workflow using the provided applications.



Source: Melchiorri et al (2021). INE, 2023.

Both DEGURBA methodology at the grid level and the territorial units classified according to DEGURBA classes are considered results of the process. These territorial units allow for a great diversity of analyses based on the associated census data and the behavior of demographic and geographic variables, according to this proposed definition of urban and rural.

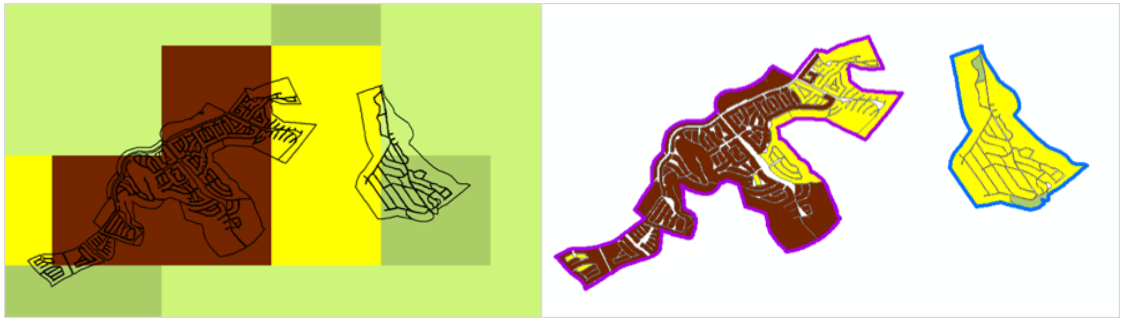
However, distortion may arise from the difference between the size of the grid and the territorial units available and selected for the application of DEGURBA methodology. Figure 3 shows the transfer of class information from a one-square-kilometer grid to the processed territorial units (in this case, urban blocks); if DEGURBA methodology used smaller grids, the results might vary.

6) These tools are GHS-POP2G, GHS-DUG, and GHS-DU-TUC, respectively, (European Commission, and Statistical Office of the European Union, 2021). The tools are systems developed within the framework of the Global Human Settlement Layer (GHSL) to produce geospatial information in the form of grids and territorial units of interest:

- **GHS-POP2G:** performs grid-level population counts at different spatial resolutions. For more information, see the user guide at https://publications.jrc.ec.europa.eu/repository/handle/JRC121485
- **GHS-DUG:** produces spatial grids whose objective is to classify settlement classes and extract related statistics according to DEGURBA methodology. For more information, see https://publications.jrc.ec.europa.eu/repository/handle/JRC121484
- **GHS-DU-TUC:** the territorial unit classifier (TUC) classifies territorial units according to the results of the implementation of DEGURBA methodology through the use of GHS-DUG. For more information, see https://publications.jrc.ec.europa.eu/repository/handle/JRC121486

7) The territorial units should cover the entire territory to be studied. The methodology proposes different solutions for different formats and quality of georeferenced information. (European Commission, and Statistical Office of the European Union, 2021).

Figure 2: Assignment of classes in DEGURBA level 2 in two urban areas according to the national classification.



Symbols used for DEGURBA, level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

1.2. Conceptual background considered by the INE for the analysis and understanding of the results of the application of DEGURBA methodology

INE's national classification[8] uses a dichotomous definition of urban and rural that has been adjusted in censuses throughout the years (INE, 2018e) while maintaining intercensal comparability.

The 2017 Population and Housing Census (the 2017 Census) defines an urban area as a human settlement with continuity and concentration of constructions in regular blocks and with a population greater than 2,000 people (or between 1,001 and 2,000 people when less than 50% of the population state that they engage in primary activities). In contrast, any human settlement that does not meet these criteria is classified as rural. The classification of urban areas includes at least three criteria: (i) geographical characteristics of the settlement, (ii) total population actually enumerated in the census[9], and (iii) economic activity of the economically active population (INE, 2018e). According to the national classification, urban areas are delimited with respect to the rural area by the urban census boundary (UCB), which is defined as the imaginary line that separates the urban area from the rural area (INE, 2015b).

Both urban and rural settlements are classified into urban and rural entity categories (INE, 2015c). Urban settlements are divided into two categories called city and town, while rural settlements are divided into eleven categories[10] (INE, 2015c). For the application of DEGURBA methodology, it is important to analyze both categories of the urban area as well as the categories of village and subdivided plot of the rural area. The description of these categories and the relevance to the analysis are shown in Table 3.

8) For the purposes of this document, INE's definitions of urban and rural are referred to as the **national classification**. In addition, the concepts of the entity category are included.

9) The application of this methodology is based on the registered population, whether or not they are habitual residents.

10) The entity categories of the rural area are village, hamlet, small holding-rural property, country estate-ranch-farm, mining settlement, fishing settlement, encampment, summer pasture/livestock shelter/oasis, indigenous community, subdivided plot, and other. (INE, 2015c)

Table 3: INE's definition of the urban categories of city and town and the rural categories of village and subdivided plot.

Area	Category	Population threshold (number of persons)	Relevance of analysis
Urban area according to national classification	**City**	The population level actually enumerated in the census is over 5,000.	Urban area with a greatest number of inhabitants, the same minimum population requirement for urban as defined by DEGURBA
		Block division, concentration, and continuity of constructions	Urban area with possible density necessary to be designated as urban in DEGURBA methodology
	Town	Actual census population size between 2,001 and 5,000 persons, or between 1,001 and 2,000 when certain economic-activity characteristics are met	The population level is less than what is required by DEGURBA to designate a settlement as urban
		Less than 50% of the population actually enumerated in the census reported that they work in primary activities	Possible categorization as a rural area according to DEGURBA
		Block division, concentration, and continuity of constructions	
National classifications of rural area included in the analysis	**Village**	Population actually enumerated between 301 and 2,000 persons, or between 1,001 and 2,000 when more than 50% of its population engage in primary activities	Concentrated rural area as defined by INE (compare with DEGURBA rural cluster)
		Block division and or continuity of dwellings	
	Subdivided plots	Settlement with one or more properties	Impacto sobre la periferia de las ciudades, asimilable a la clase 21 de DEGURBA (Periurbano / Suburbano). Representa un área de transición entre el área urbana y rural.
		They do not constitute an agricultural operation, even if there are crops within it.	
		They are usually of medium-high and high socioeconomic level.	
		They are generally located near major urban centers (INE, 2015c).	

Source: Own elaboration, based on INE (2015). INE, 2023.

Table 3 shows that the definition of urban and rural in the national classification does not share population criteria with DEGURBA methodology. Figure 4 shows the different population thresholds for each of the categories of the entity of interest according to the national classification (city, town, and village) and for urban and rural areas according to both classifications.

Figure 4: Comparison between national classification categories and the classes of level 2 of DEGURBA.

Population thresholds of both classifications	Assignment of entity categories according to national classification	
≥ 5,000 persons	City	30: City Center; 23: Dense Urban Cluster; 22: Semi-dense Urban Cluster; 21: Suburban/ Peri-urban Area
2,001 to 5,000 inhabitants, or 1,001 to 2,000 with specific economic characteristics	Town	13: Rural Cluster
Remaining population	Village (rural concentrate area) and dispersed rural area)	12: Low-density Grid Cells; 11: Very low-density Grid

Source: Own elaboration, INE 2023.

Information available for the application of DEGURBA methodology in the country

INE has geographical mapping for the entire national territory at the level of **blocks for the urban area** and at the level of **entities for the rural area**, a product of the 2017 Census (INE, 2018), which can be seen in Figure 5. These units are similar because both represent the minimum scale of data dissemination with cartographic representation. The origin of these units is the cartographic update of the 2016 pre-census operation (INE, 2015), which was subsequently consolidated into the geographical adjustment according to the population and housing data actually enumerated in the 2017 Census (INE, 2016), (INE, 2018f). The cartographic base is related to the census database by a unique code for each defined unit, which is called MANZENT (INE, 2015d). **These elements will be used as the basic territorial units for the application of DEGURBA methodology**.

Figure 5: Example of urban census blocks (upper image, in red) and rural entities (lower image, in blue) with data on the population actually enumerated.

Source: Own elaboration, based on cartography of the 2017 Census, INE 2023.

The 2017 Census was a de facto census, which consists of enumerating people according to the place where they spent the previous night, regardless of whether this place was their habitual residence (INE, 2018c). In addition, it identifies and counts people who spent the night outside a dwelling or were in transit (people in transit, unsheltered, etc.)[11], which makes it difficult to link them to a block or census entity represented in the cartography. For this reason, the people counted in the analysis correspond to the population actually enumerated and geolocated at the level of urban block or rural entity in the census. For the application of DEGURBA methodology, the following were excluded from the 2017 Census:

- People enumerated in collective dwellings
- Unsheltered people and people in transit
- At the national level, 146 records of blocks and entities that could not be geolocated in the geographical adjustment process.
- The Commune of Antarctica, located in the Magallanes Region, because it does not have associated cartography.

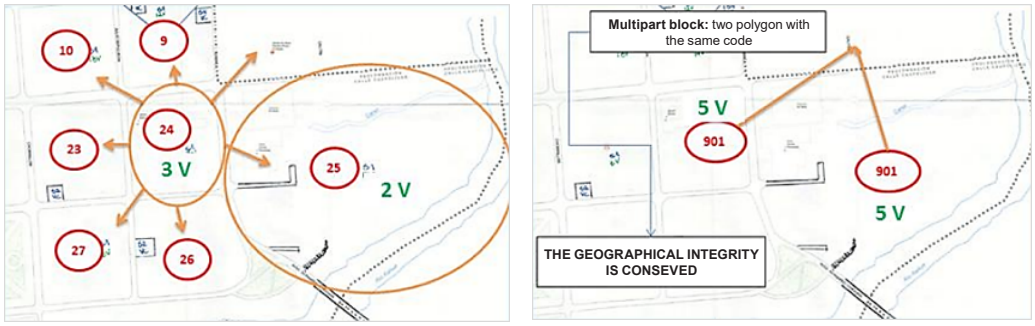
11) In these cases, people are registered by means of a special questionnaire without address, and therefore it cannot be linked to the cartography (questionnaire at https://www.ine.gob.cl/docs/default-source/censo-de-poblacion-y-vivienda/formularios/cuestionarios-censo-2017/cuestionario-censo-2017-personas-en-tr%C3%A1nsito.pdf?sfvrsn=33514b66_6)

The dissemination of the results of the 2017 Census used institutional guidelines of statistical secrecy[12], which required making both the cartographic base (INE, 2018) and data base indeterminate (INE, 2018c).

Broadly speaking, cartographic indeterminacy means that blocks or entities (both represented in the form of polygons) with three or fewer occupied dwellings with residents present are to be joined to other blocks or entities to reach a minimum of four occupied dwellings with residents present.

Figure 6 (left) shows an example of indeterminancy: block 24 has three occupied dwellings with residents present and block 25 has two dwellings in the same condition. The indetermination process therefore unites both units into a single record with five dwellings.

Figure 6: Example of geographical indetermination process.



Source: Own elaboration, INE 2023.

The population redistribution resulting from the indeterminacy process may affect the calculations of DEGURBA methodology, which is based on population density within one-square-kilometer grids. Therefore, the **original 2017 Census database, without indeterminacy, was used in the application of DEGURBA methodology**. The use of this database is exclusively internal because the data is protected by the law of statistical secrecy, but in any case the confidentiality of the information is not put at risk with the application of DEGURBA methodology, because the results are population averages per one-square-kilometer grid.

12) For more information, see https://www.ine.gob.cl/institucional/buenas-practicas/secreto-estadistico

2 Chapter

Instituto Nacional de Estadísticas • Chile

IMPLEMENTATION OF DEGURBA IN CHILE

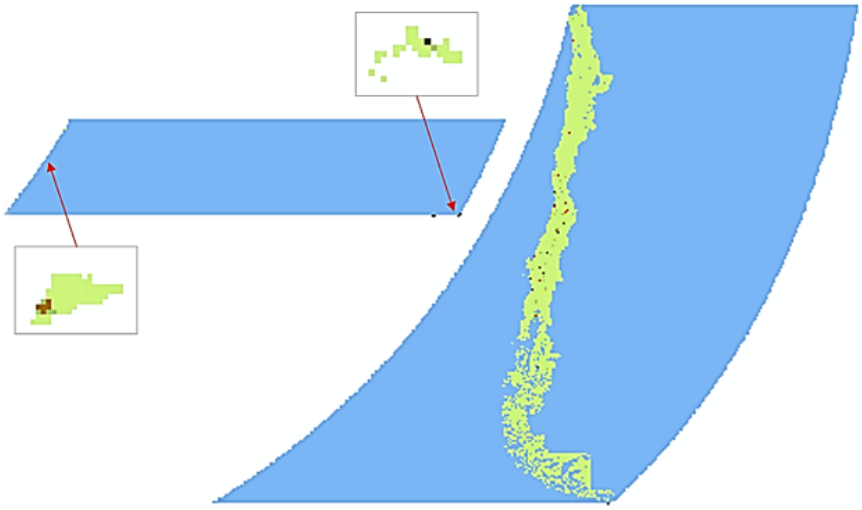
Chapter 2

This chapter presents the results of the application of DEGURBA methodology in the country, both at the geospatial level and in terms of population distribution according to the national classification.

2.1. Geospatial results of the application of DEGURBA methodology in urban and rural areas

DEGURBA methodology was applied at the national level to avoid distortions and population overlaps between regions or other administrative divisions of the territory. Taking this into consideration, and in order to overcome technical difficulties of processing capacity, the results are presented graphically while dividing the continental territory from the insular territory (Figure 7). However, all derived analyses have been carried out together.

Figure 7: Overview of processing results of level 2 of DEGURBA.



Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

General results of the application in urban areas

Table 1 organizes the results by macro-zone[13] and region, according to the number of clusters that make up settlements of urban centers (class 30), dense urban clusters (23) and semi-dense urban clusters (22), all of which are classified as within level 2 of DEGURBA methodology. Additionally, the total area associated with these urban clusters is included[14], as well as that corresponding to cells classified as part of level 2, class 21 of DEGURBA. (Class 21 does not make up an urban cluster or settlement. Instead, it consists of the rest of an urban area that does not meet the required population thresholds.)

13) For analytical purposes, the country's territory is divided into four macro-zones: **the northern macro-zone** consists of the Arica and Parinacota, Tarapacá, Antofagasta, Atacama, and Coquimbo Regions; **the central macro-zone** consists of the Valparaíso, Metropolitan, O'Higgins, and Maule Regions; **the southern macro-zone** consists of the Ñuble, Biobío, La Araucanía, Los Ríos, and Los Lagos Regions; and the far southern macro-zone consists of the Aysén and Magallanes Regions.

14) The area resulting from the application of DEGURBA is based on the total area of one-square-kilometer grid cells.

Table 1: Number of clusters that make up settlements of level 2, classes 30, 23, and 22 of DEGURBA, by region (ordered from north to south) and macro-zone. The area associated with the clusters and class 21 (peri-urban/suburban) is included.

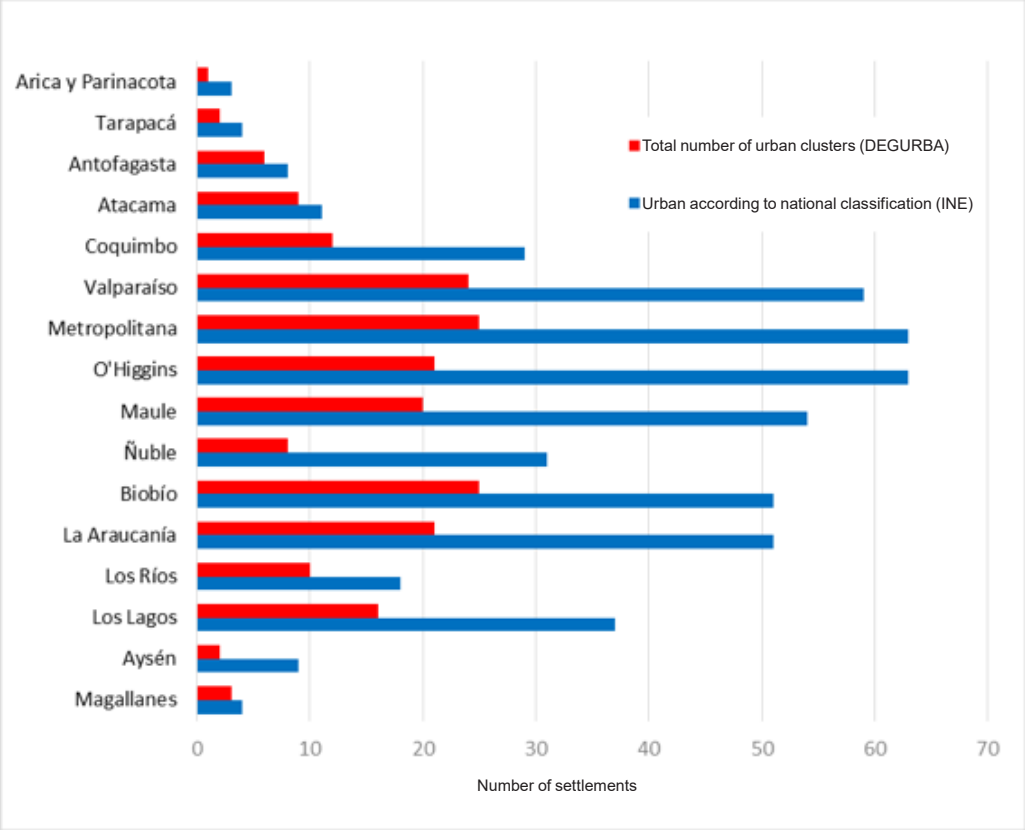
Macro-zone and region		Number and area of clusters forming settlements in the urban area according to DEGURBA level 2 classification.					Area in km² suburban/ peri-urban area (class 21)
		30: Urban center	23: Dense urban cluster	22: Semi-dense urban clusters	Urban cluster total	Surface area in km² of urban clusters (classes 30+23+22)	
North	Arica y Parinacota	1	0	0	1	34	10
	Tarapacá	1	1	0	2	49	11
	Antofagasta	2	3	1	6	86	30
	Atacama	1	4	4	9	77	23
	Coquimbo	3	5	4	12	137	77
	TOTAL	**8**	**13**	**9**	**30**	**383**	**151**
Central	Valparaíso	5	13	6	24	405	227
	Metropolitana	6	11	8	25	901	303
	O'Higgins	2	9	10	21	223	120
	Maule	3	8	9	20	195	94
	TOTAL	**16**	**41**	**33**	**90**	**1724**	**744**
South	Ñuble	1	6	1	8	71	47
	Biobío	4	16	5	25	315	154
	La Araucanía	1	15	5	21	175	101
	Los Ríos	1	6	3	10	78	50
	Los Lagos	2	10	4	16	145	110
	TOTAL	**9**	**53**	**18**	**80**	**784**	**462**
Far south	Aysén	0	2	0	2	16	12
	Magallanes	1	1	1	3	35	20
	TOTAL	**1**	**3**	**1**	**5**	**51**	**32**
NATIONAL TOTAL		**34**	**110**	**61**	**205**	**2942**	**1389**

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

In total, the regions with the highest number of urban clusters (sum of classes 30, 23, and 22) are the Metropolitan Region and Biobío Region, followed by the Valparaíso Region. The highest concentration of urban centers (class 30) is found in these same regions, which are home to the country's largest conurbations. Dense urban clusters (23) and semi-dense urban clusters (22) vary in their distribution: most of the settlements classified into classes 22 and 23 are in the regions of Biobío (21 settlements), La Araucanía (20 settlements), and Valparaíso (19 settlements). This result may indicate that the population is also concentrated (or mostly concentrated) in smaller and less dense urban centers in these regions.

Compared to the number of urban areas according to the national classification (INE)[15], the number of urban settlements according to DEGURBA is less similar in the central-southern part of the country (Graph 1), and it tends to narrow its margin at the extremes. The difference is due to the greater number of urban centers in the town category according to INE, which does not reach the minimum population to be called an urban area according to DEGURBA.

Graph 1: Distribution of urban clusters from north to south (classes 30, 23 and 22) according to DEGURBA and the national classification (INE).



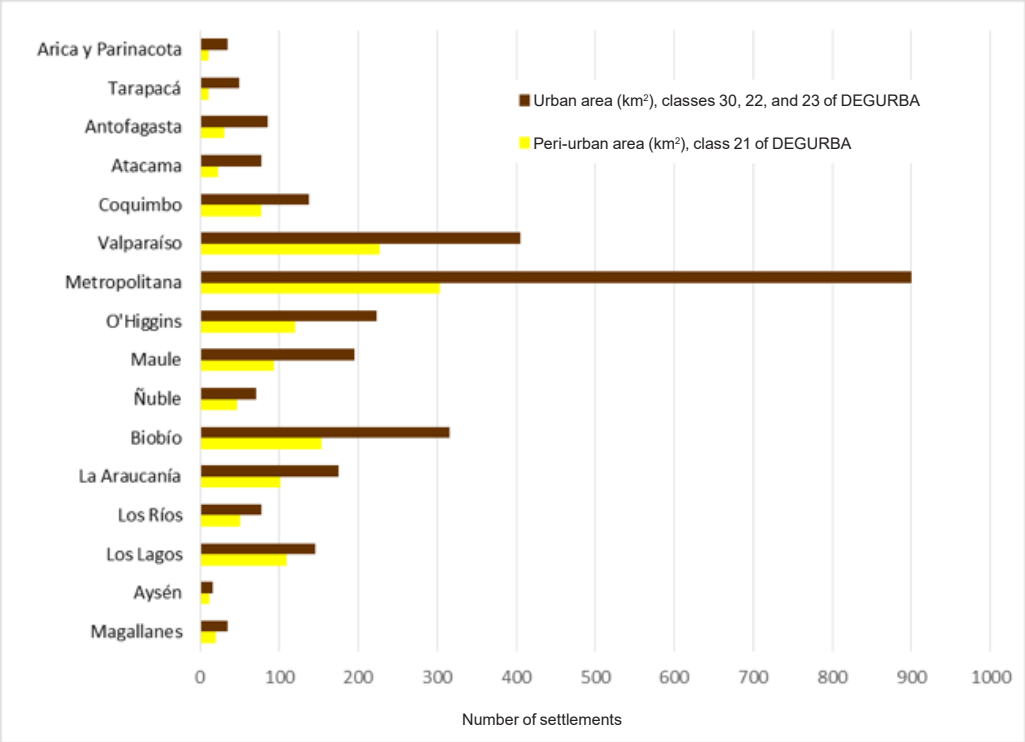
Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

The largest areas of urban clusters (classes 30, 23, and 22) identified are concentrated in the central macro-zone of the country, as shown in Table 1 and in Graph 2. The regions of Biobío, La Araucanía, and Los Lagos have the most surface area in the southern macro-zone, as opposed to regions such as Ñuble and Los Ríos, where, according to DEGURBA, urban areas are less extensive.

15) To calculate the number of urban areas according to the national classification, each conurbation is considered as a single urban area in order to obtain greater similarity to the logic of DEGURBA methodology. The remaining urban areas are considered individually. In Chile, a total of 559 urban areas were identified in the 2017 Census; when applying the filter just described, this number decreases to 495.

With respect to the surface area of peri-urban/suburban areas (class 21), a class that does not consist of clusters but generally does indicate a transition from urban centers to rural areas, there is a certain correspondence between the surface area of class 21 and the surface area of urban clusters, despite class 21 always having less area than classes 30, 22, and 23. The largest surface area of both class 21 and urban clusters can be found in the Metropolitan, Biobío, and Los Lagos Regions. In the Los Lagos Region, the surface area of peri-urban/suburban areas is practically equal to the total surface area of level 2, classes 30, 23, and 22 of DEGURBA.

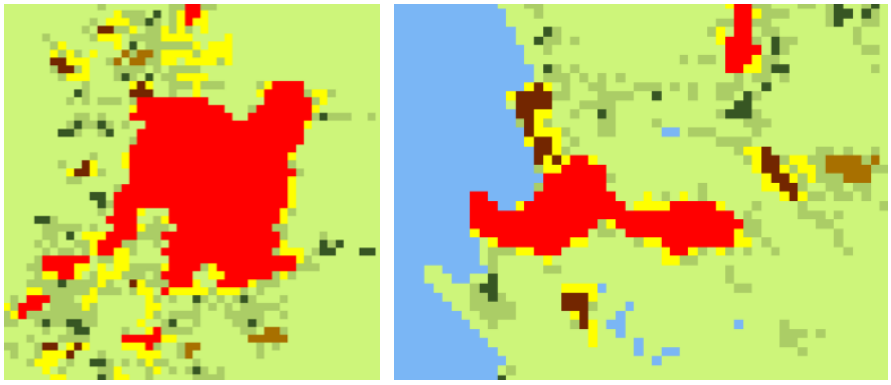
Graph 2: Distribution of surface area in square kilometers of urban areas (DEGURBA Level 2 classes 30, 23 and 22) and peri-urban areas (DEGURBA Level 2 class 21) by region and counted according to the results of DEGURBA one-square-kilometer grid.



Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

Figure 8 shows the geographical distribution of class 21 (suburban/peri-urban) around Greater Santiago, which is located in the Metropolitan Region (in yellow, image on the left), and the conurbation of Greater Valparaíso, which belongs to the Valparaíso Region (in yellow, image on the right).

Figure 8: Distribution of the peri-urban area (DEGURBA, level 2, class 21) around Greater Santiago (left) and Greater Valparaíso (right).



Symbols used for DEGURBA level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, INE 2023.

The satellite image of Greater Santiago shows a large presence of subdivided plots in areas identified as peri-urban/suburban according to DEGURBA (Figure 9), which is not necessarily the case in other urban areas of the country. In this case, the subdivided plots of this metropolitan area are located closer to one another, which results in a higher density. In the rest of the country, subdivided plots do not meet the necessary characteristics (density and population threshold) to be categorized as part of DEGURBA, class 21, despite their relative proximity to the cities (INE; Instituto de Estudios Urbanos y territoriales de la Pontificia Universidad Católica de Chile, 2020).

Figure 9: Example of distribution of subdivided plots of land in the Colina commune, Metropolitan Region.

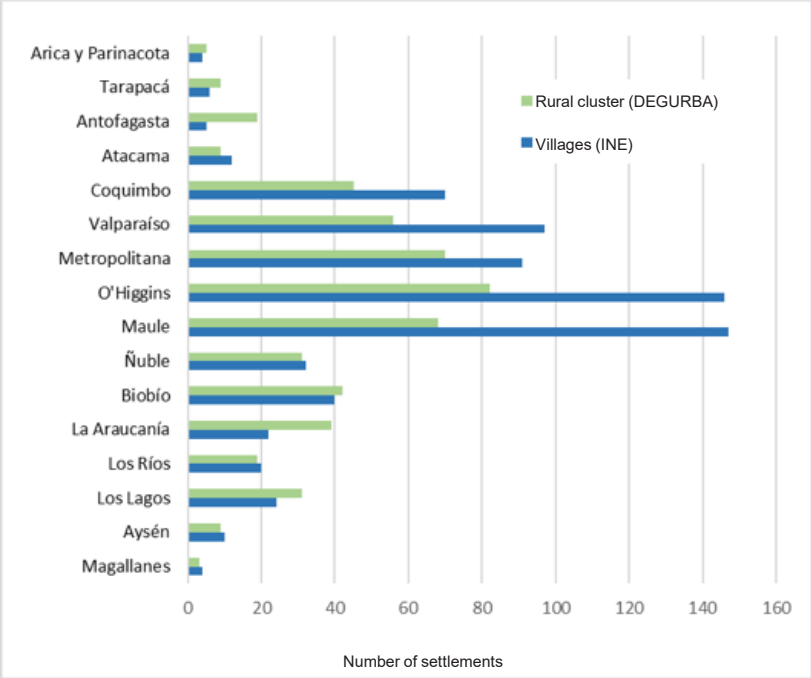
Source: Image extracted from Google Earth, 2022.

Overall results focused on rural clusters in the rural area

With the results associated with the rural area according to level 2 of DEGURBA, intermediate or transitional areas can be recognized and validated, thus moving away from the dichotomous definition of urban and rural used by INE. Of particular interest is the analysis of the rural entity category of village. Because it can be assimilated to class 13 of DEGURBA (rural clusters), it is defined as a concentrated rural area in the national classification.

In total, there are more villages than rural clusters according to DEGURBA classification (Graph 3), and both classifications are concentrated in the center of the country.

Graph 3: Distribution from north to south of the national classification category of village (Aldeas) and class 13 of DEGURBA (rural clusters).



Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

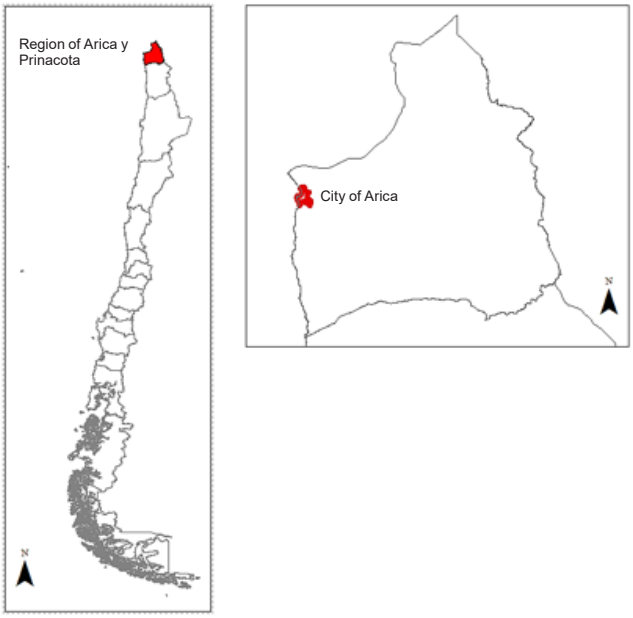
Case studies

Below are some of the results of the application of DEGURBA methodology within the framework of the pilot study. These examples were analyzed in terms of the behavior of the classification of grid cells in comparison with the urban census boundary (UCB) as defined by national classification and in terms of the distribution of the results in some rural areas.

- **Case studies in the Region of Arica y Parinacota**

Arica y Parinacota is the northernmost region of the national territory (Figure 10). It borders Peru to the north, Bolivia to the east, the Tarapacá Region to the south, and the Pacific Ocean to the west (INE, 2007). The region can be divided into four basic forms of topography: (1) narrow coastal or coastal plain (2 km wide), except for the area around the city of Arica; (2) coastal scarp, which is steep on the coastline south of the city of Arica; (3) coastal mountain range, intermediate depression, which forms an extensive plain in altitudes between 500 and 2,000 meters; and (4) the Tarapacá plateau and the Andes Mountain Range. The region's climate is mainly desert with some exceptions (INE, 2007); its hydrography, characterized by a precarious water availability, allows for agricultural activity in oases in some areas of the intermediate depression, as is the case in the Azapa Valley.

Figure 10: Location of the region of Arica and Parinacota and of the city of Arica.

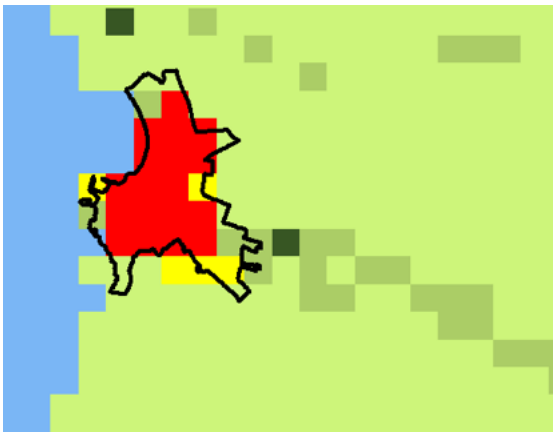


Source: Own elaboration, INE 2023.

a. The city of **Arica**, located on the coastal plain (Figure 10), is characterized by a desert climate (INE, 2007). The population is concentrated in the urban area according to the results of the 2017 Census, and the city of Arica has the largest population in the region (INE, 2019). This concentration follows the trend of urban areas at the extremes of the country, where the natural characteristics lead to the concentration of the population in the regional capitals (INE, 2019).

DEGURBA methodology defines the city of Arica as a highly concentrated urban center (class 30) that is surrounded by cells classified as rural areas of very low density and mostly uninhabited (class 11), with the exception of its extension towards the Azapa valley (Figure 11). A comparison of the distribution of these results with the UCB (represented by the continuous black line) shows some agreement with class 30, level 2 of DEGURBA (67.20% of the UCB area covered by the international definition). If class 21 (peri-urban/suburban) is included, the area covered by DEGURBA reaches 78.71% of the surface area according to the national classification.

Figure 11: Comparison of the urban census boundary (in black) with the result of the application of DEGURBA methodology in the urban area of Arica.



Symbols used for DEGURBA level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

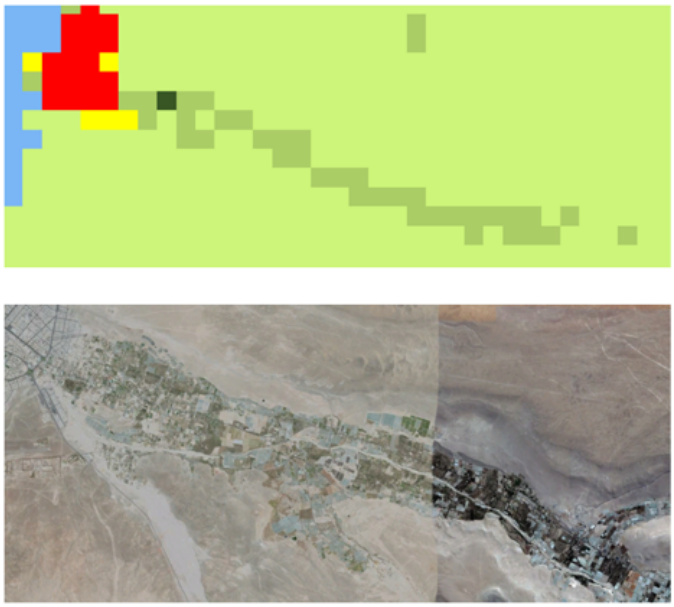
Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

b. The **Azapa valley** extends to the east of the urban center of Arica and around the Azapa ravine, creating an oasis for agricultural activity (INE, 2007).

Figure 12 (top) shows the result of the application of DEGURBA methodology in the Azapa valley and Arica, with cells classified as dispersed rural areas (class 12) and rural clusters (class 13), in contrast with extensive areas of class 11 (mostly uninhabited areas). Figure 12 (bottom) shows the characteristic plot-like growth of the area.

The results of the application of DEGURBA methodology around the Azapa Valley correspond to observations on the ground because the region is mostly desert and thus the population is mainly concentrated in oases or urban centers.

Figure 12: Distribution of DEGURBA classes in the Azapa valley, commune of Arica (upper image); satellite image of the Azapa valley, commune of Arica (lower image).



Symbols used for DEGURBA level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

- **Case studies in the Region of O'Higgins**

This region (Figure 13) is located immediately south of the Metropolitan and Valparaíso Regions and north of the Maule Region. The O'Higgins Region is bordered by the Andes Mountains and Argentina to the east and by the Pacific Ocean to the west (INE, 2007). Its topography is characterized by the four traditional forms of the country: coastal plains, coastal mountain range, the Rancagua basin, the intermediate depression, and the Andes. Its climate is mostly warm-temperate, with Mediterranean characteristics and winter rain (INE, 2007).

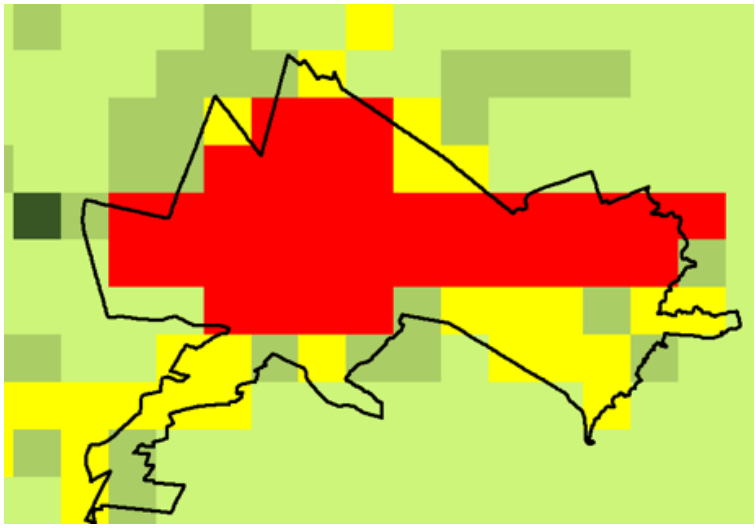
Figure 13: Location of the region of O'Higgins and the city of Rancagua.

Source: Own elaboration, INE 2023.

a. The **city of Rancagua** (Figure 13) is located less than 90 kilometers south of Santiago. It is connected to the country's capital by road and train. According to the 2017 Census, the urban area with the largest population actually enumerated in the region is Rancagua (231,370 persons), a figure that increases when considering its conurbations: Gultro, Los Lirios, and Machalí (INE, 2019).

When comparing the results of the application of DEGURBA methodology with the urban census boundary (Figure 14), the delimitation according to the national classification includes cells classified as urban centers according to DEGURBA (class 30) and peri-urban/suburban areas (class 21).

Figure 14: Application of DEGURBA methodology in the urban area of Rancagua.



Symbols used for DEGURBA level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, INE 2023.

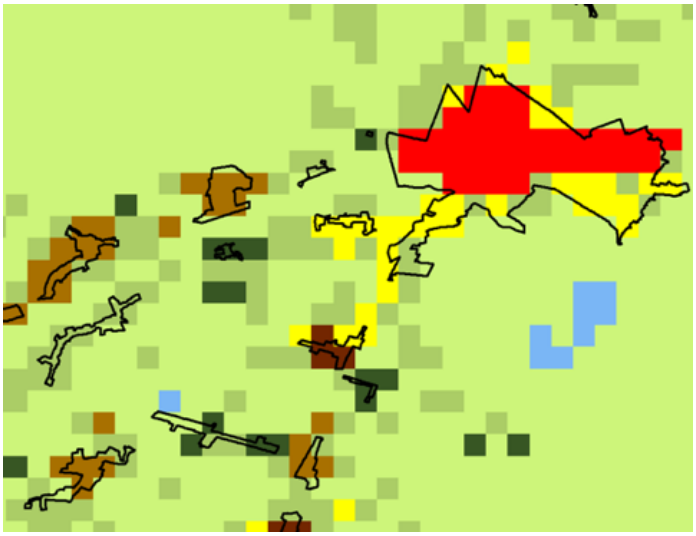
Figure 15 shows a satellite image of an example of an area classified as class 21, level 2 of DEGURBA (suburban/peri-urban).

Figure 15: Suburban/peri-urban area according to DEGURBA methodology (class 21, level 2) within the urban area and according to the national classification.

Source: Google Earth, 2022.

b. Urban areas around the **city of Rancagua**: Around the city of Rancagua and its conurbation (Figure 16) are a series of smaller urban areas according to the national classification. These areas are classified by DEGURBA as mostly semi-dense urban clusters (class 22), the next most common classification is urban clusters (class 23), while some contiguous areas are classified as rural clusters and low-density rural grid cells (class 13 and 12).

Figure 16: Results of the application of DEGURBA methodology in Rancagua and the surrounding area.



Symbols used for DEGURBA level 2

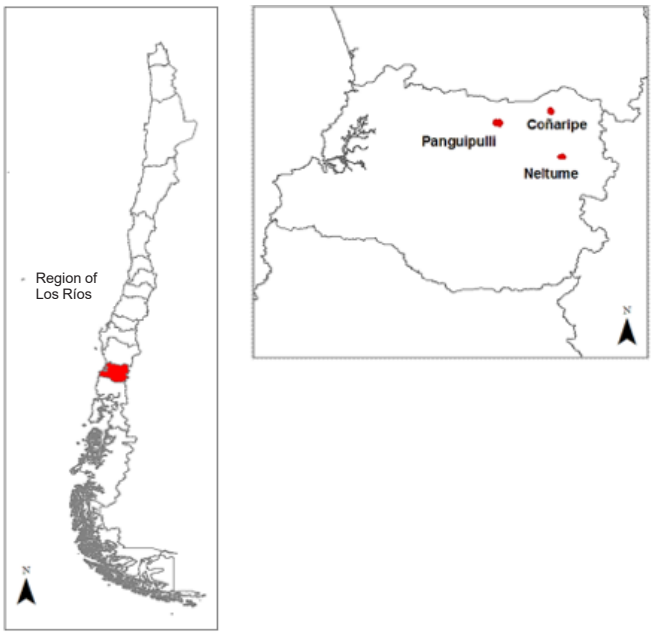
Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

- **Case study in the Region of Los Ríos**

This region is located to the south of the Araucanía Region and to the north of the Los Lagos Region (Figure 17). From the geographical point of view, the Los Ríos Region is characterized by the great presence of riverbeds, lakes, and precipitation. Four morphological units can be distinguished: coastal plains, coastal mountain range, the intermediate depression, and the volcanic Andean mountain range (INE, 2007). The most populated urban area is Valdivia, the regional capital (INE, 2019).

Figure 17: Location of the Region of Los Ríos and the urban areas (according to national classification) of Panguipulli, Coñaripe, and Neltume.



Source: Own elaboration, INE 2023.

a. **Urban areas of Panguipulli, Neltume, and Coñaripe** (Figure 18): only the urban center of Panguipulli is considered an urban area by DEGURBA (dense urban cluster; class 23 of level 2). The other two urban areas are considered rural clusters (class 13 of level 2), mainly because they do not meet the minimum population threshold to be considered urban clusters according to DEGURBA methodology. A higher concentration can be found around Lake Calafquén, which is represented by areas classified as low-density rural grid cells (class 12).

Figure 18: Results of the application of DEGURBA methodology around urban areas and according to national classification: Panguipulli, Neltume, and Coñaripe.

Symbols used for DEGURBA level 2

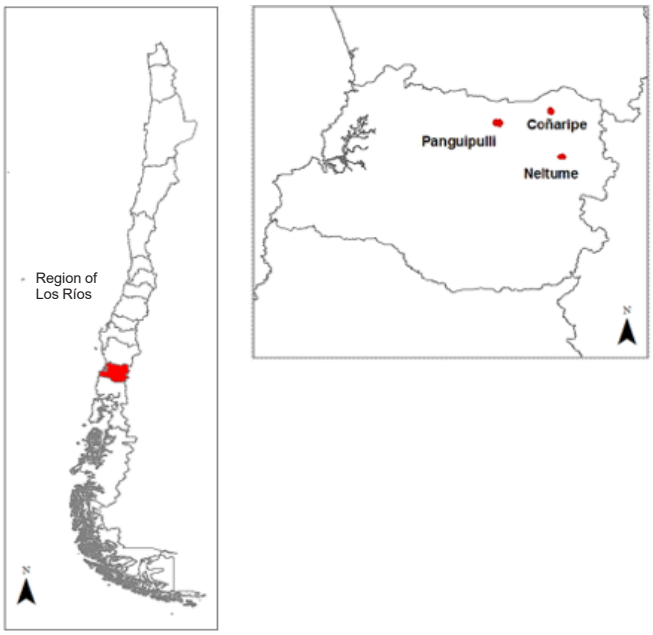
	Urban		Rural
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

- **Case study in the Region of Magallanes y de la Antártica Chilena**

This region is the southernmost of Chile, and it is also the largest in area (Figure 19). The population is concentrated in the east and in urban centers connected to the sea. The sparse rural population is distributed over extensive areas, which are mainly used for livestock farming (INE, 2007). The regional territory is characterized by low average temperatures, extensive archipelagos, and pampas.

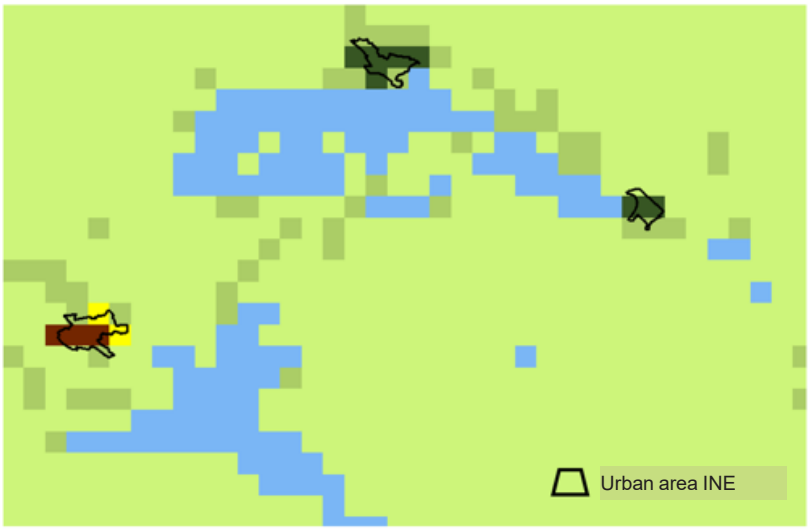
Figure 19: Location of the Region of Magallanes y de la Antártica Chilena and the city of Punta Arenas.



Source: Own elaboration, INE 2023.

a. **The city of Punta Arenas** (Figure 19) is the main urban center of the Region of Magallanes y de la Antártica Chilena. The application of DEGURBA methodology shows an area with a significant concentration of population (Figure 20) in an environment classified as mostly uninhabited and of dispersed rural density (classes 11 and 12). A comparison between the distribution of the cells compared and the urban census boundary (UCB) shows some coincidence of classes 30 and 21 (urban center and suburban/peri-urban area). Punta Arenas has the highest concentration of urban population, as occurs in the extreme regions of the country (such as in the city of Arica), in contrast to the central regions.

Figure 20: Results of the application of DEGURBA methodology in Punta Arenas.



Symbols used for DEGURBA level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

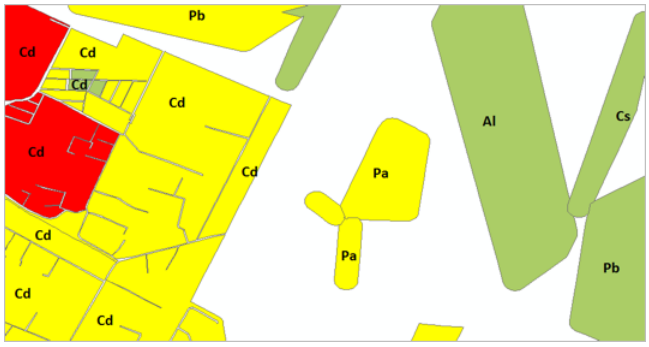
Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

2.2. Comparative analysis of the national classification and the DEGURBA methodology

The analysis compares the distribution of the population assigned by the national classification at the urban and rural level (as reported in the 2017 Census) and the results of level 1 of DEGURBA methodology and then to the results of level 2 in order to identify and evaluate nuances in the territory that may be difficult to capture in the dichotomous urban and rural definition of the national classification.

In both analyses, and in the demographic analysis presented below, the classification of the processed territorial units is addressed according to DEGURBA methodology. An example of the distribution of **territorial units** by DEGURBA class is shown in Figure 21.

Figure 21: Example of equivalence in DEGURBA, level 2 cartography compared to entity categories of the national classification



Symbols used for DEGURBA level 2

	Urban		Rural
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, INE 2023.

The main input used in the analysis was the database generated by the processing phase, which is shown in Figure 21 and schematized in Table 4. Each MANZENT code represents a territorial unit in the processing, either urban block or rural entity, which were assigned an urban or rural category according to the corresponding definition of the national classification and based on information from the 2017 Census. In contrast, DEGURBA methodology classifies territorial units according to its own definitions into classes for both level 1 and level 2.

Table 4: Example of fictitious cases of equivalence in level 2 classes of DEGURBA compared to the entity categories of the national classification.

MANZENT of each territorial unit analyzed	National classification and categorization, according to the results of the 2017 Population and Housing Census.		Classes according to DEGURBA methodology	
	National classification	INE 2017 entity category	Level 1	level 2
12101011001001	Urban	City	2	21
12101011001004	Urban	City	3	30
12101011001006	Urban	Town	3	30
12303012012061	Rural	Village	2	21
12303012013062	Rural	Village	2	23
12303012013063	Rural	Subdivided plots	1	11
12303012013064	Rural	Village	1	11

Source: Own elaboration, INE 2023.

Using these territorial units, conclusions can be drawn about the demography, the distribution of categories into urban and rural areas, the availability of services, and even the quality and construction materials of housing in each of the classes of DEGURBA methodology.

Comparison with level 1 of DEGURBA methodology

The results provide a snapshot of the comparison between the two methodologies, showing high levels of coincidence between the classifications. Table 2 shows the coincidence between the national classification and DEGURBA methodology: 66.41% of the people in urban areas at the national level are classified in the high-density cluster and 17.67% in the moderate-density cluster; consequently, it can be stated that 84.07% of the national population are classified as urban population by both methods[16]. On the other hand, low-density grid cells show a coincidence of 11.16% with the rural area of the national classification.

However, the national classification based on the 2017 Census would classify a higher level of population as residing in urban areas (87.71%) than the corresponding population observed in DEGURBA methodology (85.21%)[17], which represents a difference of 2.5% of the national population.

Table 2: National level population coincidence matrix according to DEGURBA methodology and national classification, based on the 2017 Population and Housing Census (number and percentage of population).

DEGURBA classification Level 1		National classification					
		Rural	Urban	NATIONAL TOTAL	Rural(%)	Urban(%)	NATIONAL TOTAL
3	High-density cluster	16,769	11,609,659	11,626,428	0.10	66.41	66.5
2	Moderate-density cluster	181,417	3,088,380	3,269,797	1.04	17.67	18.7
1	Low-density grid cells	1,950,669	635,782	2,586,451	11.16	3.64	14.79
NATIONAL TOTAL		**2,148,855**	**15,333,821**	**17,482,676**	**12.29**	**87.71**	**100**

Source: Own elaboration, based on the results of the 2017 Population and Housing Census and DEGURBA methodology, INE 2023.

Regarding the distribution of the population by region and commune of the country, Table 3 shows that, based on the percentage difference between both classifications, the Metropolitan Region (-0.25%) as well as the Regions of Antofagasta (1.87%), Tarapacá (1.74%), Arica y Parinacota (0.85%), and Magallanes (0.59%) show the greatest concordance in the allocation of population at the regional level in the urban area. In contrast, the largest percentage differences between the two classifications are in the Regions of Aysén (13.06%), Ñuble (9.52%), Maule (7.06%), and O'Higgins (6.18%), where the national classification assigns a higher proportion of the population to urban areas.

16) The urban population is the sum of the population in the urban areas according to the national classification as well as the population in high-density clusters (66.41%) and in moderate-density clusters, villages, and semi-dense areas (17.67%) according to DEGURBA methodology.

17) In DEGURBA methodology, this figure is the sum of the population who reside in high-density clusters (66.50%) and moderate-density clusters, villages, and semi-dense areas (18.70%).

Table 3: National level population according to DEGURBA methodology and national classification, based on the 2017 Population and Housing Census (percentage of population).

Region	National classification			DEGURBA classification, level 1					% difference in urban areas
				3	2	1		3 + 2	
	Rural	Urban	National Total	High-density cluster	Moderate-density cluster	Low-density grid cells	National Total	Urban	(National classification - DEGURBA classification, level 1)
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	
Arica y Parinacota	8.42	91.58	100	89.16	1.57	9.27	100	90.73	0.85
Tarapacá	6.15	93.85	100	88.54	3.57	7.9	100	92.1	1.74
Antofagasta	5.97	94.03	100	80.74	11.42	7.84	100	92.16	1.87
Atacama	9.02	90.98	100	44.82	43.83	11.35	100	88.65	2.33
Coquimbo	18.94	81.06	100	60.45	16.85	22.7	100	77.3	3.76
Valparaíso	9.04	90.96	100	61.11	27.24	11.65	100	88.35	2.61
Metropolitana	3.72	96.28	100	90.47	6.07	3.47	100	96.53	-0.25
O'Higgins	25.68	74.32	100	35.01	33.14	31.85	100	68.15	6.18
Maule	26.9	73.1	100	39.05	27	33.96	100	66.04	7.06
Ñuble	30.65	69.35	100	38.98	20.84	40.17	100	59.83	9.52
Biobío	11.48	88.52	100	55.44	29.1	15.45	100	84.55	3.98
La Araucanía	29.31	70.69	100	24.05	40.91	35.04	100	64.96	5.73
Los Ríos	28.52	71.48	100	35.12	32.99	31.89	100	68.11	3.36
Los Lagos	26.5	73.5	100	36.92	32.23	30.85	100	69.15	4.35
Aysén	20.58	79.42	100	0	66.36	33.64	100	66.36	13.06
Magallanes	8.13	91.87	100	72.6	18.68	8.72	100	91.28	0.59
National Total	**12.29**	**87.71**	**100**	**66.5**	**18.7**	**14.79**	**100**	**85.21**	**2.50**

Source: Own elaboration, based on the results of the 2017 Population and Housing Census and DEGURBA methodology, INE 2023.

When carefully observing the communes in different regions of the country, it will be noticed that there are some communes where DEGURBA methodology does not record population in the urban area, unlike the national classification based on the 2017 Census. In ninety-three of the 346 communes in the country, the percentage difference in the population classified as urban (high-density clusters and moderate-density clusters) fluctuates between 20% and 90% because DEGURBA methodology classifies the population mainly as rural (mostly low density cells). Extreme cases occur in the communes of Guaitecas and Cabo de Hornos of the Aysén and Magallanes Regions, respectively, where there is a 90% difference between the two classifications.

Similarly, DEGURBA methodology identifies the entire population as rural (class 1) in eighty-three communes, while the national classification identifies them mainly as urban and rural. An example of this situation is the Aysén Region, which has at least ten communes where DEGURBA methodology does not identify population in the urban area (high-density clusters and moderate-density clusters).

The differences described above are mainly due to the size of the settlements, especially their population. The extreme regions, especially in the extreme south, are characterized by small urban areas with low population density.

In contrast, in seven of the country's communes, DEGURBA methodology assigns a higher proportion of urban population compared to the national classification (5% or more), as can be seen in the commune of Calera de Tango, where DEGURBA methodology classifies 30% more of the population as mainly urban. This case is mainly explained by the density of the plots around the densest population centers, which makes it possible to classify them as urban areas.

Finally, ninety-nine communes show no differences, or the percentage difference is less than 1% between the two classifications. These communes are to a large extent densely populated urban centers such as regional capitals and the thirty-five communes of the Province of Santiago in the Metropolitan Region.

Comparison with level 2 of DEGURBA methodology

Regarding the comparative analysis between the categories of the national classification and DEGURBA methodology, level 2, four assumptions were made to guide the discussion. These assumptions were validated by contrasting the results with the population values by territorial unit of the 2017 Census.

1. The assumption that the population registered in the urban area of the city category according to the national classification would mainly be concentrated in classes 30 (urban centers) and 21 (suburban/peri-urban areas) of level 2 of DEGURBA methodology.
2. The assumption that the population registered in settlements categorized as towns according to the national classification would be mostly concentrated in low-density grid cells and to a lesser extent in classes 30, 23, 22, and 21, level 2 of DEGURBA because they do not meet the population thresholds.
3. The assumption that the population registered in settlements categorized as villages according to the national classification would be mainly concentrated in class 13 (rural clusters), level 2 of DEGURBA.
4. The assumption that the subdivided plots, because of their morphological characteristics in the national classification, would be mainly concentrated in class 12 (low-density grid cells), level 2 of DEGURBA.

Although there are other criteria for the definition of urban areas according to DEGURBA and the national classification (Table 2 and Table 3), **these assumptions considered the population thresholds only**. The distribution of the population (percentages) in each entity category versus the classes of DEGURBA level 2 was analyzed and compared at the regional level. The main objective was to evaluate the national classification of urban and rural and to identify nuances in the territory that may be difficult to capture in the dichotomous definition of urban and rural. These four assumptions are discussed in detail below.

1. **The assumption that the population registered in the urban area of the city category according to the national classification would mainly be concentrated in classes 30 (urban centers) and 21 (suburban/peri-urban areas) of level 2 of DEGURBA methodology.**

Graph 4 and Table 4 show that in all regions of the country the population belonging to the city category is mostly classified as a center or a dense-urban cluster according to level 2 of DEGURBA. In terms of population, DEGURBA methodology considers it starting with population of 5,000, which coincides with the definition of the category of city in the national classification. According to DEGURBA, all cities are essentially urban, either urban centers, dense-urban grid cells, or suburban/peri-urban grid cells. Depending on the remaining criteria of the methodology, they would, with minimal exceptions, be classified as belonging to another class.

Graph 4: Percentage distribution of the population in the city category according to the national classification, and in the different classes of level 2 of DEGURBA methodology[18].

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

18) The nomenclature for each class in this graph and subsequent graphs in this section is for the urban area: **"30 U-Center"** for the "Urban Center", **"23 U-ClusterDen"** for the "Dense Urban Clusters", **"22 U-ClusterSemiden"** for the "Semi-Dense Urban Clusters", and **"21 U-SubPeri"** for the "Suburban/Peri-urban" areas. The nomenclature for rural areas is as follows: **"13 R-Cluster"** for "Rural Clusters", **"12 R-DenLow"** for "Low Density Cells", and **"11 R-DenVeryLow"** for "Very Low Density Cells".

Table 4: Percentage distribution of the population in the city category according to the national classification, and in the different classes of level 2 of DEGURBA methodology.

Region	30 Urban center	23 Dense urban cluster	22 Semi-dense urban clusters	21 Suburban/ peri-urban	13 Rural clusters	12 Low-density grid cells	11 Very low-density grid cells	Total
	%	%	%	%	%	%	%	%
Arica y Parinacota	98.66	0.00	0.00	1.11	0.00	0.21	0.02	100.00
Tarapacá	95.89	2.97	0.00	0.89	0.00	0.22	0.03	100.00
Antofagasta	86.74	6.81	0.92	4.34	0.76	0.39	0.03	100.00
Atacama	50.38	32.67	11.79	4.36	0.00	0.78	0.02	100.00
Coquimbo	78.27	9.56	4.12	6.69	0.88	0.47	0.01	100.00
Valparaíso	69.17	16.49	4.73	8.42	0.33	0.83	0.03	100.00
Metropolitana	95.02	2.50	0.56	1.73	0.06	0.13	0.00	100.00
O'Higgins	53.47	23.60	11.38	9.50	0.95	1.08	0.01	100.00
Maule	59.58	23.06	9.78	6.36	0.71	0.50	0.01	100.00
Ñuble	65.22	22.96	3.62	7.12	0.00	1.06	0.03	100.00
Biobío	65.46	24.72	3.54	5.61	0.34	0.32	0.01	100.00
La Araucanía	37.90	45.86	7.65	8.19	0.00	0.40	0.00	100.00
Los Ríos	53.45	27.47	6.14	11.68	0.00	1.24	0.01	100.00
Los Lagos	54.82	31.27	4.85	8.37	0.09	0.58	0.03	100.00
Aysén	0.00	89.72	0.00	10.18	0.00	0.08	0.02	100.00
Magallanes	80.00	10.67	3.87	5.03	0.00	0.43	0.00	100.00

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

In most of the country's regions, more than 50% of the population that the national classification defined as belonging to a city was classified as an urban center using DEGURBA methodology. The exceptions are the Regions of La Araucanía (37.9%) and Aysén, which has no urban centers.

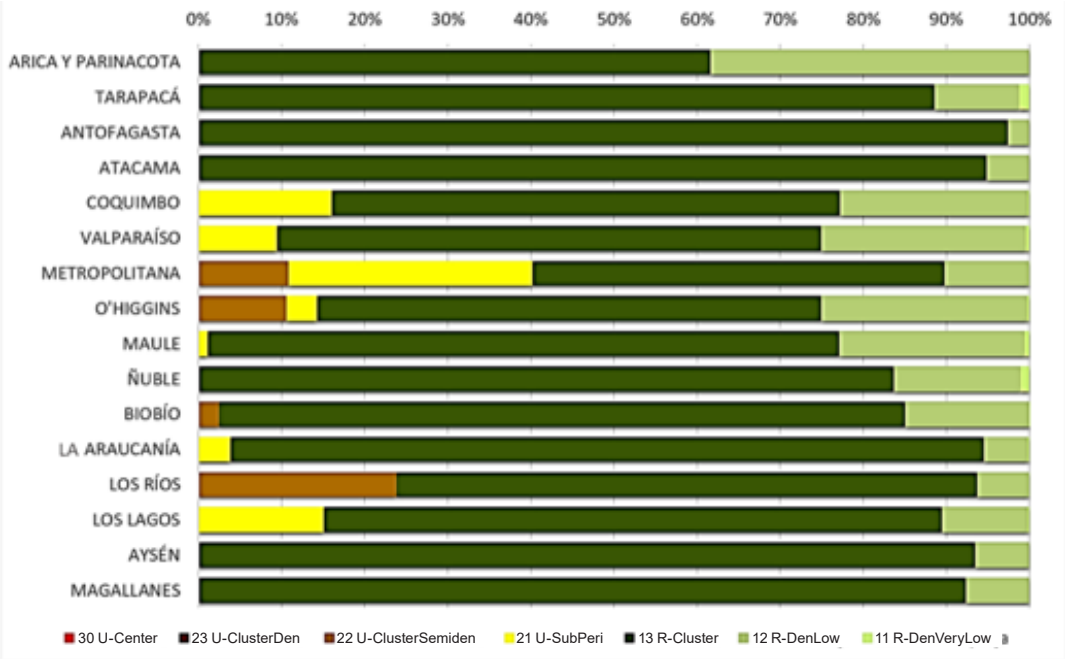
The majority of the population that is not classified as belonging to an urban center is concentrated in dense urban clusters, especially in the Araucanía Region, where the weight of class 23 (45.86%) is greater than the weight of class 30, and in Aysén, where almost the entire population (89.72%) is concentrated in dense urban areas. Finally, the semi-dense urban cluster and the suburban/peri-urban area of DEGURBA have a lower representation within the distribution of the population categorized as city in the national classification.

Therefore, the sum of the population of the areas classified as urban centers and suburban/ peri-urban areas represent the highest percentages of all categories, coinciding to a large extent with the percentages found in the national classification.

2. **The assumption that the population registered in settlements categorized as towns according to the national classification would be mostly concentrated in low-density grid cells and to a lesser extent in classes 30, 23, 22, and 21, level 2 of DEGURBA because they do not meet the population thresholds.**

Graph 5 shows the distribution of the population of the town category in the different classes of level 2 of DEGURBA methodology. A first glance shows a majority concentration of the population in the rural cluster in all regions. However, a closer look and an analysis of Table 5 shows a slightly different tendency in the Metropolitan Region, which has a high percentage of population in the suburban/peri-urban area (29.41%), even though the concentration in rural clusters continues to be predominant (49.57%). One of the reasons for this tendency is the proximity between the multiple urban centers in the region, which causes the territorial units to be identified as remnants of urban clusters and not as independent units. However, a previously unconsidered factor cannot be disregarded, which is that the size of the grid may not capture the details of the distribution of smaller-scale units.

Graph 5: Percentage distribution of the population in the town category according to the national classification and in the different classes of level 2 of DEGURBA methodology.



Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

Table 5: Percentage distribution of the population in the town category according to the national classification and in the different classes of level 2 of DEGURBA methodology.

Region	30 Urban center	23 Dense urban cluster	22 Semi-dense urban clusters	21 Suburban/ peri-urban	13 Rural clusters	12 Low-density grid cells	11 Very low-density grid cells	Total
	%	%	%	%	%	%	%	%
Arica y Parinacota	0.00	0.00	0.00	0.00	61.65	38.35	0.00	100.00
Tarapacá	0.00	0.00	0.00	0.00	88.56	10.25	1.19	100.00
Antofagasta	0.00	0.00	0.00	0.00	97.42	2.58	0.00	100.00
Atacama	0.00	0.00	0.00	0.00	94.82	5.18	0.00	100.00
Coquimbo	0.00	0.00	0.00	16.02	61.19	22.60	0.19	100.00
Valparaíso	0.04	0.00	0.00	9.44	65.44	24.64	0.43	100.00
Metropolitana	0.00	0.00	10.80	29.41	49.57	10.12	0.10	100.00
O'Higgins	0.00	0.00	10.60	3.70	60.66	24.79	0.26	100.00
Maule	0.00	0.00	0.00	1.11	76.01	22.32	0.56	100.00
Ñuble	0.00	0.00	0.00	0.00	83.72	15.20	1.08	100.00
Biobío	0.00	0.00	2.49	0.00	82.57	14.90	0.05	100.00
La Araucanía	0.00	0.00	0.00	3.83	90.68	5.35	0.14	100.00
Los Ríos	0.00	0.00	23.86	0.00	69.83	6.18	0.13	100.00
Los Lagos	0.00	0.00	0.00	15.07	74.38	10.39	0.16	100.00
Aysén	0.00	0.00	0.00	0.00	93.45	6.55	0.00	100.00
Magallanes	0.00	0.00	0.00	0.00	92.34	7.66	0.00	100.00

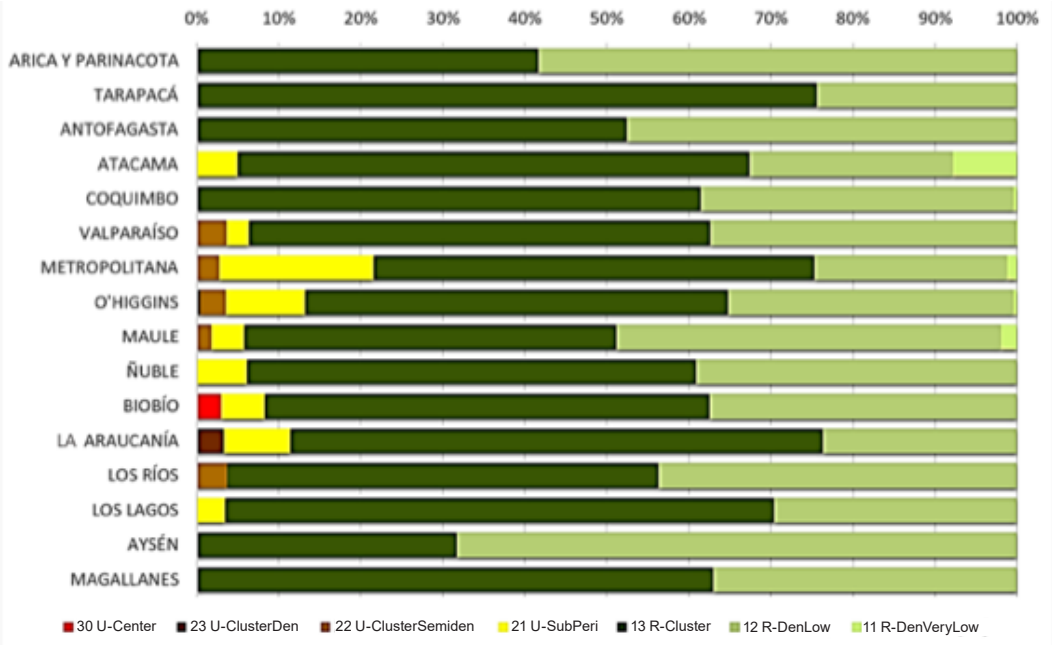
Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

3. The assumption that the population registered in settlements categorized as villages according to the national classification would be mainly concentrated in class 13 (rural clusters), level 2 of DEGURBA.

Graph 6 and Table 6 show the regional distribution of the population belonging to villages according to each of the classes of level 2 of DEGURBA methodology. Unlike what was observed in the previous assumptions, where the preponderance of one of the classes over the others is clearly evident, in this case the distribution of the population tends to be centered between the rural cluster and the low-density grid cell, the former concentrating most of the population in practically all the regions of the country. Only in Arica and Parinacota (58.35%), Maule (slightly higher at 46.88%), and Aysén (68.27%) is the percentage of population classified as part of the low-density area greater than the population classified as living in rural clusters. These differences might be explained by the size of the settlements that are not included in the one-square-kilometer grid and the greater or lesser distance of rural settlements from a larger urban center, where, for the same reason, a village might be considered as part of the urban center or independently within the territory.

In addition, the Metropolitan Region has a greater presence of suburban/peri-urban areas (18.76%) compared to the rest of the regions, while the Biobío Region is the only region that includes population in urban centers, although a minimal percentage.

Graph 6: Percentage distribution of the population in the village category according to the national classification and in the different classes of level 2 of DEGURBA methodology.



Source: Own elaboration, INE 2023.

Table 6 : Percentage distribution of the population in the village category according to the national classification and in the different classes of level 2 of DEGURBA methodology.

Región	30 Urban center	23 Dense urban cluster	22 Semi-dense urban clusters	21 Suburban/ peri-urban	13 Rural clusters	12 Low-density grid cells	11 Very low-density grid cells	Total
	%	%	%	%	%	%	%	%
Arica y Parinacota	0.00	0.00	0.00	0.00	41.65	58.35	0.00	100.00
Tarapacá	0.00	0.00	0.00	0.00	75.64	24.36	0.00	100.00
Antofagasta	0.00	0.00	0.00	0.00	52.49	47.51	0.00	100.00
Atacama	0.00	0.00	0.00	5.04	62.38	24.80	7.79	100.00
Coquimbo	0.00	0.00	0.00	0.00	61.45	38.12	0.43	100.00
Valparaíso	0.00	0.00	3.64	2.75	56.23	37.38	0.00	100.00
Metropolitana	0.00	0.00	2.80	18.76	53.71	23.48	1.25	100.00
O'Higgins	0.00	0.45	3.12	9.69	51.47	34.87	0.40	100.00
Maule	0.00	0.00	1.79	4.02	45.37	46.88	1.94	100.00
Ñuble	0.00	0.00	0.00	6.12	54.82	39.07	0.00	100.00
Biobío	3.01	0.00	0.00	5.33	54.17	37.48	0.00	100.00
La Araucanía	0.00	3.36	0.00	8.12	64.89	23.62	0.00	100.00
Los Ríos	0.00	0.00	3.73	0.00	52.62	43.65	0.00	100.00
Los Lagos	0.00	0.00	0.00	3.51	66.91	29.58	0.00	100.00
Aysén	0.00	0.00	0.00	0.00	31.73	68.27	0.00	100.00
Magallanes	0.00	0.00	0.00	0.00	62.98	37.02	0.00	100.00

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

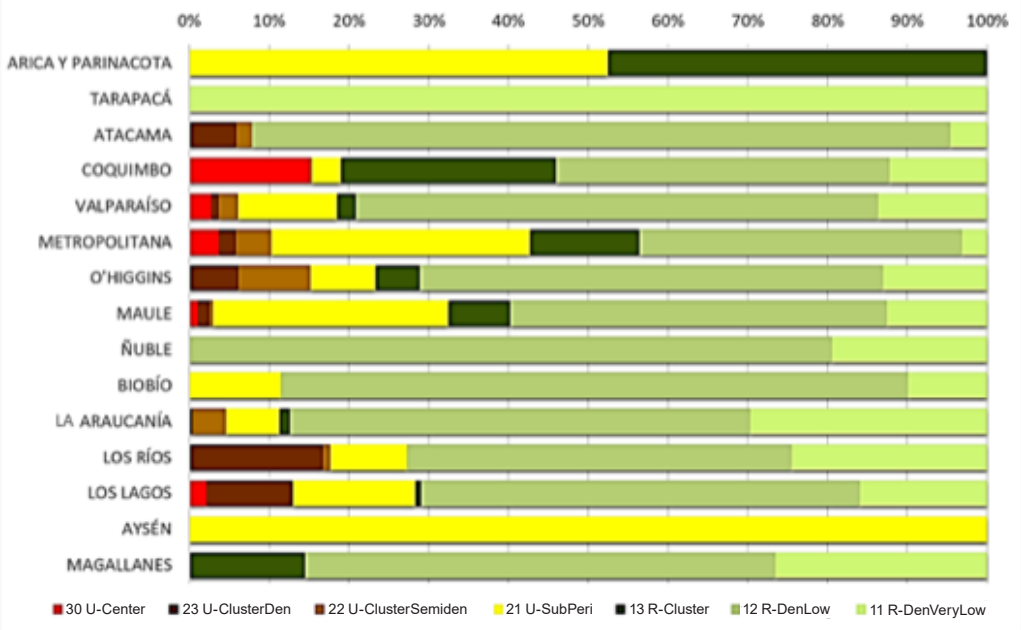
4. The assumption that the subdivided plots, because of their morphological characteristics in the national classification, would be mainly concentrated in class 12 (low-density grid cells), level 2 of DEGURBA

The regional distribution of the population belonging to subdivided plots according to level 2 classes can be seen in Graph 7 and Table 7. In this case, the population in most of the regions presents a heterogeneous distribution with respect to DEGURBA classification, unlike what was observed in the previous national categories (city, town, and village). Subdivided plots cannot be associated exclusively with one or two of the level 2 classes, because of the significant distinctions among regions of the country. However, at a general level, it can be seen that subdivided plots are mainly classified as low-density areas (class 12), the class that predominates in most of the country's regions. On the other hand, subdivided plots in the Valparaíso, Metropolitan, and Maule Regions are all classified as level 2 classes, especially as suburban/peri-urban areas.

A special case is the Aysén Region that, according to DEGURBA methodology, concentrates its entire population in suburban/peri-urban areas, presumably to access services offered only in the main cities. Finally, the population distribution in the Regions of Tarapacá, Ñuble, and Magallanes is exclusively in low- and very low-density areas (classes 12 and 11).

This tendency demonstrates that, with some exceptions, subdivided plots are associated with the dispersed rural area of DEGURBA level 2. The exceptions are due to a combination of higher population density and proximity to urban centers, as is the case in the Metropolitan, Maule, and Arica and Parinacota Regions, where subdivided plots have a significant presence in the suburban/peri-urban area of DEGURBA methodology (INE; Instituto de Estudios Urbanos y territoriales de la Pontificia Universidad Católica de Chile, 2020).

Graph 7: Percentage distribution of the population in the subdivided plot category according to the national classification, and in the different classes of level 2 of DEGURBA methodology.



Source: Own elaboration, INE 2023.

Table 7 : Percentage distribution of the population in the subdivided plot category according to the national classification and according to the classes of level 2 of DEGURBA methodology.

Región	30 Urban center	23 Dense urban cluster	22 Semi-dense urban clusters	21 Suburban/ peri-urban	13 Rural clusters	12 Low-density grid cells	11 Very low-density grid cells	Total
	%	%	%	%	%	%	%	%
Arica y Parinacota	0.00	0.00	0.00	52.51	47.49	0.00	0.00	100.00
Tarapacá	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00
Antofagasta	0.00	5.92	1.97	0.00	0.00	87.50	4.61	100.00
Atacama	15.15	0.00	0.17	3.70	26.95	41.87	12.17	100.00
Coquimbo	2.77	0.88	2.46	12.39	2.35	65.51	13.62	100.00
Valparaíso	3.67	2.21	4.38	32.42	13.75	40.44	3.13	100.00
Metropolitana	0.00	6.16	9.00	8.20	5.51	58.10	13.02	100.00
O'Higgins	1.04	1.51	0.45	29.47	7.78	47.23	12.52	100.00
Maule	0,00	0,00	0,00	0,00	0,00	80,55	19,45	100,00
Ñuble	0.00	0.00	0.00	0.00	0.00	80.55	19.45	100.00
Biobío	0.00	0.00	0.00	11.49	0.00	78.61	9.90	100.00
La Araucanía	0.00	0.44	4.13	6.77	1.25	57.71	29.70	100.00
Los Ríos	0.00	16.77	0.87	9.69	0.00	48.16	24.51	100.00
Los Lagos	2.17	10.85	0.00	15.29	0.78	54.98	15.92	100.00
Aysén	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00
Magallanes	0.00	0.00	0.00	0.00	14.55	58.94	26.50	100.00

Source: Own elaboration, based on results of the application of DEGURBA methodology, INE 2023.

2.3. Demographic analysis of the application of DEGURBA methodology in Chile

In addition to the comparison with the national geographical classification, demographic comparisons were made in terms of population composition. The main objective was to analyze the sex and age distribution of the population within each of the resulting classes at the national level[19]. The observation of intermediate or transitional classes sought to determine the similarities and differences between the national definition of urban-rural and the classes according to levels 1 and 2 of DEGURBA methodology in order to carry out a more detailed characterization.

The analysis was organized around two main inputs. First, the percentage distribution by sex and five-year age groups according to the different classifications was presented for each case, in order to visualize the general distribution of the population and facilitate comparison of results. Second, the demographic structure was presented through population pyramids by simple ages up to the final open group of 100 years and over[20].

19) As in the previous section, the base input for this analysis is the classification of territorial units (according to the workflow indicated in Figure 2), from which information has been extracted from the 2017 Census.

20) The creation of population pyramids through simple ages enables an enriched visualization of the demographic structure.

2 Chapter

Demographic characteristics resulting from the 2017 Population and Housing Census.

The population structure by sex and age of the country is shown below, as a point of comparison for the evaluation of results obtained through DEGURBA methodology. Table 8 shows the distribution by sex and five-year age bracket resulting from the 2017 Census for urban areas, rural areas, and the national total.

Table 8 : Percentage distribution of the population by sex, five-year age bracket, and urban-rural classification, according to the 2017 Population and Housing Census.

Five-year age bracket	Urban			Rural			NATIONAL TOTAL		
	Male (%)	Female (%)	Total per range (%)	Male (%)	Female (%)	Total per range (%)	Male (%)	Female (%)	Total per range (%)
0 - 4	7.09	6.40	6.73	5.84	6.25	6.04	6.92	6.38	6.65
5 - 9	7.33	6.58	6.94	6.41	6.83	6.61	7.21	6.60	6.90
10 - 14	6.89	6.21	6.54	6.42	6.66	6.53	6.83	6.26	6.54
15 - 19	7.54	6.84	7.18	6.48	6.34	6.41	7.40	6.79	7.09
20 - 24	8.47	7.81	8.13	6.15	6.23	6.19	8.17	7.63	7.89
25 - 29	8.91	8.33	8.61	6.68	6.74	6.71	8.62	8.15	8.38
30 - 34	7.68	7.34	7.50	6.25	6.26	6.25	7.49	7.22	7.35
35 - 39	6.97	6.87	6.92	6.52	6.43	6.48	6.91	6.82	6.86
40 - 44	6.73	6.80	6.77	7.29	6.99	7.15	6.81	6.82	6.81
45 - 49	6.37	6.58	6.48	7.59	7.33	7.47	6.53	6.67	6.60
50 - 54	6.41	6.78	6.60	7.94	7.46	7.72	6.62	6.85	6.74
55 - 59	5.62	6.05	5.84	7.00	6.55	6.78	5.80	6.11	5.96
60 - 64	4.47	4.91	4.70	5.79	5.53	5.67	4.64	4.98	4.82
65 - 69	3.37	3.82	3.60	4.58	4.47	4.53	3.53	3.90	3.72
70 - 74	2.56	3.09	2.83	3.71	3.65	3.68	2.71	3.16	2.94
75 - 79	1.70	2.27	1.99	2.55	2.73	2.64	1.81	2.32	2.07
80 - 84	1.04	1.59	1.32	1.56	1.79	1.67	1.11	1.61	1.37
85 - 89	0.59	1.09	0.85	0.84	1.14	0.98	0.62	1.10	0.87
90 - 94	0.20	0.45	0.33	0.28	0.47	0.37	0.21	0.46	0.34
95 - 99	0.05	0.13	0.09	0.07	0.13	0.10	0.05	0.13	0.09
100 and over	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04	0.03
Totals per range	**48.36**	**51.64**	**100.00**	**52.80**	**47.20**	**100.00**	**48.90**	**51.10**	**100.00**
Totals per area	**87.71**			**12.29**			**100.00**		

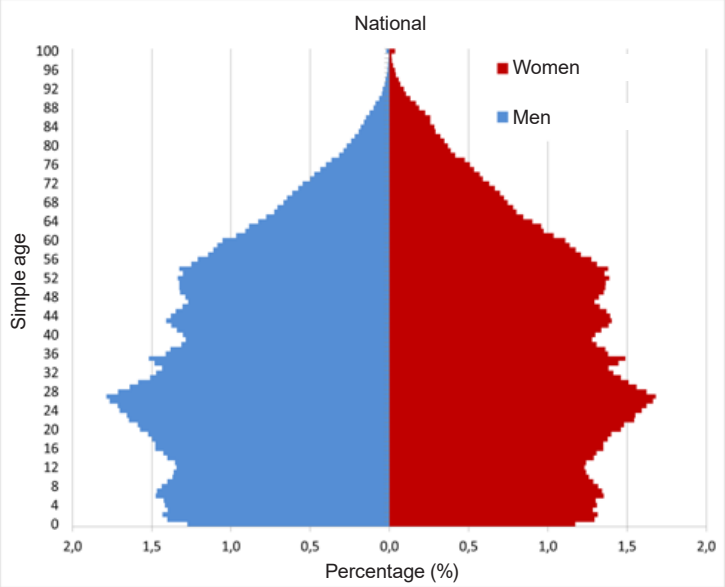
Source: Own elaboration, INE 2022.

According to the 2017 Census, 87.71% of the total population was classified as residing in urban areas, which is equivalent to 15,333,821 persons. Of this group, 7,414,737 were male (48.36%) and 7,919,084 were female (51.64%). On the other hand, 12.29% of the population was classified as residing in rural areas, which is equivalent to 2,148,855 persons. Of this group, 1,134,552 were male and 1,014,303 were female (52.80% and 47.20%, respectively).

With regard to the total population and its distribution by age bracket, both men and women are concentrated in the bracket 20 to 34 years, where the largest group within this bracket is 25 to 29 years, which has 1,464,844 persons. A similar distribution can be seen in urban areas, where the same age bracket predominates, standing at 1,320,718 persons, or 8.61% of the total urban population, and 8.91% and 8.33% for males and females, respectively. Unlike the national population and the urban area, the rural area has an older age structure in which the age bracket with the greatest population is between 40 and 54 years, where the largest group within this bracket are between 50 and 54 years of age for both men and women (7.72% of the rural population, equivalent to 165,851 persons).

The distribution of simple ages is reflected in a generally regular pyramid up to approximately 55 years of age, despite some fluctuations (Graph 8).

Graph 8 : Population pyramid (%), total population, according to results of the 2017 Population and Housing Census.

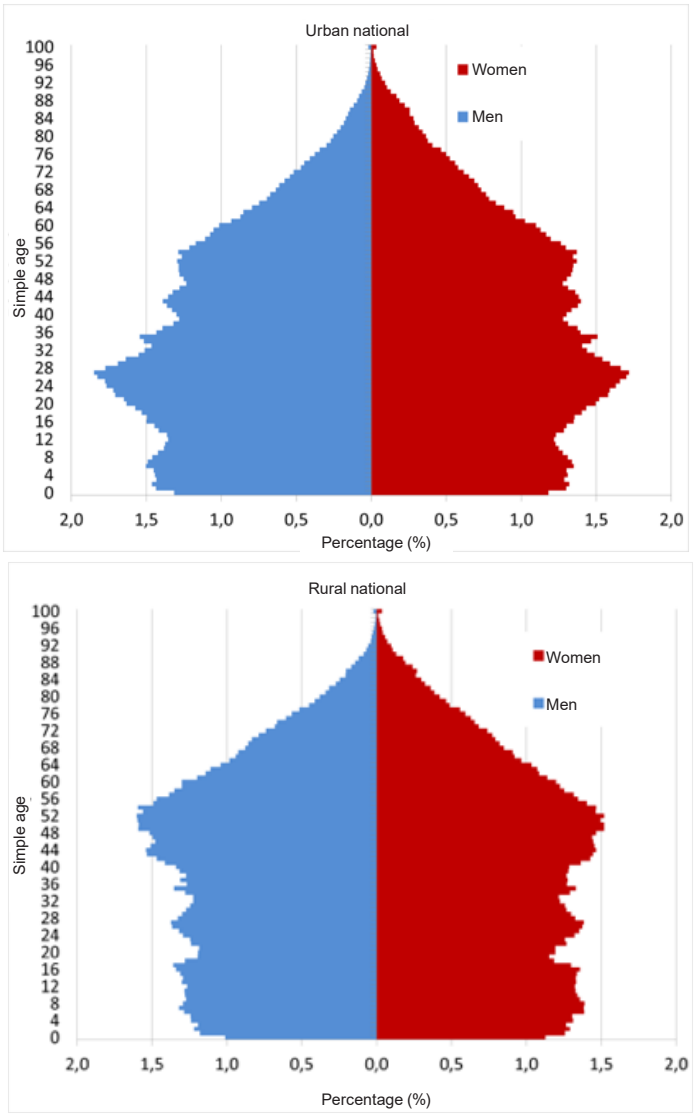


Source: Own elaboration, INE 2022.

The percentage of members of each age cohort is greater than 1% for both sexes until approximately 60 years of age, after which the percentage tends to decrease gradually. The only significant variation to the rectangular shape occurs in the age group with the highest proportion in the pyramid (between ages 20 and 30), where both men and women exceed 1.5% and where age 27 is the cohort with the highest percentage with respect to the total population (1.8% for men and 1.7% for women). Finally, with regard to the relationship between both sexes, it should be noted that up to age 30 the male cohorts have a higher proportion than the female cohorts, while from age 31 onwards the higher proportion is in females. Based on these results, the overall sex ratio is 95.7 males per 100 females.

The urban and rural population pyramids resulting from the national classification are shown in Graph 9.

Graph 9 : Population pyramids according to national classification of urban (top) and rural (bottom).



Source: Own elaboration, INE 2022.

As the urban population represents 87.71% of the country's total population (Table 8), the corresponding population pyramid tends is very similar to the national pyramid. An observable difference in the graph is that, especially from age 40 onwards, the male side is thinner than the female side, where the sex ratio for the age bracket 40 and over is 84.0 males per 100 females.

The rural population pyramid is different from the national pyramid. The rural pyramid show a more aged population, where the ages with the highest proportion are between 40 and 54 years, approximately 20 years older than those of the national and urban population (Table 8). In addition, the rural population has a higher percentage of males compared to the national and rural pyramids, reflecting a higher proportion of males residing in rural areas of the country (sex ratio 111.9/100).

Demographic characteristics resulting from application of DEGURBA, level 1

Table 9 shows the distribution by sex and age (five-year brackets), which are organized according to the three classes of level 1 of DEGURBA methodology. It should be remembered that **class 1 represents the rural area and classes 2 and 3 the urban areas**; the totals of men and women in the urban area, therefore, are expressed in percentages and are listed in the column "3+2 (Urban)" in Table 9.

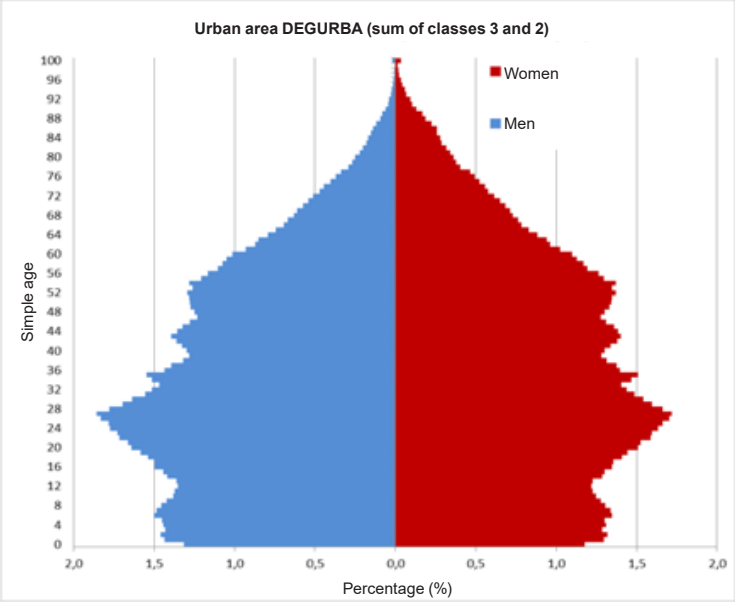
Table 9 : Percentage distribution by sex and five-year age brackets, according to level 1 of DEGURBA methodology.

Five-year age bracket	3 High-density cluster			2 Moderate-density cluster			1 Low-density grid cells			3 + 2 (Urban)		
	Male (%)	Female (%)	Range total (%)	Male (%)	Female (%)	Range total (%)	Male (%)	Female (%)	Range total (%)	Male (%)	Female (%)	Range total (%)
0 - 4	6.93	6.22	6.56	7.64	6.98	7.30	6.06	6.34	6.19	7.09	6.39	6.73
5 – 9	7.09	6.34	6.70	8.13	7.37	7.74	6.61	6.84	6.72	7.32	6.57	6.93
10 – 14	6.67	5.98	6.32	7.65	6.98	7.30	6.52	6.65	6.58	6.89	6.20	6.53
15 – 19	7.51	6.81	7.15	7.76	7.03	7.38	6.53	6.35	6.45	7.57	6.86	7.20
20 – 24	8.87	8.09	8.47	7.30	6.96	7.13	6.25	6.33	6.29	8.52	7.84	8.17
25 – 29	9.26	8.48	8.85	7.85	7.86	7.86	6.85	6.97	6.91	8.95	8.34	8.63
30 – 34	7.86	7.36	7.60	7.09	7.27	7.18	6.39	6.47	6.43	7.69	7.34	7.51
35 - 39	7.01	6.80	6.90	6.86	7.12	6.99	6.56	6.49	6.52	6.98	6.87	6.92
40 - 44	6.70	6.73	6.71	6.89	7.07	6.98	7.17	6.92	7.05	6.74	6.80	6.77
45 - 49	6.29	6.53	6.41	6.59	6.76	6.68	7.45	7.20	7.33	6.36	6.58	6.47
50 - 54	6.34	6.80	6.58	6.59	6.69	6.64	7.78	7.33	7.57	6.40	6.78	6.59
55 - 59	5.62	6.15	5.89	5.58	5.72	5.65	6.84	6.44	6.65	5.61	6.06	5.84
60 - 64	4.46	4.99	4.73	4.44	4.63	4.54	5.64	5.45	5.55	4.46	4.91	4.69
65 - 69	3.35	3.88	3.62	3.36	3.61	3.49	4.48	4.39	4.44	3.35	3.82	3.59
70 - 74	2.53	3.14	2.85	2.57	2.90	2.74	3.60	3.58	3.59	2.54	3.09	2.82
75 - 79	1.66	2.30	1.99	1.76	2.13	1.95	2.52	2.70	2.60	1.68	2.26	1.98
80 - 84	1.01	1.63	1.33	1.07	1.44	1.26	1.54	1.78	1.66	1.03	1.58	1.31
85 - 89	0.58	1.14	0.87	0.59	0.93	0.77	0.84	1.14	0.98	0.58	1.09	0.85
90 - 94	0.20	0.47	0.34	0.20	0.39	0.30	0.28	0.47	0.37	0.20	0.45	0.33
95 - 99	0.04	0.13	0.09	0.05	0.11	0.08	0.07	0.13	0.10	0.05	0.13	0.09
100 and over	0.02	0.04	0.03	0.02	0.03	0.02	0.02	0.04	0.03	0.02	0.04	0.03
Total per range	48.28	51.72	100.00	48.57	51.43	100.00	52.11	47.89	100.00	48.34	51.66	100.00
Total per class/area	66.50			18.70			14.79			85.21		

Source: Own elaboration, INE 2022.

The total distribution of the population of the urban area according to DEGURBA (the sum of classes 2 and 3, shown in Graph 10) is similar to that resulting from the national classification shown in Graph 9. The population is mainly between the ages of 20 and 34, within which the population between 25 to 29 years has the highest percentage of both men and women (8.95% and 8.34%, respectively).

Graph 10: PPopulation pyramid (%) for the urban area according to DEGURBA (classes 1 and 2 of level 1).



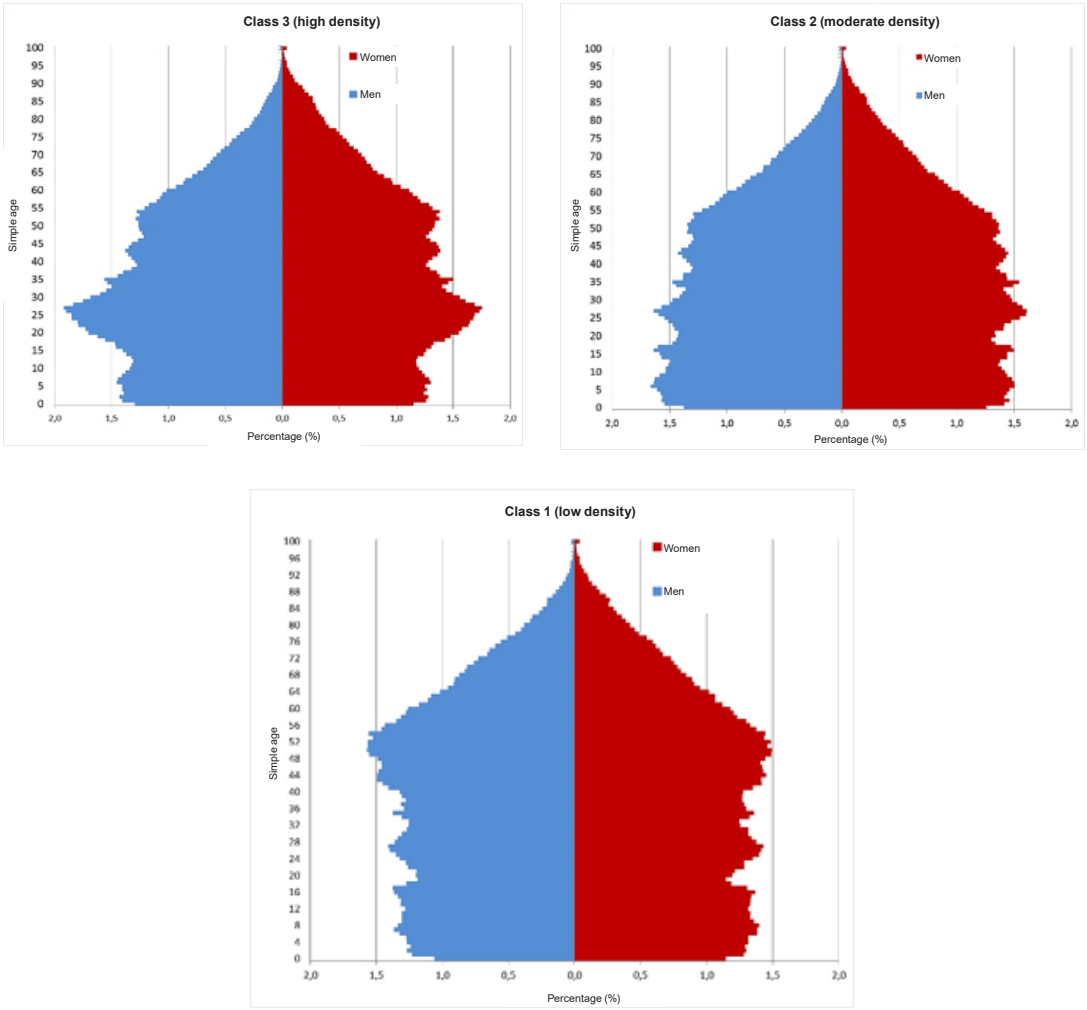
Source: Elaboración propia, INE 2022.

In the rural area according to DEGURBA (class 1 in Graph 11), the age distribution is quite similar to its equivalent in the national classification. The age brackets with the highest proportion are located in the population between 40 and 54 years of age, within which the largest segment is between 50 and 54 years (195,723 persons, or 7.57%, as compared to 7.72% in the national classification). Class 1, moreover, is the only class with a greater number of males; its sex ratio is 108.8 males for every 100 females.

Notwithstanding these similarities, classes 2 and 3 (as subdivisions of the urban area) differ in some aspects, as can be seen in Table 9. Class 2 is characterized by the most heterogeneous distribution of age brackets, where the brackets, 5 to 9, 15 to 19, and 25 to 29 are the most numerous for both sexes (7.74%, 7.38%, and 7.86%, respectively). In high-density clusters (class 3), the distribution is similar to the sum of classes 2 and 3. Consequently, its distribution is also similar to the results for the urban area from the 2017 Census (i.e., brackets between 20 and 34 years are the most numerous, and the greatest population is in the bracket 25 to 29 years).

The population pyramids show these characteristics (Graph 11): the three levels resulting from DEGURBA methodology are associated with populations with differentiated structures.

Graph 11: Population pyramids according to level 1 of DEGURBA methodology (classes 1, 2, and 3 respectively).



Source: Own elaboration, INE 2022.

A comparison of the pyramid of class 3, level 1 of DEGURBA (high density) in Graph 11 with the pyramid of the urban area of the national classification in Graph 8 shows that both have similar characteristics. The class-3 pyramid emphasizes the characteristics of the urban population according to the national classification: the proportion of women is even higher (the sex ratio is 93.3 males/100 females compared to 93.6 males/100 females in urban areas according to the national classification) and the population of the age bracket 30 to 40 years represents an even higher proportion of the total population, 14.87% in class 3, compared to 14.65% of the urban area according to the national classification.

The relationship between rural areas according to the national classification and level 1 of DEGURBA (low density) is inverse in terms of population: level 1 of DEGURBA has 20.36% more population than rural areas according to the national classification (437,596 persons). This difference in population does not change the general characteristics of either pyramid, both of which have similar age and sex ratios. In this case, the class-1 pyramid (Graph 11) smooths out the more distinctive features of the rural pyramid in the national classification: the male-to-female sex ratio is lower (108.8/100 versus 111.9/100) and the proportion of the population aged 40 to 55 is also slightly lower (23.4% of the general population in level 1 and 23.8% in the rural stratum).

The population structure of class 2, level 1 of DEGURBA (moderate density) has characteristics different from those observed in the other pyramids. The pyramid for class 2, level 1 of DEGURBA is more rectangular, without the prominences that characterize the urban pyramids according to national classification (Graph 9), the class 3 pyramid of DEGURBA (Graph 11) between ages 20 and 30, the rural pyramid (also shown in Graph 9), and the low-density pyramid (Graph 11) between ages 40 and 55. The pyramid of class 2 (moderate density) shows fluctuations typical of demographic dynamics, but none of these fluctuations stand out. This pyramid maintains a general rectangular shape until around age 55, where it acquires a pyramidal shape that ends in the last age group. The sex ratio is 94.5 males per 100 females, which places it between the ratios of classes 1 and 3, but much closer to the latter.

DEGURBA results reflect greater similarity with respect to the national urban/rural classification in the extreme classes (3 and 1), which can be attributed to the high percentage of population in urban centers and the conceptual similarities between definitions of rural of DEGURBA methodology and the national classification. The main differences in the moderate-density clusters are the concentration of a higher percentage of persons aged under 20 compared to those of high-density clusters and a higher proportion of school-age population; thus, class 2 represents a transition between the denser urban and rural areas, not only in terms of population, but also in the distribution of age ranges.

Demographic characteristics resulting from the application of level 2 of DEGURBA in Chile (seven classes)

The demographic analysis of the results of level 2 of DEGURBA methodology is shown below, following the same structure as in the previous section. At this point, it is necessary to recall what is specified in Figure 1: class 30 of level 2 can be assimilated to class 3 of level 1 of DEGURBA; classes 23, 22, and 21 are subdivisions of class 2; and 13, 12, and 11 are subdivisions of class 1.

The demographic analysis of level 2 provides a more detailed view of the distribution of the population in urban and rural areas, according to the density, concentration, proximity, and particularities of human settlements.

The results of the population distribution in percentages are shown below in Table 10.

Table 10 : Distribution of five-year age brackets according to the 2017 Population and Housing Census and to level 2 of DEGURBA methodology.

	DEGURBA classification, level 2						
	Urban				Rural		
Five-year age bracket	30 Urban center (%)	23 Dense urban cluster (%)	22 Semi-dense urban cluster (%)	21 Suburban / peri-urban (%)	13 Rural cluster (%)	12 Low-density grid cells (%)	11 Very low-density grid cells (%)
0 - 4	6.56	7.18	6.93	7.79	6.52	6.37	5.23
5 - 9	6.70	7.68	7.44	8.08	6.99	6.88	5.89
10 - 14	6.32	7.33	7.15	7.34	6.72	6.75	5.94
15 - 19	7.15	7.42	7.14	7.45	6.83	6.66	5.30
20 - 24	8.47	7.18	6.99	7.08	6.97	6.36	5.04
25 - 29	8.85	7.91	7.94	7.69	7.95	6.78	5.56
30 - 34	7.60	7.13	6.96	7.45	7.27	6.30	5.41
35 - 39	6.90	6.82	6.77	7.53	7.04	6.45	5.87
40 - 44	6.71	6.86	6.76	7.41	7.19	7.02	6.90
45 - 49	6.41	6.67	6.65	6.74	7.12	7.30	7.72
50 - 54	6.58	6.69	6.84	6.40	7.11	7.53	8.38
55 - 59	5.89	5.72	5.85	5.39	6.04	6.56	7.83
60 - 64	4.73	4.60	4.83	4.22	4.81	5.50	6.85
65 - 69	3.62	3.52	3.87	3.20	3.72	4.39	5.70
70 - 74	2.85	2.78	3.03	2.48	2.93	3.55	4.75
75 - 79	1.99	2.01	2.18	1.68	2.13	2.54	3.52
80 - 84	1.33	1.32	1.37	1.07	1.39	1.61	2.21
85 - 89	0.87	0.79	0.85	0.66	0.84	0.95	1.28
90 - 94	0.34	0.31	0.33	0.25	0.31	0.36	0.48
95 - 99	0.09	0.08	0.09	0.07	0.08	0.10	0.13
100 and over	0.03	0.02	0.02	0.03	0.02	0.03	0.03
Totals by class compared to the national level (%)	**66.50**	**10.96**	**2.95**	**4.80**	**4.66**	**7.21**	**2.93**

Source: Own elaboration, based on results of the 2017 Population and Housing Census, INE, 2022.

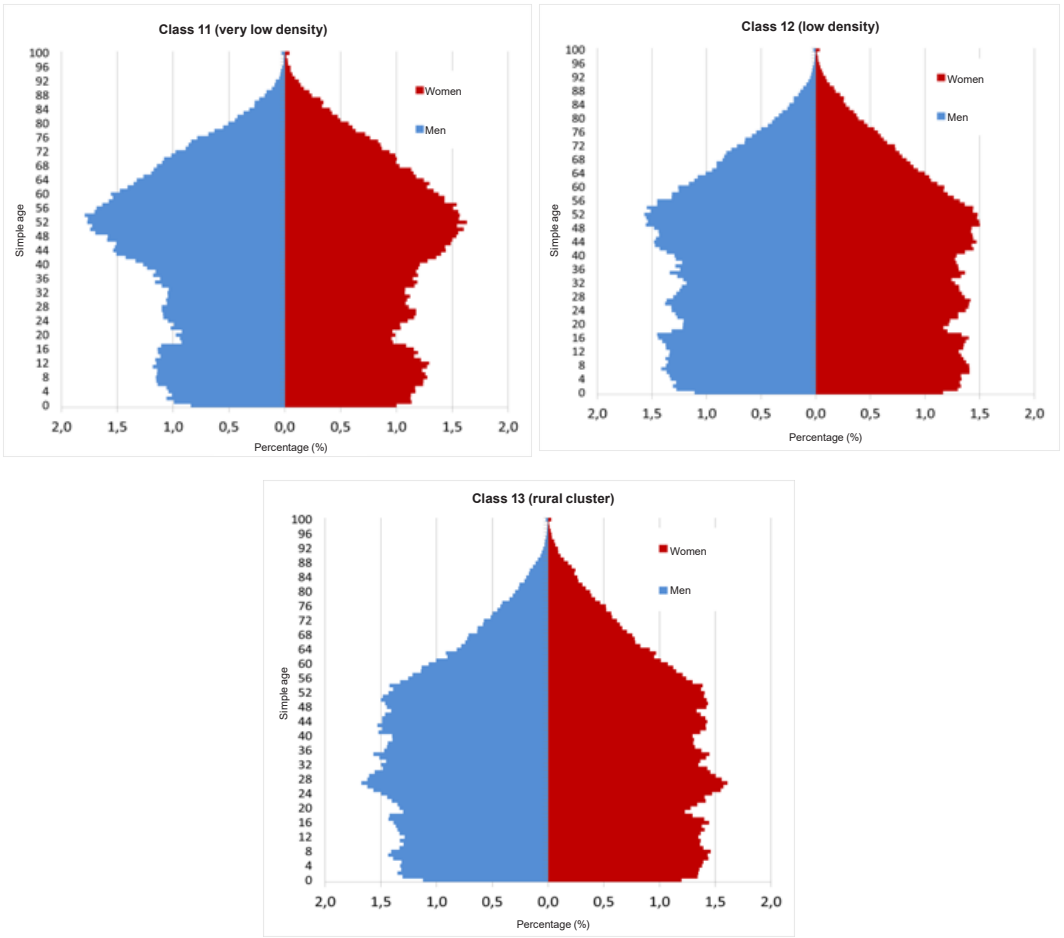
The rural population is mainly concentrated in class 12, which represents 7.21% of the total population. The age brackets with the highest proportion at this level are between 40 and 59 years. Following is class 13, which represents 4.66% of the population, and it has a slightly younger age distribution than level 12 because the preponderance of ages is between 25 and 44 years. Finally, level 11 (very low density), which represents 2.93% of the population, has an age distribution similar to level 12, and it has a higher concentration of population aged between 45 and 59 years.

Regarding the urban area, specifically the classes derived from class 2 of level 1 (moderate density), most of the population is concentrated in level 23 (dense urban clusters), which accounts for 10.96% of the country's total population. The age distribution within this class is heterogeneous: the highest number of persons are aged between 25 and 29 and between 5 and 9, a distribution quite similar to that of class 2. Class 21 (suburban/peri-urban area) contains 4.80% of the total population. Unlike level 23, the majority of this subgroup is between 0 and 9 and between 25 and 29 years old. Class 22 represents 2.95% of the total population, its age distribution similar to the other level 2 classes, and its largest populations between the ages of 25 and 29, 5 and 9, and 10 and 14.

Finally, class 30 (equivalent to class 3 of level 1, already analyzed) represents 66.50% of the total population, and its age distribution is concentrated between ages 20 and 34.

The population pyramids shown in Graph 12 represent only the rural area classes according to class 11 of DEGURBA (very low density), which have very particular characteristics. Its population's sex ratio (117.4 males/100 females) is significantly more masculine than other DEGURBA classes and the national urban/rural classification. The pyramid thickens for both men and women (especially the former) between the ages of approximately 40 and 65 years. The pyramids of classes 12 (low density) and 13 (rural cluster) have sex ratios very similar to class 1, level 1 of DEGURBA. The sex ratios for these two classes are 106.2 males/100 females and 107.8 males /100 females, respectively. However, the age structure is different, as shown in Table 10. Class 12 is older and presents a structure similar to the rural stratum of the national classification and to class 1 of DEGURBA, while class 13 has a younger structure and, although a subclass derived from class 1, leve1 of DEGURBA, it is more similar to class 2 of level 1 (moderate-density cluster, conceptualized as urban).

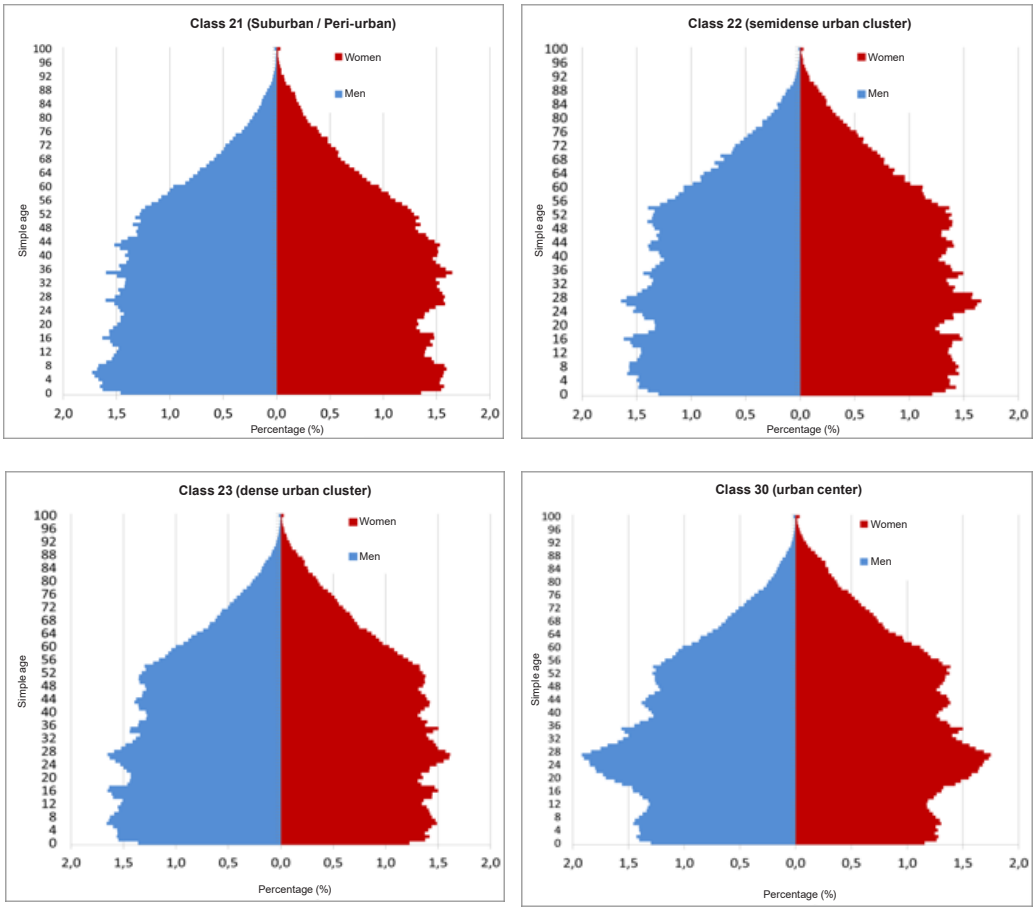
Graph 12: Population pyramids of classes 11, 12, and 13 of level 2 of DEGURBA methodology, which represent rural areas.



Source: Own elaboration, INE 2022.

Levels derived from class 2 of level 1 (21, 22, and 23; suburban/peri-urban, semi-dense urban cluster, and dense urban cluster, respectively) have population structures similar to each other and to class 2 from which they are derived (moderate density) (Graph 13). However, some of these classes also have distinctive characteristics. Class 21 (suburban/peri-urban) is the level with the highest proportion of the population aged 9 and under, which represents 15.87% of the total population of the level. (Nationally, this population represents 13.54% of the total.) Class 23 (dense urban) is the level with the lowest male-to-female ratio (93.0/100), making it the class with the highest proportion of women in relation to the total population.

Graph 13: Population pyramids of classes 21, 22, 23, and 30 of level 2 of DEGURBA methodology (urban area).



Source: Own elaboration, INE 2022.

From the analysis of level 2, it is again clear that, in general, DEGURBA classification is useful not only for defining the continuum of population densities in the territory, but also for showing a certain continuum in the distribution of age ranges from the most urban to the most rural. Roughly speaking, the lower the density of settlements, the older the population; the more consolidated the urban area, the greater is the presence of young people and school-age population. However, it is interesting to observe class 21 (suburban/ peri-urban), which has a higher proportion of younger population (0 to 9 years old) and fairly even percentages between 10 to 44 years old; this distribution might indicate, for example, that peri-urban areas have better conditions for the young and school-age population or that they have become an attractive area because they have the benefits of large urban centers without their negative externalities.

3 Chapter

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CALCULATION OF PRIORITY SDG INDICATORS

3 Chapter

Methodological considerations, description of inputs, and results of the calculation of priority SDG indicators 11.2.1, 11.3.1, and 11.7.1 are presented below.

3.1. Preliminary considerations for the calculation of priority SDG indicators

Sample of cities

For the implementation of the DEGURBA pilot test and the measurement and analysis of SDG indicators 11.2.1, 11.3.1, and 11.7.1, seventeen representative cities of Chile were selected for the calculation. This selection was based on the National Samples of Cities (NSC) approach proposed by UN-Habitat[21], in which, according to the specific characteristics of the cities (population size or category), representative cities are selected to form a cluster (or macro-zone) of the country (ONU Hábitat, 2018). In Table 5, these clusters are called "Regions" and their characterization was defined in conjunction with UN-Habitat.

The selected cities are shown in Table 5.

Table 5: National sample of cities selected for the calculation of priority SDG indicators as part of DEGURBA pilot test (cities ordered from north to south).

Region (cluster)	City	Population range
Norte Grande	Arica	100,000–250,000
Norte Grande	Iquique-Alto Hospicio	100,000–250,000
Norte Grande	Antofagasta	250,001–500,000
Norte Chico	Copiapó	100,000–250,000
Norte Chico	La Serena-Coquimbo	250,001–500,000
Norte Chico	Ovalle	<100,000
Central nucleus	Greater Valparaíso	500,001–1,000,000
Central nucleus	Greater Santiago	5,000,001–9,999,999
Central nucleus	Peñaflor	<100,000
Central nucleus	Rancagua-Machalí-Gultro-Los Lirios	250,001–500,000
Central nucleus	Curicó	100,000–250,000
Central nucleus	Talca-Culenar	100,000–250,000
Biobío	Los Ángeles	100,000–250,000
Biobío	Greater Concepción	500,001–1,000,000
Biobío	Temuco-Padre Las Casas	250,001–500,000
Los Lagos	Osorno	100,000–250,000
Los Canales	Punta Arenas	100,000–250,000

Source: UN-Habitat, based on data from INE. INE, 2022.

21) For more information, see: https://sustainabledevelopment.un.org/content/unsurvey/attachments/National_sample_of_cities.DOC_UNHAB.29012018.pdf

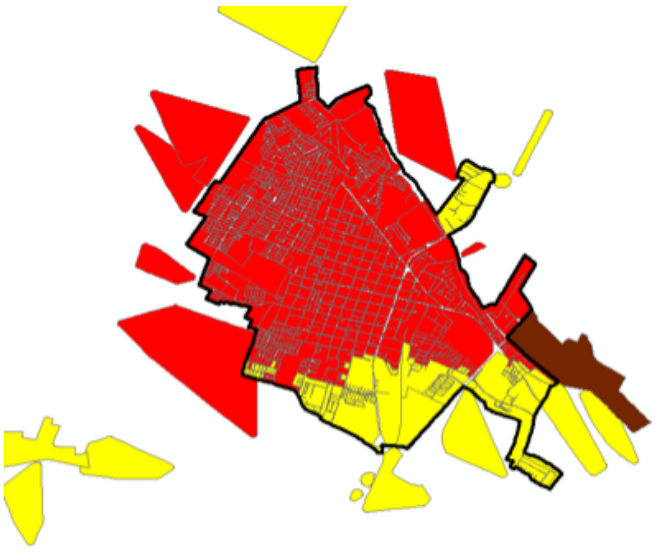
Definition of the extent of urban areas

After selecting the cities, the limits of each urban center had to be defined in order to calculate the indicators. The discussion focused on the possibility of using **(a) the result of the application of DEGURBA in Chile at the level of urban census block and rural entities** or **(b) the area defined by urban census boundaries** (INE, 2018f) because the latter is Chile's official statistical unit for urban areas. The chosen alternative had to represent the urban area in the best possible way, such that the results of the calculation would reflect the extent of the urban area and would have conceptual support for the fulfillment of the objectives.

(a) Results of the application of DEGURBA in Chile at the census block and rural entity level

This option entailed the use of urban census blocks and rural entities (according to national classification) that were considered urban according to DEGURBA methodology. The advantage of this option was that the results could be harmonized with international experiences. However, the inputs on which the results were obtained had certain characteristics that made it difficult to draw an urban-area boundary as a continuum for the calculation. As seen in Figure 22, rural entities of the 2017 Census are not contiguous to urban census blocks (delimited in this case by the black line), because their boundaries are fictitious, having been generated through automated processes. This situation makes it more difficult to draw a continuous area for the calculation of indicators.

Figure 22: Entities resulting from the 2017 Population and Housing Census compared to urban census blocks of DEGURBA classification.



Symbols used for DEGURBA level 2

Urban		Rural	
30	Urban center	13	Rural clusters
23	Dense urban cluster	12	Low-density grid cells
22	Semi-dense urban clusters	11	Very low-density grid cells
21	Suburban/peri-urban		

Source: Own elaboration, INE 2023.

However, the main difficulty in using DEGURBA classification arose with respect to the results of the 2002 Census, which were fundamental to the calculation of indicator 11.3.1 ("Ratio of land consumption rate to population growth rate "). The 2002 Census fieldwork was carried out analogously on paper maps and then the information was transferred to georeferenced layers. Specifically, the georeferenced information for the urban areas consists of blocks with different planimetric qualities[22], and, for the rural areas, it consists of points that were digitized in a referential manner based on the maps. Figure 23 (left) shows an example of a 2002 Census working map, where the blue lines represent the identified rural entities. The complexity can be seen in the image on the right, where the elements are not digitized as polygons, but as points. Its coverage is partial, its location not precise, and it does not represent the area effectively covered by the entity.

Figure 23: Example of digitization of rural entities from the 2002 Census.

Source: Own elaboration, INE, 2022.

Taking this into consideration, the 2002 inputs make it even more difficult to draw an urban boundary for the calculation of the indicators.

(b) Use of the area defined by the urban census boundary (UCB) as the calculation area

Using the UCB also leads to difficulties in the interpretation of results. By definition, the layout of UCBs conforms to elements recognizable in the field (INE, 2015b), which may lead to overestimating the extent of urban areas. Some UCBs extend into areas with rural characteristics (Figure 24).

22) The state of development of INE's geographic information systems in the years around the 2002 Census has led to problems in the accuracy of the layout and location in the cartography. When comparing cartographic information from 2002, it does not necessarily match planimetrically with the cartography of 2017.

Figure 24: Urban census boundary of the city of Fresia of the Los Lagos Region.

Source: Own elaboration, INE, 2022.

The use of the USB for the calculation of indicators 11.2.1 ("proportion of population with convenient access to public transportation, by sex, age, and persons with disabilities") and 11.7.1 ("average share of the built-up area of cities that is open space for public use for all, by sex, age, and persons with disabilities") was approved by UN-Habitat, after explaining the complexities of using DEGURBA results as the calculation area. For indicator 11.3.1, however, a solution encompassing the built-up area and the included population had to be proposed.

(c) Use of DANE methodology to define the area of calculation for indicator 11.3.1

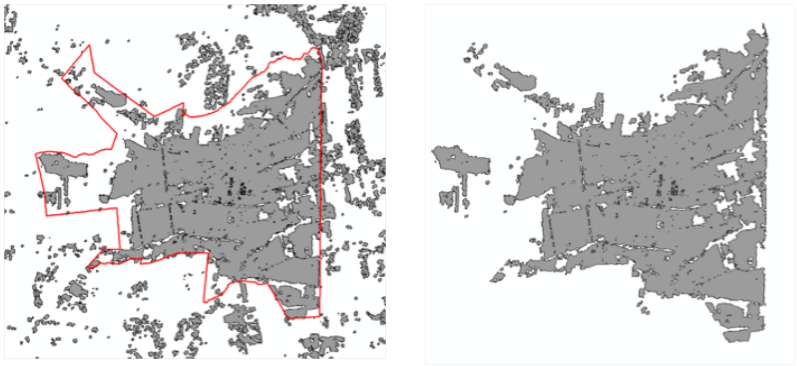
After a series of conversations with UN-Habitat and DANE[23], the methodology proposed by DANE was chosen for defining the calculation area of indicator 11.3.1, a methodology that combines the statistical urban limits with the built-up area in order to narrow the analysis. In general, DANE's methodology delimits the area of analysis to the built-up area (presence of buildings)[24] that is covered by the statistical boundary (UCB in Chile).

23) The information can be reviewed in the Experimental Statistics section of the DANE website (https://www.dane.gov.co/index.php/estadisticas-por-tema/estadisticas-experimentales), specifically in the methodological description published for SDG indicators 11.2.1, 11.3.1, and 11.7.1.

24) The built-up surface is defined by the Global Human Settlement Layer (GHSL), which provides information in raster format for different years of analysis and at different resolutions. For more information, see https://ghsl.jrc.ec.europa.eu/download.php, and in particular the document "GHSL Data Package 2022".

Figure 25 shows the process of defining the area of calculation for indicator 11.3.1 in the city of Los Angeles of the Biobío Region. The red lines show the proposed limit of the built-up surface (gray zone) using the urban census boundary (UCB). The result can be seen in the image on the right. For the purposes of the document, the result of this intersection is referred to as the ***urban spread***.

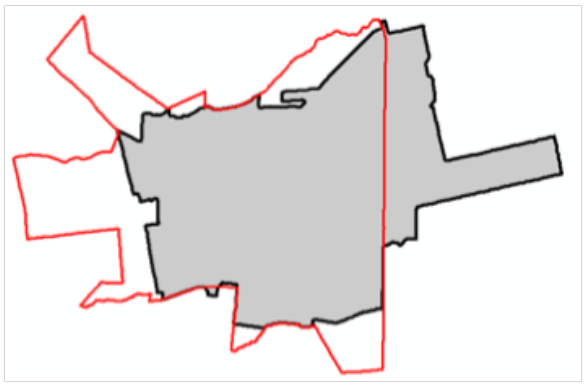
Figure 25: Delimitation of the built-up surface according to the UCB for the generation of an urban spread that delimits the indicator calculation area (image on the right).



Source: Own elaboration, INE, 2022.

Because indicator 11.3.1 measures urban and population growth rate for a time series, Chile uses its only sources with population information at disaggregated levels: the 2002 and 2017 Censuses. At this point, it is important to note that the application of this methodology is limited by the criteria for defining the UCB in both censuses (INE, 2015b). In some urban centers, the 2002 urban area is larger or presents important differences with respect to the one drawn for 2017, as shown in Figure 26 for the city of Los Angeles, Biobío Region. (The line in red is the UCB of the 2017 Census, and the gray area is the UCB of the 2002 Census.)

Figure 26: Difference between urban census boundary (UCB) of the 2002 Census (gray area) and of the 2017 Census (red line).

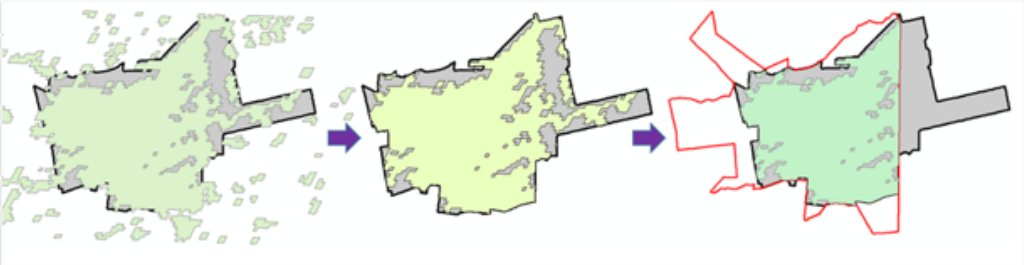


Source: Own elaboration, INE, 2022.

It is proposed that, under the assumption that urban centers only expand in area and do not contract over time (Minvu; INE, 2019), the area for the 2002 calculation is limited to the USB of the census process, but circumscribed by the 2017 UCB, that is, by the intersection of both limits. This proposal ensures that the 2002 urban spread would never be larger in area than the spread of 2017.

The image on the left in Figure 27 shows the 2002 construction layer for the city of Los Angeles (in green) versus the UCB from the 2002 Census. In the second figure (middle), the construction layer is adjusted to the 2002 UCB in order to narrow the analysis. Finally, the third image (right) shows the intersection of the 2002 construction layer and the 2017 USB (in red) to ensure that the 2002 construction layer (in green) is never larger than the 2017 layer.

Figure 27: Adjustment of the 2002 urban spread to the 2017 UCB in order to ensure that the methodological differences in the layout do not generate inconsistencies with respect to the growth of the city.

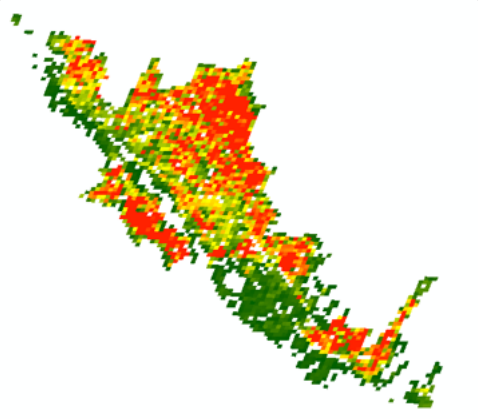


Source: Own elaboration, INE, 2022.

Having stated the arguments, **the UCB will be used as the calculation area for indicators 11.2.1 and 11.7.1 and the urban spread of the years 2002 and 2017 for indicator 11.3.1.**

An important input for the calculation of all indicators is the population grid at 100 meters, both for 2017 and 2002 (the latter limited to indicator 11.3.1). The input is generated from the blocks and rural entities of both census processes (if applicable), and it includes data on the population actually enumerated, using the application provided by UN-Habitat POP2G (see Figure 2). Through the use of ArcGIS software, these population grids enable the extraction of total population data by area related to the requirements of the requested indicators. Figure 28 shows an example of a population grid at 100 meters in the city of Copiapó, where red indicates a higher concentration of population and green indicates a lower concentration.

Figure 28: Population grid at 100 meters of the city of Copiapó, generated with population data from the 2017 Population and Housing Census.



Source: Own elaboration, INE, 2022.

In addition, the calculation of priority SDG indicators is limited in some cases by a lack of information inputs.

- **The analysis is restricted to urban areas that have cartographic information for the calculation of each indicator**; for example, the calculation of indicator 11.2.1 includes only cities of the selection that have georeferenced coverage of public transport stops.
- **Currently, not all the required census information for fully calculating indicators 11.2.1 and 11.7.1 is available**. Specifically, there is currently no data on the distribution of persons with disabilities by census block[25].

The results of the calculation of priority SDG indicators 11.2.1, 11.3.1, and 11.7.1 are shown below.

25) It should be noted that the 2017 Population and Housing Census was an abbreviated process, so it did not consider questions related to the population with disabilities. Therefore, for the purposes of this report, there is no such disaggregation for this indicator. As for the breakdown by sex and age, this information will be available at a later date.

3.2. Indicator 11.2.1 "Proportion of population that has convenient access to public transport, by sex, age, and persons with disabilities"

For the calculation of this indicator, the following inputs were used as a source of information:

- **GTFS (georeferenced public transportation stops)**[26] of the Ministry of Transportation and Telecommunications (MTT) are used to measure the provision of major public transportation stops. In the selected urban centers, information from 2016 and 2018 was considered because of its proximity to the 2017 Census.
- **The population grid at 100 meters** (Figure 28) for the total population, population by sex, and population by age bracket[27] was generated from the blocks of the 2017 Census in order to measure demand according to the requested characterization. For reasons of availability of inputs, the characterization of persons with disabilities was not included.
- **2017 UCB enables the delimitation of the calculation area** to the place where the population affected by the corresponding service areas is located.
- **Streets in INE's 2017 Census** with topology analysis for pedestrian modeling[28] to measure the distance between supply and demand.

SDG indicator 11.2.1 deems access to public transportation to be convenient when a stop is accessible on foot along the road network at a maximum distance of 500 meters from a reference point (e.g., home, school, workplace, market, etc.) to a low-capacity public transportation system (e.g., bus) and/or a distance of 1 kilometer to a high-capacity system (e.g., train, metro) (ONU Hábitat, 2021c). An example of public transportation stops and service areas can be seen in Figure 29.

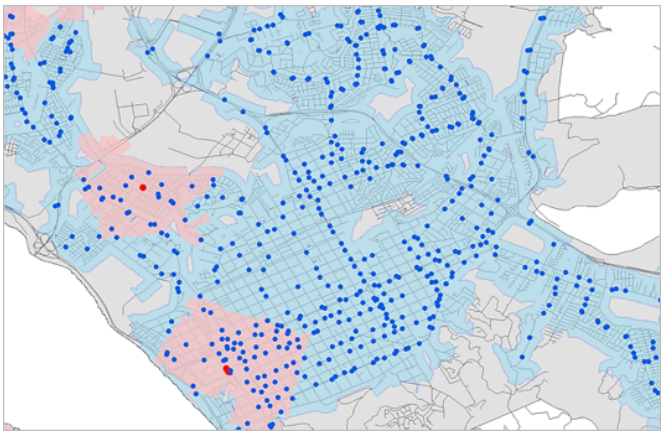
Given the definition of the indicator and available inputs, the distance through streets was measured from the blocks in which the population was registered in the 2017 Census to bus stops (low-capacity transportation) and metro stations (high-capacity transportation). These data were then aggregated at the city level to determine the proportion of the population falling within the indicator threshold, a distance of 500 meters and 1000 meters from low and high capacity transportation stops, respectively.

26) The General Transit Feed Specification (GTFS), sometimes known as GTFS Static, is a common format for public transport timetables and related geographical information.

27) This information was for the ranges 0 to 5 years, 6 to 14 years, 15 to 64 years, and 65 years and over.

28) Topology is a collection of rules that, when coupled with a set of tools and editing techniques from ESRI's ArcGIS software, enables geometric relationships to be modeled between layers more accurately and ensures integrity between layers. The topological analysis for pedestrian modeling of streets considers the analysis of overlapping, intersection, and hanging nodes of the lines (arcs) of which it consists.

Figure 29: High-capacity (red dots) and low-capacity (blue dots) stops, plus their corresponding service areas (in red and blue, as appropriate).



Source: Own elaboration, INE, 2022.

Of the seventeen cities included in the sample, the calculation was made only for those with georeferenced public transport stops (GTFS), which resulted in a total of eight cities. The results of the indicator are shown in Table 11.

Table 11: Results of indicator 11.2.1 Proportion of population with convenient access to public transportation for the selected communes of DEGURBA pilot test.

% of the population with convenient access to public transportation							
City	% of total population	% of females	% of males	% of the population aged 0 to 5 years	% of the population aged 6 to 14 years	% of the population aged 15 to 64 years	% of the population aged over 65 years
Arica	95.26	95.39	95.12	95.03	96.26	95.05	87.77
Iquique-Alto Hospicio	91.84	91.85	91.83	90.22	90.23	92.09	94.73
Copiapó	88.76	88.86	88.66	86.66	87.39	88.85	92.49
Greater Santiago	91.97	92.01	91.92	90.06	89.71	92.07	94.95
Talca-Culenar	88.29	88.35	88.22	83.56	87.34	88.35	92.45
Greater Concepción	91.82	92.05	91.57	89.62	90.06	91.79	95.15
Osorno	88.76	88.89	88.61	86.97	88.17	88.67	81.13
Punta Arenas	88.20	88.90	87.48	86.25	87.48	88.00	91.38

Source: Elaboración propia, INE 2022.

In four of the eight cities measured, 90% of the population has convenient access to public transportation, while the percentages for the other four cities are around 88%. The national average is 91.7%. The city with the lowest proportion of its population with convenient access to public transportation is Punta Arenas, where 88.2% of the population is within 500 meters or less of a low-capacity stop or within 1000 meters of a high-capacity stop. In contrast, the city with the highest proportion of population with convenient access to public transportation is Arica, where 95.3% of the population meets this standard. For metropolitan areas[29], 92% of the population of Greater Santiago has convenient access to public transportation, and Greater Concepción has a similar proportion (91.8%).

Regarding convenient access to public transportation according to sex, women have better access than men in all cities, without exception, which shows a mitigation of gender gaps, at least for the cities included in the pilot test.

Regarding access disaggregated by age, in six of eight cities, the elderly have better access than other age groups, except in Arica and Osorno, where the population between 15 and 64 years of age has the most convenient access to public transportation. Given the results, it can be affirmed that these cities are more equitable because they provide better access to those who potentially have more mobility problems.

It should be noted that, given the methodological differences and the existing scales of disaggregation between the two measurements, it is not possible to make direct comparisons with the current report on this indicator[30]. The current report was conducted with a methodology that uses as the only source of information the National Socioeconomic Characterization Survey (CASEN) of the years 2015 and 2017, which focuses on measuring the proportion of households that state that they are less than eight blocks or one kilometer away a public transportation service (bus stop, station, or other)[31].

These differences mean that, on the one hand, current reporting of the SDG indicator is based on the respondents' own statement regarding their proximity to public transportation stops and, on the other hand, its representation at the population level is subject to the design of the CASEN survey itself[32] for reporting on indicator data at the regional level. In contrast, the results of the present pilot test are available at the city level and were calculated according to international methodology rather than on the statements of CASEN respondents.

An evaluation of the impact of the change in methodology is shown in Table 12 with the results of the indicator using both methodologies. For the regions in common and their cities, the international methodology applied of the pilot test shows worse results (92% average) than the national methodology currently used and reported (93.2% average).

29) Metropolitan areas include cities such as Greater Valparaíso, Greater Santiago, and Greater Concepción.

30) For more information, see: https://www.chileagenda2030.gob.cl/indicadores/detalle11-2-1

31) The indicator is reported as a dichotomous question (Yes or No) that is answered by an eligible household respondent aged 18 or over: "v37. From the following list of services, is your dwelling located . . . (a) Less than eight blocks or one kilometer from a public transportation service (bus stop, station)?"

32) The geographical coverage of the CASEN Survey has a national scope for the population residing in private homes, excluding twenty-one communes that have been identified as areas of difficult access by the National Statistics Institute. The sample design of the survey includes country, area (urban and rural), and regions as geographical domains of representation. In its 2015 version, the CASEN survey included 139 communes that represent 80% or more of the dwellings in each region.

Table 12: Results of indicator 11.3.1 in the framework of the implementation of DEGURBA pilot test and report on priority SDG indicators, 2017.[33]

City (DEGURBA Pilot Test, 2022)	% of the population with convenient access to public transportation (DEGURBA Pilot Test, 2022)	Region (2017 Report)	% of the population with convenient access to public transportation (2017 Report)
Arica	95.3	Arica y Parinacota	95.8
Iquique-Alto Hospicio	91.8	Tarapacá	94.0
Copiapó	88.8	Atacama	90.9
Greater Santiago	92.0	Metropolitan	97.7
Talca-Culenar	88.3	Maule	91.1
Greater Concepción	91.8	Biobío	94.3
Osorno	88.8	Los Lagos	86.5
Punta Arenas	88.2	Magallanes	95.9

Source: Own elaboration, INE, 2022.

In summary, the DEGURBA pilot test used the international methodology for calculating the indicator based on geographic information systems (GIS). Thus, the information is not based on respondent statements, but on the measurement of distances through the road network, between stops and places of residence.

In addition, by moving from a national to an international methodology, more disaggregated results can be obtained and the indicator can be measured at the level of city and eventually expand coverage to other areas, such as neighborhood units and neighborhoods.

3.3. Indicator 11.3.1 "Ratio of land consumption rate to population growth rate"

For the calculation of the indicator, the working group agreed upon the following sources of information:

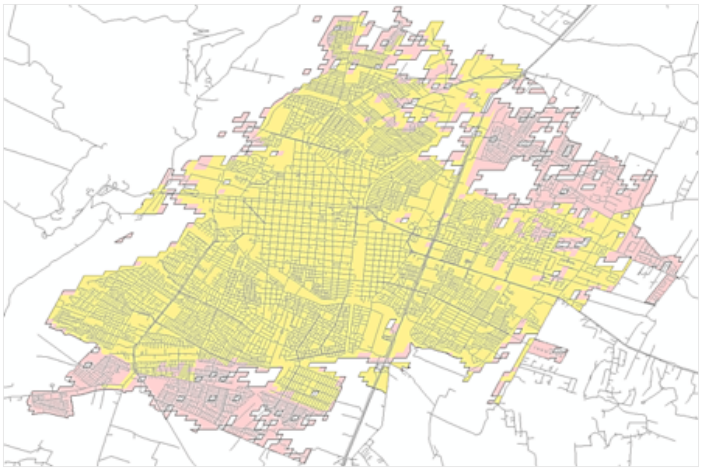
- **Urban area of the year 2002** (according to the procedure indicated in Figure 27) was used to delimit the population included in the 2002 Census and to calculate the surface of the urban area at Time 1 (T1).
- **Urban spread of the year 2017** (according to the procedure indicated in Figure 25) was used to delimit the population included in the 2002 Census and to calculate the surface of the urban area in Time 2 (T2).
- **Population grid at 100 meters from the year 2002** (shown in Figure 28) was generated from the blocks of the 2002 Population and Housing Census in order to obtain the population in T1 enumerated in the urban spread.
- **Population grid at 100 m of the year 2017** (shown in Figure 28), generated from the blocks of the Population and Housing Census of that year, in order to obtain the population in T2 enumerated in the urban spread.

33) It should be observed that the data are not strictly comparable, because the two methodologies cover different geographical areas (regions in one and cities in the other). Therefore, they are included for reference purposes only.

SDG 11.3.1 "Ratio of land consumption rate to population growth rate" seeks to assess the level of urbanization of human settlements in all countries; their inclusion, sustainability, and integration; and whether they have the capacity for participatory management.

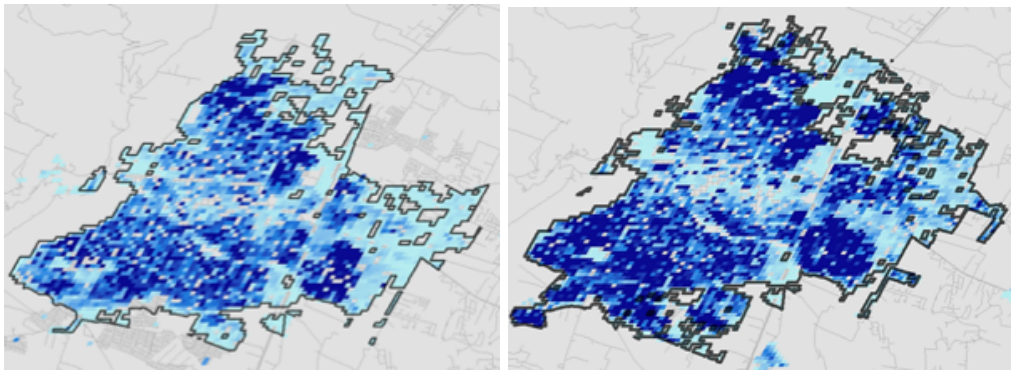
The indicator consists of a temporal analysis between two periods, which for Chile is between the 2002 and 2017 Censuses. Ideally, annual data should be available to determine growth rates for the calculation of this indicator. In this case, annual data is available for the surface area of the cities (Figure 30); however, disaggregated data on the total population is available for the 2002 and 2017 censuses only (Figure 31). Given this limitation, a constant growth rate is assumed for the intercensal period between 2002 and 2017 (i.e., the same growth rate of the city and population for each of the 15 years).

Figure 30: Difference in built-up area in 2002 (yellow) and 2017 (pink), which is represented through the so-called urban spread.



Source: Own elaboration, INE, 2022.

Figure 31: Population distribution in the city of Talca in 2002 (left) and 2017 (right), which are framed within the urban spread. Darker colors represent a higher concentrations of the population.



2002 **2017**

Source: Own elaboration, INE, 2022.

For the interpretation of the indicator, it is desirable that the ratio between both rates be equal to 1, which indicates a balance in the growth of human settlements. Conversely, if the ratio between the rates is **other than 1**, the following needs to be considered:

- A ratio of less than 1 between the rate of land consumption and the rate of population growth in a city reflects a more densely populated city, and it can lead to such benefits as less consumption of land with agricultural potential or with high ecological and landscape value (biodiversity) and less commuting from places of residence to places of work or study. However, analysis within the city can reveal high levels of vehicular congestion and poor living environments, which works against sustainable development.
- A value equal to or greater than 1 could be a sign of a lack of an optimal balance between the spatial growth of a city and the consequent growth of its population, because it entails new land consumption for each added unit of population. (ONU Hábitat, 2021).

Results of this indicator are available for the seventeen cities of the sample because all the required data are available. The results of the indicator are shown in Table 13:

Table 13: Results of indicator 11.3.1 for DEGURBA pilot test.

City	Years analyzed[34]		Built-up area within the limits of the urban area (Km²)		Estimated total population within the boundaries of the urban area for each year of analysis.		Land consumption rate	Relationship between the land consumption rate and the population growth rate
	T1	T2	T1	T2	T1	T2	T1 - T2	T1 - T2
Arica	2002	2017	27.43	31.32	171,706	201,703	0.01	0.82
Iquique-Alto Hospicio	2002	2017	27.92	32.08	210,208	286,782	0.01	0.45
Antofagasta	2002	2017	31.35	40.18	270,465	342,865	0.02	1.05
Copiapó	2002	2017	24.11	27.96	121,614	149,463	0.01	0.72
La Serena-Coquimbo	2002	2017	59.09	84.50	290,066	397,351	0.02	1.14
Ovalle	2002	2017	8.53	11.08	64,548	74,534	0.02	1.82
Gran Valparaíso	2002	2017	136,68	157.31	763,669	888,888	0.01	0.93
Gran Santiago	2002	2017	615.85	685.51	5,219,586	6,110,806	0.01	0.68
Peñaflor	2002	2017	11.41	12.29	61,198	82,522	0.00	0.25
Rancagua-Machalí-Gultro-Los Lirios	2002	2017	49.53	63.91	237,306	286,507	0.02	1.35
Curicó	2002	2017	34.78	45.37	94,495	123,972	0.02	1.23
Talca-Culenar	2002	2017	18.32	26.61	188,137	233,627	0.02	1.38
Los Ángeles	2002	2017	112.31	125.68	114,812	140,739	0.01	1.43
Gran Concepción	2002	2017	17.43	24.16	656,630	710,445	0.02	1.60
Temuco-Padre Las Casas	2002	2017	38.37	46.03	252,765	274,119	0.01	2.25
Osorno	2002	2017	22.08	27.17	126,654	146,177	0.01	1.45
Punta Arenas	2002	2017	23.20	28.71	109,332	122,653	0.01	1.85

Source: Own elaboration, INE, 2022.

34) T1 (Time 1) is the first year analyzed; T2 (Time 2), the second year.

The seventeen cities measured have an average ratio of 0.93 between the rate of land consumption and the rate of population growth, slightly below an equilibrium of city growth, which is defined as the ratio between urban expansion and population growth.

Six cities have a ratio of less than 1, the lowest value in Peñaflor, followed by Iquique-Alto Hospicio, Greater Santiago, Copiapó, Arica, and Greater Valparaíso. These lower ratios might be explained by their population growing faster than the built-up area over the same period. Thus, these cities are densely populated and consume a smaller proportion of land; however, these characteristics may also include high levels of vehicular congestion, pollution, and other negative externalities related to their population density.

In addition, the ratio is greater than 1 in eleven cities, including La Serena-Coquimbo, Gran Concepción, and Punta Arenas. In these cities, the growth of the city and population lacks balance, because new land consumption is higher than each added unit of population. Temuco-Padre Las Casas has the highest ratio (2.25) of all the cities in the sample (i.e., for each unit of population added, more than twice as many units of land are consumed). In general, these cities are characterized by lower densities with no major densification tendencies, but with high land consumption. Furthermore, they are more likely to generate negative externalities, such as the loss of agricultural or ecologically valuable land and the long distance between places of residence and places of work or study, thus reducing the quality of life of their inhabitants.

3.4. Indicator 11.7.1 "Average share of the built-up area of cities that is open space for public use for all, by sex, age, and persons with disabilities"

Para el cálculo del indicador las Sources de información consensuadas en la mesa de trabajo fueron:

- **The population grid at 100 meters** (Figure 28) for total population, population by sex, and population by age bracket was generated from the blocks of the 2017 Census in order to measure demand according to the requested characterization. For reasons of availability of inputs, the characterization of persons with disabilities was not included.
- **The 2017 UCB** delimits the calculation area to the place where the population affected by the corresponding service areas is located.
- **Cartographic coverage of land used for streets within the UCB**, which was taken from the cartography of the 2017 Census. The space between census blocks allocated to streets of all types (Figure 33) was considered.
- **INE's 2019 national cadaster of green areas**[35] to determine open public space. The source was agreed upon and validated in a working group formed by the Ministry of Housing and Urban Planning (MINVU), the Ciudad Accessible Corporation, the Mi Parque Foundation, The National Council for Urban Development (CNDU), the Sustainable Urban Development Center (Cedeus), the Compañía Verde Consultancy, the Public Policy Center and City Observatory of the Pontifical Catholic University of Chile, and INE. The availability of validated inputs meant that only this coverage was used to determine open public space.
- **Streets in INE's 2017 Population and Housing Census** with topology analysis for pedestrian modeling to measure the distance between supply and demand.

35) Green areas fulfill social functions for leisure, recreation, and enjoyment of nature, as well as environmental and ecological functions at scales according to their size. Green areas are for public use, and their ownership may be public or private. They are grouped into squares (from 450 to 20,000 m²) and parks (over 20,000 m²). For more information, see https://storymaps.arcgis.com/stories/391dac6ee0c3438fbf186aed3ea1cff1

Indicator 11.7.1 "Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities" is determined according to the area of cities that is public open space with free public access, disaggregated by gender, age, and persons with disabilities.

Public space is defined as any place of public ownership or public use, accessible and enjoyable by all free of charge and without profit, which can be classified as streets, open spaces, and public facilities. It also includes spaces such as meeting or gathering places that exist outside the household and workplace, that are generally accessible to members of the public and that encourage resident interaction and opportunities for contact and proximity.

To define an "acceptable walking distance" to public open spaces, UN-Habitat organized a series of consultations with officials from national statistical offices, as well as from civil society and community groups, experts in various fields, representatives of academia, think tanks, and other UN agencies and regional commissions, among other partners. These consultations, which were held between 2016 and 2018, concluded that a walking distance of 400 meters, which is equivalent to a 5-minute walk, was a practical and realistic threshold. On this basis, a service area is drawn according to the street network around each open public space, using the 400-meter access threshold (Figure 32).

Figure 32: Example of 400-meter service areas around open public spaces.

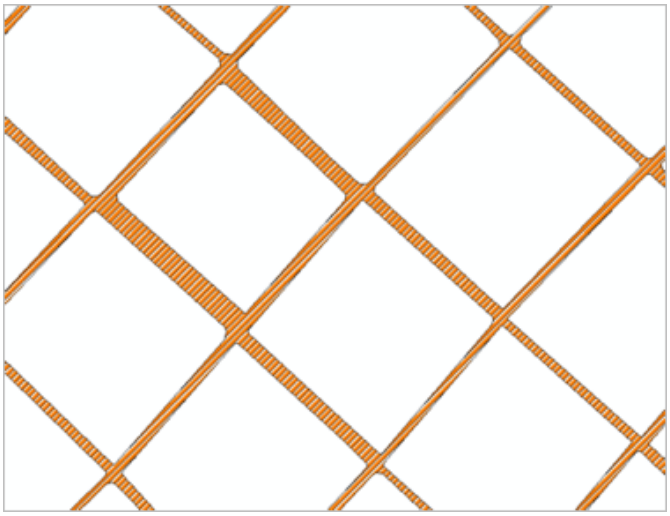
Source: Own elaboration, INE, 2022.

All populations living within the service areas are, in turn, identified as having access to public open space, according to the following key assumptions:

- Equal access to each space by all groups of people, including children, persons with disabilities, women, and the elderly, can walk a distance of 400 meters (about 5 minutes) to access the spaces. (In practice, this will vary significantly by group.)
- All streets are walkable; where existing barriers are known (e.g. non-walkable streets, lack of crosswalks, etc.), they can be defined in the delineation of the service area of the space.
- All public open spaces have the same area of influence, which is measured at 400 meters along the street network. In reality, larger spaces have a much larger area of influence.
- All buildings in the service area are habitable, and the population is equally distributed in all buildings/built-up areas (ONU Hábitat, 2021b).

In the calculation of the indicator and for the test, restrictions on access to information on the components that define freely accessible public space have led to their being considered public space only when the land is designated as a green area (parks, squares, community gardens, and similar spaces)[36] or when they are designated as streets, pedestrian walkways, and passageways[37] and they are located within the urban spread.

Figure 33: Space between blocks corresponding to streets (in red).



Source: Own elaboration, INE, 2022.

Because data are available at the national level, the results of the indicator calculation are available for the seventeen cities of the sample. The results of the indicator are shown in Table 14.

36) 2019 Cadaster of Green Areas (INE).

37) Cartographic coverage of land used for streets within the urban area within the urban spread, 2017.

3 Chapter

Table 14: Results of indicator 11.7.1 for DEGURBA pilot test.

City	Land used for streets (km²)	Land used for public open spaces[38]	% of the built-up area that is open space for public use for everyone	% de población urbana a 400 m de distancia a pie de un espacio público abierto (%), respecto al total de población del área urbana.						
				% of total population	% of females	% of males	% of the population aged 0 to 5 years	% of the population aged 6 to 14 years	% of the population aged 15 to 64 years	% of the population aged over 65 years
Arica	3.55	0.76	9.91	83.94	83.92	83.95	82.74	83.11	83.52	70.20
Iquique-Alto Hospicio	3.98	0.72	10.2	88.68	88.74	88.61	87.63	88.49	88.77	89.59
Antofagasta	5.87	0.85	11.97	72.41	72.62	72.18	71.77	73.02	72.42	71.97
Copiapó	3.36	0.84	12.25	92.19	92.36	92.01	91.82	92.77	92.18	91.75
La Serena-Coquimbo	8.58	3.11	10.93	86.14	86.42	85.83	86.24	87.00	86.09	85.34
Ovalle	1.51	0.4	12.82	96.05	96.12	95.96	96.24	96.12	96.01	96.00
Greater Valparaíso	16.33	2.96	7.51	62.51	62.97	62.00	61.4	61.97	62.78	62.16
Greater Santiago	78.06	34.99	13.97	90.23	90.25	90.22	90.6	91.23	90.09	89.91
Peñaflor	1.14	0.39	11.84	83.64	84.36	84.36	85.03	85.44	84.53	82.42
Rancagua-Machalí-Gultro-Los Lirios	6.1	2.79	9.73	94.08	94.32	93.81	94.06	93.83	94.05	94.55
Curicó	2.65	1.12	11.14	91.57	91.59	91.56	91.61	92.33	91.50	91.13
Talca-Culenar	5.57	1.71	13.13	95.78	95.94	95.61	95.39	96.18	95.79	95.61
Los Ángeles	2.72	0.8	11.74	90.29	90.27	90.31	89.79	90.84	90.15	90.94
Greater Concepción	13.39	4.29	9.89	86.26	86.54	85.94	86.57	86.69	86.09	86.65
Temuco-Padre Las Casas	5.34	2.48	13.91	90.87	91.01	90.73	90.83	91.45	90.93	89.98
Osorno	2.96	2.27	16.17	96.42	96.46	96.39	96.51	96.82	96.48	95.64
Punta Arenas	2.99	1.37	11.59	92.51	93.1	91.9	92.51	92.96	92.43	92.57

Source: Own elaboration, INE, 2022.

38) Open public spaces, for calculation purposes, refer to the green areas in INE's cadaster.

The seventeen cities measured have an average of 11.9% of their surface area allocated for open space for public use (streets and public open spaces), with seven cities above the average and ten below. The city of Osorno has the highest proportion of area allocated to open space for public use (16.1%). In contrast, Greater Valparaíso has the lowest proportion of area allocated to such uses (7.5%). In the remaining major metropolitan areas, 14% of Greater Santiago's surface area allocated to open space for public use, making it the city with the second highest proportion, while Greater Concepción, with 9.9%, is the city with the third lowest proportion allocated to such uses.

As for the percentage of the urban population within 400 meters walking distance to an open public space, which can be measured by a complementary indicator of the accessibility of people to these spaces, the average of the seventeen cities of the sample is 87.1%. Osorno is the city with the highest proportion of its population with access within 400 meters of these spaces (96.4%). In contrast, Greater Valparaíso is the city with the greatest accessibility problems; only 62.5% of its population lives within 400 meters of a public space.

With population data disaggregated by sex[39] and age[40] at the level of census block, access to public spaces for these population groups can be measured. Thus, access to public spaces for men and women and different age groups can be compared when using the complementary indicator.

In terms of access according to sex, 87.2% of women on average have access to these spaces and 87.0% of men; when comparing the values by city, the percentages of access are in general similar for each sex. For the cities of Los Angeles and Arica, the percentages of access to public spaces are slightly higher for men; in Peñaflor, the proportion of access is identical for each sex; and in the remaining fourteen cities the percentages are slightly higher for women. In all the cities analyzed, the percentage difference in access by sex does not exceed 1%, except in Punta Arenas, where the difference is 1.2% in favor of women.

Regarding access by age, it was decided to provide the results in the same age ranges in which the 2017 Census was disseminated (i.e., 0 to 5, 6 to 14, 15 to 64, and 65 and over). As in the disaggregation by sex, when the results are disaggregated by age range, the values are generally similar for each: 87.4% for persons from 0 to 5 years old; 87.9% for 6 to 14; 87.1% for 15 to 64; and 86.1% for 65 and over. This last age range has the lowest level of access to public spaces; on the other hand, the 6 to 14 age range has the highest level of access. Nevertheless, the results do not vary greatly among the defined age ranges.

39) Sex refers to the biological condition of the person, which can be male or female. Taken from https://www.ine.gob.cl/docs/default-source/censo-de-poblacion-y-vivienda/cuadros-estadisticos/censo-2017/conceptos-usados-en-cuadros-estad%C3%ADsticos.pdf?sfvrsn=f1ddbb89_4.

40) Age refers to the number of completed years from birth up to the time of the census (at 00:00 on 19 April 2017). Taken from https://www.ine.gob.cl/docs/default-source/censo-de-poblacion-y-vivienda/cuadros-estadisticos/censo-2017/conceptos-usados-en-cuadros-estad%C3%ADsticos.pdf?sfvrsn=f1ddbb89_4.

CONCLUSIONS

Application of DEGURBA methodology in Chile

The analysis of the results validates the possibility of identifying intermediate areas while diversifying and enriching the urban/rural dichotomous definition used by INE. DEGURBA methodology also provides a greater variety of territorial analysis and international comparability.

Given the far-reaching impacts on internal survey and census methodologies, the official implementation of these concepts within INE must be thoroughly evaluated, and it is therefore not possible in the short term. However, with the due safeguards for consistency of statistical design and estimate precision, the methodology provides a novel and useful way of disseminating results through its application.

The results are also regarded as a contribution to other institutions. The new perspective on the understanding of the territory can be translated into a useful tool for evaluating the needs of the population according to their location in urban, rural, and transitional areas, thus enabling more effective public policies.

Based on the analysis presented in this document, which has mainly focused on demographics and the adjustment of the national classification to DEGURBA methodology, we have concluded that the urban area is overestimated according to international parameters and, consequently, Chile has a larger rural population than what has been identified in the national classification. This overestimation can largely be attributed to the category of village entities, which would be considered part of concentrated rural areas, instead of urban areas as in the national classification. INE is faced with the challenge of reviewing its own methodology for defining urban/rural, specifically its population thresholds and the associated economic activity conditions, and thus we can valuate possible adjustments based on the results of DEGURBA methodology.

As for the criteria used by DEGURBA to define the classes, it seems reasonable to use density together with population thresholds and clusters derived from both as the main criteria, because, at least in Chile, the presence or absence of infrastructure such as street lighting, sewerage, and paved roads does not differentiate urban areas from rural areas, given their widespread availability throughout the national territory.

Finally, we can conclude that data generated by INE and available for the application of DEGURBA methodology satisfactorily meet the objectives proposed for this pilot test by which disaggregated population data at specific block levels of the urban area and at the level of rural entities can be obtained.

However, a critical analysis of INE data used for the pilot test shows that census cartography of the rural area has limitations, especially the absence of fixed boundaries for rural entities, which results from their definition and the dispersion of their dwellings, impeding the transfer of classes by DEGURBA level to the corresponding territorial units.

Calculation of priority SDG indicators

The calculation of the SDG indicators was limited to the available data, leaving as a challenge the execution of complementary analyses that include the required demographic variables (population disaggregation by sex, age ranges, and people with disabilities).

For indicator 11.2.1 "Proportion of the population that has convenient access to public transportation, by sex, age, and persons with disabilities", there is an opportunity to migrate from a national methodology (which currently uses data derived from the CASEN survey) to the international methodology used in the pilot test. On the other hand, the results of the survey make it possible to compare the results of the international methodology and verify its consistency. Additionally, we face the challenge of expanding the coverage of the indicator, in an initial stage, to the seventeen cities in the sample, and, in a second stage, to the remaining cities of Chile.

The main challenge to measurement of 11.3.1 "Ratio of land consumption rate to population growth rate" is the quality of the geospatial inputs of the 2002 Census, which, given the stage of development of geographic information systems at that time, do not meet INE's current geospatial information standards and policies. At the same time, the challenge is to expand the coverage of the indicator, in an initial stage, to the seventeen cities in the sample, and, in a second stage, to the remaining cities of Chile.

With respect to indicator 11.7.1 "Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities", although the updated cadaster of green areas is the main source for the definition of public space, there is a lack of geospatial information on the remaining public spaces (such as esplanades, public sports centers, etc.) to complete the cadaster and adequately measure the indicator. Therefore, the main challenge is to complete the cadaster and recalculate the indicator. However, it should be noted that green areas and land used for streets comprise practically all of the open spaces for public use by everyone.

In addition, the availability of three SDG 11 indicators for Chile makes it possible to close the national gap for meeting the challenges and goals of the Agenda 2030[41].

Finally, we can affirm that the indicators were processed and calculated correctly, which reflects both the availability of disaggregated and updated geospatial data and the national capacities to obtain results from DEGURBA methodology and the priority SDG 11 indicators, through coordination between the participating and deliberating public institutions.

41) For more information on Chile's progress toward the Agenda 2030, see: https://www.chileagenda2030.gob.cl/

Suggestion for other countries in the application of DEGURBA methodology and calculation of SDG indicators.

As a suggestion regarding the application of DEGURBA methodology and the calculation of SDG indicators by other National Statistical Offices (NSOs) in the region, we recommend the incorporation of geospatial information standards and policies, both for defining geodetic reference frames and for linking geospatial information with statistical information. These steps will ensure the correct positioning of the geospatial data and its linkage with the required statistical data (mainly on the population and its characteristics).

Second, we recommend that NSOs have available disaggregated geospatial data, ideally in the smallest possible statistical units for both urban and rural areas with national coverage that is linked to population data updated to the latest available population census.

We also recommend that NSOs have the capacity to process geospatial data, both in terms of the availability of professionals trained in the use of geographic information systems and geographic analysis and in the availability of related hardware and software.

SDG indicators require georeferenced cadasters of public goods and services for the respective measurements, in addition to disaggregated geospatial data with updated population data. Therefore, the development stage of geographic information systems and the production of geospatial data must be well developed not only in the NSOs, but also in the rest of the public services of the State that are responsible for keeping the cadasters of these goods and services up to date. This need could be integrated into the NSOs themselves in order to guarantee the availability of these data for the calculation of the indicators.

Indicator 11.3.1 “Ratio of land consumption rate to population growth rate” requires a time series of city growth, which may be difficult to obtain if countries have only recently developed capacities for the production of geospatial data or if they do not have geospatial data to reconstruct time series. Based on our experience of the pilot test, the quality of the geospatial data available for the time series made this indicator the most difficult to calculate.

However, UN-Habitat, the OECD, and Eurostat, among other organizations, have presented a series of alternatives for countries that lack sufficient development in the production of geospatial data. These alternatives involve the availability of a set of geographic information that has been developed in freely available platforms or as part of international initiatives aimed at making geospatial data available for countries to calculate SDG indicators through geographic information systems, which, although they may have problems of accuracy or temporality, are useful for satisfactorily obtaining results for measuring the advancement and fulfillment of the SDGs and the Agenda 2030.

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