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HISTORICAL POPULATION GRIDS AND SETTLEMENT DYNAMICS IN SPAIN: SPATIAL DISTRIBUTION, TERRITORIAL HETEROGENEITY, AND DEPOPULATION FROM 1887 TO 2021

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GRIDS HISTÓRICAS DE POBLACIÓN Y DINÁMICA DEL ASENTAMIENTO EN ESPAÑA: DISTRIBUCIÓN ESPACIAL, HETEROGENEIDAD TERRITORIAL Y DESPOBLACIÓN (1887-2021)

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RESUMEN

Este estudio propone una metodología innovadora para la construcción de una *grid* histórica de población, ESGRID1887, que permite analizar la distribución espacial de la población española a finales del siglo XIX. La cuadrícula se compara, a una escala granular y temporalmente consistente, con los patrones de asentamiento reflejados en la cuadrícula de población más reciente de EUROSTAT (GEOSTAT2021). ESGRID1887 utiliza datos del *Nomenclátor* de España (1887) y registros catastrales para distribuir la población registrada en el Censo español de 1887 en celdas de 1 km². A diferencia de los análisis basados en unidades administrativas, como los municipios, este enfoque detallado pone de relieve la importancia histórica de los asentamientos dispersos en amplias zonas de las periferias atlántica, cantábrica y mediterránea, así como en varias regiones montañosas de la península en 1887. La comparación con GEOSTAT2021 muestra que, aunque el área poblada aumentó del 21,6 % del territorio en 1887 al 26,4 % en 2021, este crecimiento relativamente modesto es el resultado de dos dinámicas opuestas: expansión y despoblación. Un tercio de las celdas habitadas en 2021 estaban deshabitadas en 1887, mientras que un tercio de las que estaban pobladas en 1887 se encuentran ahora vacías. Los hallazgos presentados en este artículo revelan, por tanto, una dimensión adicional del proceso de despoblación a largo plazo: el vaciamiento del territorio.

Palabras clave: Humanidades digitales, *Grids* históricas, Despoblación, Geografía, España

ABSTRACT

This study presents a novel methodology for constructing a historical population grid, ESGRID1887, that sheds light on the spatial distribution of Spain's population in the late nineteenth century. The grid is compared, at a granular and temporally consistent scale, with population settlement patterns revealed by the most recent population grid produced by EUROSTAT (GEOSTAT2021). ESGRID1887 uses data from the Nomenclátor of Spain (1887) and cadastral records to distribute the population reported in the 1887 Spanish Census across 1 km² cells. Unlike analyses based on administrative units (municipalities), this fine-grained approach highlights the historical significance of dispersed settlement across large areas of the Atlantic, Cantabrian, and Mediterranean peripheries, as well as in several mountainous regions of the peninsula in 1887. Moreover, the comparison with GEOSTAT2021 reveals that although the populated area increased from 21.6% of the territory in 1887 to 26.4% in 2021, this modest expansion resulted from two opposing dynamics: sprawl and depopulation. One third of the cells occupied in 2021 were uninhabited in 1887, while one third of those inhabited in 1887 are now

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uninhabited. The new evidence presented in this article thus reveals an additional dimension of the long-term depopulation process affecting a substantial part of Spain—the emptying of the territory—which has not previously been examined from a historical perspective.
Keywords: Digital Humanities, Historical Grids, Depopulation, Geography, Spain

Historical Population Grids and Settlement Dynamics in Spain: Spatial Distribution, Territorial Heterogeneity, and Depopulation from 1887 to 2021

1.- Introduction

Recent events in which the least-favoured territories—or "places that do not matter"—have expressed their discontent through the ballot box call into question the progress achieved in terms of balanced and inclusive development in advanced economies.[1] In this context, understanding the origins, evolution, and causes of territorial imbalances is of paramount importance. Within this framework, and particularly in the case of Spain, one of the most pressing issues is the unequal spatial distribution of the population—namely, the coexistence of densely populated areas with territories characterised by a virtual absence of population and economic activity.

Several studies that have examined this problem from a long-term perspective—whether from Economic History (Collantes and Pinilla, 2019; Collantes, 2020), Human Geography (Goerlich et al., 2006; Recaño, 2023), or Historical Demography (Franch-Auladell et al., 2013)—have argued that the current spatial distribution of population is the outcome of a long historical process, shaped by initial conditions and, above all, by the profound socio-economic and institutional transformations that have occurred since the onset of modern economic development in the mid-nineteenth century. However, other studies, such as Oto-Peralías (2017), Gutiérrez et al. (2020), and Gutiérrez et al. (2023), contend that the spatial distribution of population has remained remarkably persistent over the past two centuries. This persistence suggests that the abnormally low population density that characterises large areas of the Spanish territory did not emerge recently because of industrialisation or tertiarization processes.

In any case, these long-term studies analyse changes in population settlement and territorial emptying based on evidence that is, for the most part, aggregated at the municipal level.[2] However, settlement patterns can vary substantially within municipalities. In fact, in the Spanish case, given the pronounced heterogeneity that characterises municipalities as administrative units, evidence produced at this level of aggregation provides only a limited approximation of the actual spatial distribution of population. Therefore, to better understand the causes and consequences of depopulation, quantitative studies based on granular information—such as individual or

[1] Rodriguez-Pose (2018).

[2] In this sense, the works of Infante-Amate et al. (2016) or Ayuda et al. (2024) would be exceptions to this rule as they analyse the settlement of the population at a territorial aggregation scale smaller than the municipality: the population entity. Another apparent exception would be the works of Oto-Peralías (2017), Gutiérrez et al. (2020) or Gutiérrez et al. (2023), who use the population grid offered by EUROSTAT (GEOSTAT2011) to quantify the emptying of the Spanish territory. In this series of works, the low occupation of the territory, especially in the south of the peninsula, is related to the way in which it was repopulated, in a context of high risk of armed conflict, during the Reconquista (Gutiérrez et al., 2023). The accreditation of this hypothesis rests on the consideration of the distribution of the population in the territory collected in the *Censo de Pecheros* of 1528 or the Floridablanca Census of 1787, which relate to the existing population entities on both dates. However, since their location is unknown, it is approximated to the coordinates corresponding to the head of the municipality in which they are currently circumscribed. So again, the starting hypothesis is verified from evidence that is offered at a territorial aggregation scale that corresponds to the municipality and that hides the heterogeneity typical of the Spanish geography.

household-level data that can be aggregated—are needed (Duranton and Puga, 2020; Rosenthal and Strange, 2020).

To address this gap, the present study introduces a methodology for constructing a spatial data infrastructure that offers a rigorous and fine-grained depiction of population settlement patterns at the dawn of modern economic development. This infrastructure is built using information from two primary sources: the *Nomenclátor* of Spain of 1887 (NE1887) and cadastral records. The NE1887 provides data on *de facto* and *de jure* population, as well as the number of habitable buildings, for a total of 118,367 settlements, 106,944 of which are identified as singular entities. Among them, 42,212 are classified as cities, towns, places, or villages. The cadastral property databases, in turn, provide information on the year of registration, use, and location of existing buildings.[3]

Based on these sources, a historical grid of population distribution has been constructed through a two-stage process. In the first stage, the qualitative and quantitative information contained in the *Nomenclátor* of 1887 (NE1887) was extracted. Subsequently, the population entities recorded in 1887 were matched with those listed in other platforms—primarily the *Nomenclátor General Básico de España* (NGBE) and the *Nomenclátor Geográfico de Municipios y Entidades de Población* (NGMEP). Since these sources provide the geolocation of population entities, linking the NE1887 with the current databases made it possible to spatially process the 1887 data, thereby converting this dataset into a spatial data infrastructure. As a result, the geographical location of 58,837 population entities—out of the 106,944 singular entities identified in Spain according to the NE1887—was determined. This represents approximately 55% of all singular entities, encompassing 90.6% of the Spanish population in 1887.[4]

In the second stage, the gridding process was undertaken—that is, the spatial distribution of population entities, geo-referenced as points derived from the NE1887, across the territory. This procedure was primarily based on information from the Spanish Cadastre, as well as from the provincial cadastres of Álava, Guipúzcoa, Navarra, and Vizcaya, corresponding to buildings registered on or before 1900. Using this information, polygons were delineated around the listed isolated buildings or clusters of buildings. The population residing in geo-referenced singular entities was then allocated to the polygons containing their coordinates. The remaining population—those residing either in non-georeferenced entities or in scattered buildings—was distributed among the building polygons not used in the first step. This procedure was implemented

[3] The detailed account of the methodology employed in this study can be found in Diez-Minguela et al. (2025). A first attempt to construct historical population grids in Monteiro et al. (2019).

[4] The description of the source and the detail on the process of extracting the information, carried out within the framework of the ESPAREL project (Spain from the Old Regime to the Liberal State), can be found in Beltrán-Tapia et al. (2022). The use of the Nomenclator of 1887 to offer a spatial approximation to the distribution of the population in the territory in different geographical environments has been the subject of attention in different works. For example, Esteve (2003) or Sancho Comins et al. (2012) offer this type of evidence for Catalonia and the province of Guadalajara respectively.

municipality by municipality, ensuring that population figures were assigned exclusively to locations with habitable buildings at the time.

Finally, Geographic Information Systems (GIS) were employed to program an algorithm that mapped a population settlement grid for the late nineteenth century (1887), distributing the population across 1 km² cells. This grid can be directly compared with recently produced datasets, such as GEOSTAT2021.[5]

Therefore, the work carried out provides a spatial perspective on population settlement in Spain during the second half of the nineteenth century and allows for comparison with the current situation, dated to 2021. The initial results indicate that the number of occupied cells has increased from 21.90% to 22.57% of the territory (that is, by around 3%). Considering that the Spanish population multiplied by a factor of 2.7 between 1887 and 2021—from 17,560,340 inhabitants in 1887 to 47,487,400 in 2021—we can conclude that there has been a substantial increase in population density (measured as the number of inhabitants per occupied cell). However, this process has not occurred uniformly across space. The new evidence precisely identifies which parts of Spain's inland territory have experienced depopulation and which areas have undergone the most significant growth, particularly with the expansion of large metropolitan areas and residential and tourist zones. Overall, the study shows which portion of Spain's abnormally low territorial occupation can be traced back to conditions predating industrialisation and modern development, and which areas have been emptied over the period spanning from the late nineteenth century to the present day.

The remainder of the paper is organised as follows. Section 2 introduces the *Nomenclátor de España* of 1887, a detailed historical resource listing the population entities existing at that time. Section 3 describes the digitisation and georeferencing processes, while Section 4 explains the gridding procedure. The main contribution—the historical population grid for Spain in the late nineteenth century—is presented in Section 5. Section 6 compares the newly constructed 1887 dataset with GEOSTAT2021, and Section 7 summarises the main findings and conclusions.

2.- The *Nomenclátor de España de 1887*.

A *nomenclator* is a list, catalogue, or directory of individuals, firms, or places. In our case, the *Nomenclátor de las ciudades, villas, lugares, aldeas y demás entidades de población de España en 1º de Enero de 1888* (hereafter NE1887) is a directory of population entities (or settlements) in late 19th-century Spain. The *nomenclator* was an integral component of the official statistical system, serving as the cornerstone upon which data collection relied.[6]

[5] The comparison can also be established with the other two information structures developed by EUROSTAT in recent years, GEOSTAT2006 and GEOSTAT2011. In this sense, GEOSTAT2011 is the grid used in Gutiérrez et al. (2021) and (2023). A critical analysis of this spatial data infrastructure is found in Goerlich and Cantarino (2017).

[6] The first modern Spanish censuses were undertaken by mid-19th century (1857 and 1860) while the civil registry was introduced in 1870.

As in other countries, the consolidation of the State led to the establishment of a hierarchical system of administrative units. In Spain, the territory was organized into municipalities, judicial districts, and provinces—the former being the lowest level. Still, municipalities could comprise either a single (or a few) settlement(s) or an amalgamation of many distinct population entities.

The number of entities recorded in the early *nomenclators* (1858, 1860) varied greatly, mainly due to differing criteria.[7] In contrast, in NE1887 an entity was defined as a grouping of two or more buildings.[8] Moreover, unlike the *Nomenclátor que comprende las poblaciones, grupos, edificios, viviendas, albergues, etc., de las cuarenta y nueve provincias de España* of 1860 (NE1860), buildings without roofs or not used as dwellings were excluded. As a result, NE1887 reported a total of 106,944 singular entities—far fewer than the 478,038 listed in NE1860. Additionally, a specific category, "Disseminated buildings," was introduced to account for those residing in isolated dwellings.[9]

NE1887 not only listed the entities comprising the 9,287 municipalities existing at the time but also provided detailed information for each. First, every entity was classified as a city, town, place, village, or other category (including neighbourhoods, suburbs, railway stations, farmhouses, telegraph towers, Civil Guard barracks, labourers' houses, churches, abbeys, monasteries, palaces, and castles). Table 1 details the number of entities in each category. Furthermore, the *nomenclator* recorded the number of buildings—distinguishing whether they had one, two, three, or more floors—as well as both the *de facto* and *de jure* populations. In brief, NE1887 was published in eight volumes (comprising 1,591 pages) and was organized alphabetically by province and municipality.

[7] Muro *et al,* (1996).
[8] The dwellings could be (1) inhabited on a permanent or temporary basis or (2) uninhabited. In the NE1887 there are 6,375 entities with zero *de facto* or *de jure* population. Also, and although it was clearly stipulated that an entity was a grouping of 2 or more buildings, there are 22 (0.02% of total) dwellings with 1 building.
[9] See Melón (1961), Muro *et al,* (1996) and, above all, the general considerations of the NE1887 that can be found in Vol. 8 "*Cuaderno Cincuenta"* pp. 27-37.

Table 1. Entities in NE1887 by type.

	Number		Population	
Type	**Total**	**(%)**	**Total**	**(%)**
Cities	222	0.2	3,182,521	18.1
Towns	4,690	4.0	6,747,260	38.4
Places	17,130	14.5	3,920,782	22.3
Villages	20,170	17.0	1,253,309	7.1
Other	64,732	54.7	1,736,138	9.9
Disseminated buildings	11,423	9.7	720,330	4.1
Total	**118,367**	**100.0**	**17,560,340**	**100.0**

Source: NE1887 and own elaboration.

A simple examination of the number and type of entities that make up Spain's 9,287 municipalities reveals the remarkable heterogeneity that characterises the national territory (Table 2). At one end of the distribution, provinces such as Cádiz are organised into 42 municipalities and 167 main entities classified as cities, towns, places, or villages. At the other, A Coruña comprises 96 municipalities and 8,375 main singular entities. Moreover, when considering Spain as a whole, NE1887 indicates that roughly one-third of the population lived in entities that were not municipal capitals. This diversity calls into question the use of the municipality as the most appropriate unit of territorial aggregation for analysing the spatial distribution of population, and it provides the rationale for constructing a historical population grid.

Table 2. Municipalities and population entities by province in NE 1887.

	NE1887	
Provinces	**Municipalities**	**Singular Entities**[1]
Coruña, A	96	8.375 (11.117)
Lugo	64	5.693 (10.705)
Pontevedra	66	5.228 (7.054)
Orense	97	3.572 (4.883)
Oviedo	79	3.529 (8.029)
…	…	…
Almería	101	409 (2.426)
Ciudad Real	95	141 (617)
Murcia	42	406 (4.120)
Baleares	59	203 (1.540)
Cádiz	42	167 (2.239)
España	**9.287**	**42,212 (106.944)**

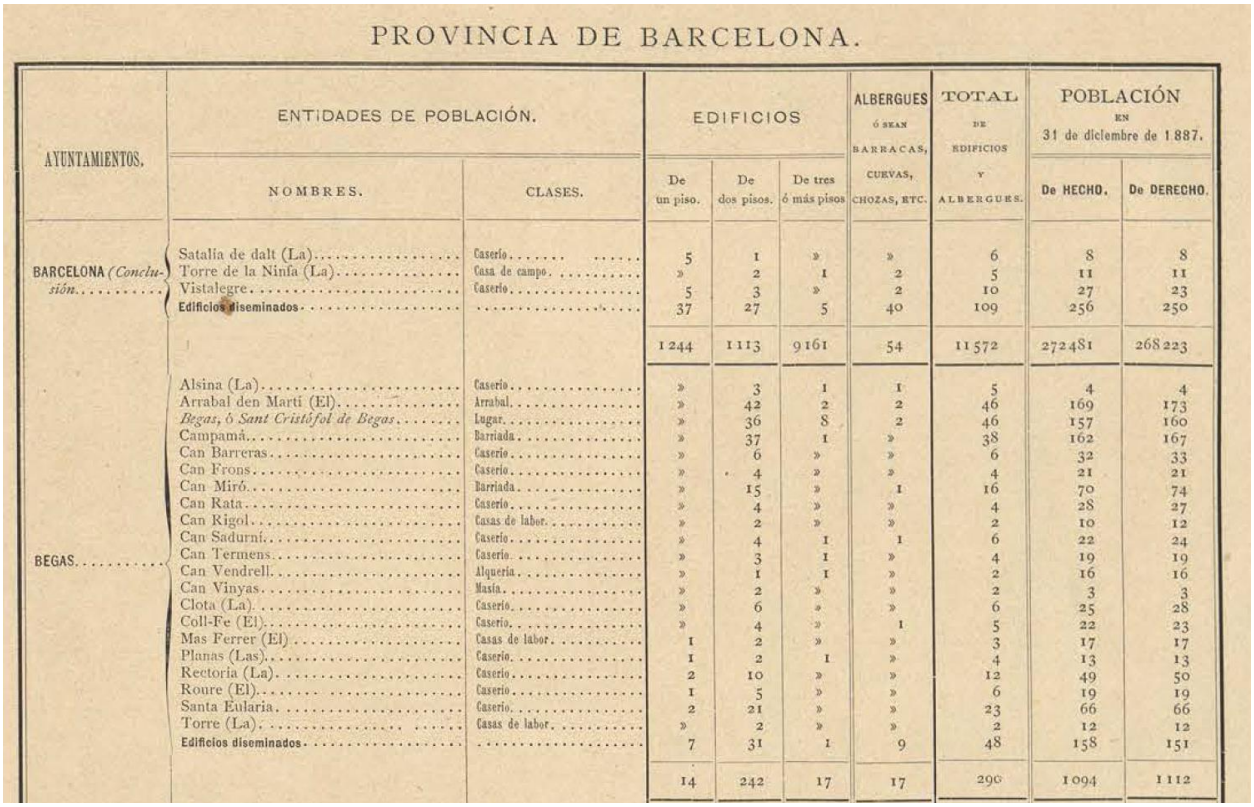
Note: Main or relevant entities, listed as cities, towns, places and villages. In brackets, total number of singular entities.
Source: NE1887.

3.- Digitization and georeferencing: looking for points

To develop a population grid dataset, the NE1887 first had to be converted into a machine-readable format. As illustrated in Figure 1 for the municipality of Begás in the province of Barcelona, the information is organised in rows, each corresponding to a singular entity, a set of disseminated buildings, or aggregated information. We employed Optical Character Recognition (OCR) tools and machine learning techniques to delimit rows and columns and to convert the scanned material into text format. Because the original entries were printed rather than handwritten, the character recognition process was relatively straightforward; nevertheless, machine learning was applied to enhance accuracy. Finally, the extracted text was tabulated and transformed into a structured dataset (CSV format). In sum, we have digitised the NE1887 for the whole of Spain, encompassing

50 provinces, 9,287 municipalities, 106,944 singular entities, and 11,423 records classified as disseminated buildings.[10]

Figure 1. NE1887: An image corresponding to the province of *Barcelona*.



PROVINCIA DE BARCELONA.

AYUNTAMIENTOS.	ENTIDADES DE POBLACIÓN. NOMBRES.	CLASES.	EDIFICIOS De un piso.	De dos pisos.	De tres ó más pisos	ALBERGUES Ó SEAN BARRACAS, CUEVAS, CHOZAS, ETC.	TOTAL DE EDIFICIOS Y ALBERGUES.	POBLACIÓN EN 31 de diciembre de 1887. De HECHO.	De DERECHO.
BARCELONA (*Conclusión*)	Satalia de dalt (La)	Caserío	5	1	»	»	6	8	8
	Torre de la Ninfa (La)	Casa de campo	»	2	1	2	5	11	11
	Vistalegre	Caserío	5	3	»	2	10	27	23
	Edificios diseminados		37	27	5	40	109	256	250
			1244	1113	9161	54	11572	272481	268223
BEGAS	Alsina (La)	Caserío	»	3	1	1	5	4	4
	Arrabal den Martí (El)	Arrabal	»	42	2	2	46	169	173
	Begas, ó Sant Cristófol de Begas	Lugar	»	36	8	2	46	157	160
	Campamá	Barriada	»	37	1	»	38	162	167
	Can Barreras	Caserío	»	6	»	»	6	32	33
	Can Frons	Caserío	»	4	»	»	4	21	21
	Can Miró	Barriada	»	15	»	1	16	70	74
	Can Rata	Caserío	»	4	»	»	4	28	27
	Can Rigol	Casas de labor	»	2	»	»	2	10	12
	Can Sadurní	Caserío	»	4	1	1	6	22	24
	Can Termens	Caserío	»	3	1	»	4	19	19
	Can Vendrell	Alquería	»	1	1	»	2	16	16
	Can Vinyas	Masía	»	2	»	»	2	3	3
	Clota (La)	Caserío	»	6	»	»	6	25	28
	Coll-Fe (El)	Caserío	»	4	»	1	5	22	23
	Mas Ferrer (El)	Casas de labor	1	2	»	»	3	17	17
	Planas (Las)	Caserío	1	2	1	»	4	13	13
	Rectoría (La)	Caserío	2	10	»	»	12	49	50
	Roure (El)	Caserío	1	5	»	»	6	19	19
	Santa Eularia	Caserío	2	21	»	»	23	66	66
	Torre (La)	Casas de labor	»	2	»	»	2	12	12
	Edificios diseminados		7	31	1	9	48	158	151
			14	242	17	17	290	1094	1112

Source: NE1887.

Using these data, we proceeded to locate the entities. In doing so, we greatly benefited from the work of the *Instituto Geográfico Nacional* (IGN) in developing the *Nomenclátor Geográfico Básico de España* (NGBE) and the *Nomenclátor Geográfico de Municipios y Entidades de Población* (NGMEP). These nomenclators not only catalogue existing settlements but also provide their precise geographical coordinates (latitude and longitude).[11] Then, using a matching technique based on the fields NAME of ENTITY and MUNICIPALITY where it belonged, we linked the past to the present.

The linkage of NE1887 with the current nomenclators involved several challenges and limitations. One of the main difficulties was the changing toponymy, resulting from the coexistence of multiple languages in Spain. In NE1887, entity names were reported exclusively in Spanish, whereas the

[10] The digitisation of the images into data was carried out at the Pattern Recognition and Human Language Technology (PRHLT) research centre (Universitat Politècnica de València), within the framework of the project ESPAREL (Beltrán-Tapia *et al,* 2022).

[11] The NGBE and the NGMEP are freely available at the *Instituto Geográfico Nacional* (IGN) website.

NGBE and NGMEP provide official names that may appear in Spanish, in a regional language, or in both. In addition, entities that belonged to a given municipality in 1887 may now form part of a different—though often neighbouring—municipality or even a different province. A clear example is Gátova, which was located in the province of Castellón in 1887 but today belongs to Valencia. Furthermore, frequent cases of municipal segregation and amalgamation have also occurred over time. For instance, the city of Madrid has absorbed a significant number of municipalities and entities (e.g., Chamartín de la Rosa, Vallecas) since 1887. Finally, some settlements have disappeared altogether due to forced population displacements, such as the construction of reservoirs (e.g., Campos de Arenoso), or because of outmigration. Table 3 summarises the main results of the geolocation process, aggregated at the provincial level and for Spain as a whole.[12]

Table 3. Entities with population and Population Georeferenced by province

Province	Populated entities	Georef. Singular entities	Georeferenced Share (%)	Population	Georeferenced Population	Georeferenced Population Share (%)
Álava	781	512	65,56	92.915	87.556	94,23
Albacete	1.368	730	53,36	229.105	210.549	91,90
Alacant/Alicante	1.623	782	48,18	433.043	371.252	85,73
Almería	2.275	787	34,59	339.452	280.303	82,58
Ávila	698	497	71,20	193.093	190.169	98,49
Badajoz	1.119	250	22,34	481.508	458.726	95,27
Illes Balears	1.451	589	40,59	312.588	259.274	82,94
Barcelona	4.208	1.150	27,33	902.970	779.457	86,32
Burgos	1.679	1.284	76,47	338.412	332.872	98,36
Cáceres	709	322	45,42	339.793	323.203	95,12
Cádiz	1.602	319	19,91	429.872	397.458	92,46
Castellón/Castelló	2.177	1.031	47,36	291.379	265.181	91,01
Ciudad Real	453	204	45,03	292.291	282.830	96,76
Córdoba	1.031	325	31,52	420.728	376.885	89,58
Coruña, A	11.398	9.071	79,58	613.881	541.701	88,24
Cuenca	833	428	51,38	242.462	232.841	96,03
Girona	2.270	1.099	48,41	306.583	275.573	89,89
Granada	2.078	551	26,52	484.638	420.845	86,84
Guadalajara	809	509	62,92	201.518	196.830	97,67
Guipúzcoa	1.916	504	26,30	181.845	105.273	57,89
Huelva	637	224	35,16	254.831	245.167	96,21
Huesca	1.512	955	63,16	255.137	245.196	96,10
Jaén	1.471	430	29,23	437.842	388.584	88,75
León	1.785	1.458	81,68	380.637	373.900	98,23
Lleida	1.609	1.039	64,57	285.417	263.643	92,37
Rioja, La	658	306	46,50	181.465	176.649	97,35
Lugo	11.101	8.119	73,14	432.165	358.204	82,89

[12] It is worth noting that in the NE1887 the information corresponding to Ceuta is included in the province of Cádiz.

Madrid	679	313	46,10	682.644	663.864	97,25
Málaga	1.839	346	18,81	519.377	444.615	85,61
Murcia	4.059	953	23,48	491.436	373.591	76,02
Navarra	1.348	913	67,73	304.122	287.512	94,54
Ourense	4.828	3.660	75,81	405.127	357.989	88,36
Asturias	8.374	5.395	64,43	595.420	505.662	84,93
Palencia	726	483	66,53	188.984	185.003	97,89
Palmas, Las	1.405	520	37,01	121.990	97.921	80,27
Pontevedra	7.212	5.027	69,70	443.385	355.733	80,23
Salamanca	1.230	883	71,79	314.472	308.159	97,99
Santa Cruz de Tenerife	1.900	596	31,37	169.635	127.620	75,23
Cantabria	1.258	962	76,47	244.274	236.885	96,98
Segovia	656	415	63,26	154.443	150.300	97,32
Sevilla	1.097	315	28,71	544.815	519.795	95,41
Soria	800	556	69,50	151.530	147.494	97,34
Tarragona	938	375	39,98	348.579	316.942	90,92
Teruel	1.018	425	41,75	241.865	218.175	90,21
Toledo	825	384	46,55	359.562	349.964	97,33
Valencia/València	2.355	707	30,02	735.036	675.932	91,96
Valladolid	586	298	50,85	267.148	259.939	97,30
Vizcaya	2.974	876	29,46	235.659	163.111	69,21
Zamora	758	529	69,79	270.072	265.252	98,22
Zaragoza	1.139	431	37,84	415.195	388.570	93,59
Total	**107.255**	**58.837**	**54,86**	**17.560.340**	**15.840.149**	**90,20**

Source: N1887.
Note: The column populated entities include one observation per municipality where the category 'disseminated buildings' is specified. Of the total 108,367 population entities contained in NE1887, 11,112 have no population data and are not considered in the analysis.

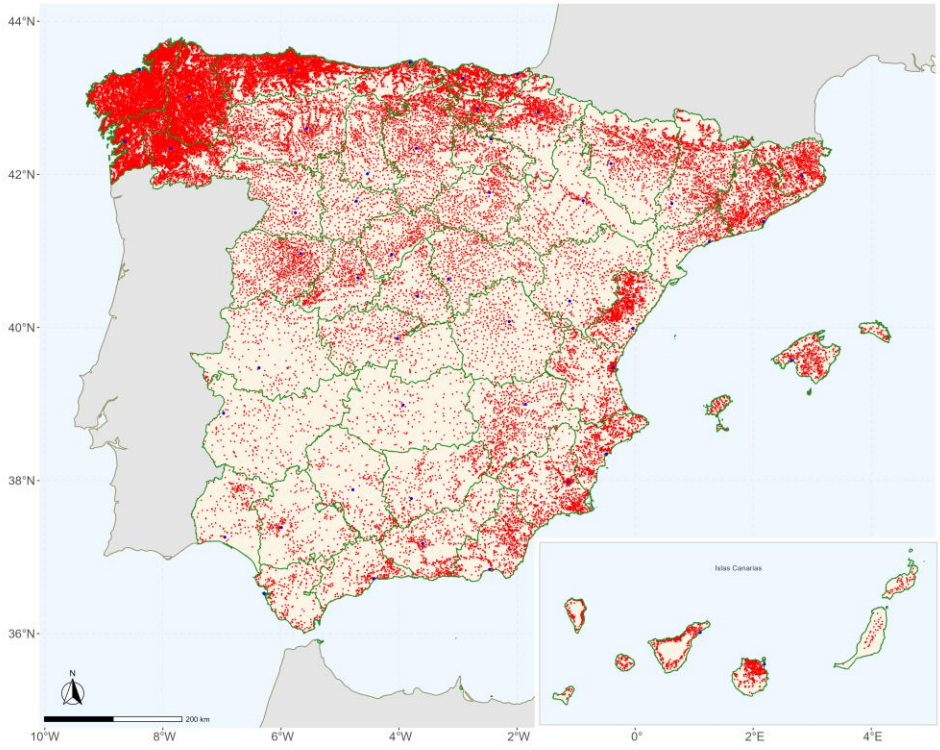
The source provides 118,237 records corresponding to both singular entities and aggregates of disseminated buildings by municipality. However, 11,112 of these records do not contain population data and were therefore excluded, resulting in a total of 107,255 records in our database. The process described above enabled the geolocation of 58,837 unique population entities, representing 54.86% of the total number of records with population data and 55.02% of the unique population entities listed in NE1887 (106,944). These include all 9,287 municipal capitals that constituted the basic administrative structure of the State. In terms of population coverage, the geolocation process identified 15,840,149 inhabitants—equivalent to 90.2% of the *de facto* population recorded in the 1887 Population Census of Spain and 94% of the total geolocatable *de facto* population.

The results of entity matching and geolocation are not homogeneous across the territory. The highest rates of geolocated entities are observed in Castilla y León (Ávila, Burgos, and Salamanca), Cantabria, and Galicia (A Coruña, Lugo, Ourense), where the percentage exceeds 70% of the total.

At the other end of the distribution are several provinces in Andalusia, Extremadura, and Catalonia, with geolocation rates below 30%. However, the percentage of geolocated entities does not correspond exactly to the share of geolocated population. For instance, in Andalusia—particularly in the province of Cádiz—population is concentrated in a small number of settlements. Consequently, geolocating fewer than 20% of entities accounts for over 90% of the population.

Conversely, in the Basque provinces of Gipuzkoa and Bizkaia, where 26.3% and 29.6% of entities were geolocated respectively, these represent only 57.9% and 69.2% of the total population. In these cases, the lower population coverage reflects the high degree of settlement dispersion, with population scattered among numerous minor entities such as *caseríos* and *casas de labor*. Finally, in much of Castilla y León, the predominance of settlements classified as *villas*, *lugares*, or *aldeas*, which are well documented historically, facilitates their identification and, consequently, the geolocation of their resident populations.

Map1. Spanish singular population entities georeferenced.



Note: The provincial capitals are the blue circles.
Source: NE1887, own elaboration.

All in all, we were able to produce Map 1, which displays the 58,857 geolocated singular population entities. The new evidence derived from the geolocation of the entities listed in NE1887 provides a representation of population settlement across the territory with a level of spatial detail far superior to that obtained from the traditional approach based solely on municipal boundaries and the location of their respective capitals.

4.- Developing the population grid: entities' contours and gridding

Using the population information published in NE1887 together with the georeferenced coordinates, it has been possible to develop Map 1. However, population data are only known at a point, corresponding to the centroid of each geolocated entity. Consequently, entities without coordinates, as well as those classified as disseminated buildings, cannot be mapped directly. To distribute population across space in a 1 km² grid, it is therefore necessary to develop a suitable allocation mechanism or rule of thumb.

On the one hand, Arribas-Bel et al. (2021) employed information on the location and surface area of buildings from the cadastre to delineate contemporary urban areas for a set of Spanish cities. On the other hand, as Uhl et al. (2023) demonstrate, the Spanish cadastre allows the reconstruction of historical building footprints, as it provides the year of construction or registration for each building. More recently, Goerlich (2025) presents an initial attempt to use cadastral information to construct historical population grids for Spain in the 20th century. Nevertheless, all these studies highlight the potential survival bias arising from relying solely on cadastral data to identify historical population settlement boundaries or to distribute population across the territory.

To overcome these constraints, in this article we propose combining two sources—NE1887 and cadastral records—to distribute population point observations across the territory. The procedure followed to allocate population to a 1 km² grid was as follows. The information extracted from NE1887 was classified into three categories: singular entities with coordinates (Category A), singular entities without coordinates (Category B), and scattered buildings (Category C) (see Table 3). Our goal was to distribute the population across space for entities in Category A, which account for 90.2% of the total population, as well as for entities in Category B (5.7%) and Category C (4.1%). To this end, we used information from the Spanish cadastre, including the cadastres of Navarra, Gipuzkoa, Álava, and Bizkaia, to identify buildings constructed in 1900 or earlier. This information allowed us to delineate historical boundaries for population entities (Categories A and B) and to locate isolated buildings classified as Category C.

It is important to note that these sources are not free from errors. Therefore, our approach should be understood as a proxy for delineating settlement boundaries and locating isolated buildings. Ideally, the first-best alternative would be access to detailed historical cartography.[13]

[13] For France, Bellefon et al. (2021) have shown how to delineate urban areas using historical maps with buildings.

Table 4. Population (NE1887) classified by type.

Category	Description	Entities	Population
A	Singular Entities with coordinates	58,837	15,840,149
B	Singular Entities without coordinates	36,995	999,861
C	Scattered buildings	11,423	720,330
	Total	**107,255**	**17,560,340**

Source: Own elaboration from NE1887.

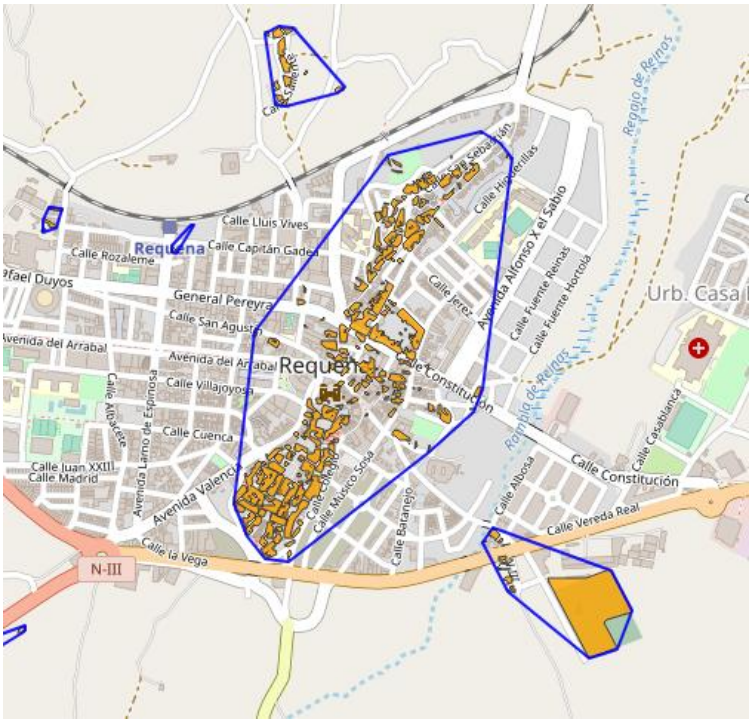
To do this, once buildings constructed in 1900 or earlier had been extracted from the cadastres, we proceeded as follows. First, the buildings were classified into two groups: those forming clusters of buildings, corresponding to the population in entities under Categories A and B, and isolated buildings, corresponding to Category C. For building clusters, we delineated the approximate historical boundaries around 1900 using an enclosing polygon.[14] Figure 2 illustrates the contours of several entities within the municipality of *Requena*, following a convex hull approach.[15] For the identification of isolated buildings, an algorithm was developed to replicate the instructions stipulated in NE1887. That is, we have classified as isolated buildings those located beyond a distance threshold (200 m.) from the existing nuclei in a municipality and which, between them, do not form a new nucleus.[16] Therefore, we have (1) clusters of buildings and (2) isolated buildings.

[14] In cases where the number of buildings registered in the Cadastre with a date equal to or earlier than 1900 did not allow for the distribution of the population, buildings registered in subsequent years (1910, 1920, etc.) were included sequentially until enough buildings were accounted for to distribute the population. The details of the procedure can be consulted in Diez-Minguela et al. (2025).

[15] Using other approaches to delineate the contours do not significantly alter the results obtained.

[16] The NE1887 instructions do not specify the minimum distance for building to be considered as isolated. In this procedure, we have stipulated a 200 meters threshold.

Figure 2.- Contours of nuclei of buildings in the municipality of Requena (Valencia).



Source: NE1887 and Cadastre, own elaboration. Buildings existing circa 1900.

With respect to Category A, and once the varying types of buildings have been identified, the contours are delineated. That is, we delineate the contours for the buildings. Then, and using the coordinates, we match the entity to the contour, or polygon.[17]. Regarding entities without coordinates (Category B), as far as some building clusters have not been associated with a georeferenced entity, the population of the most populated non-georeferenced entity was assigned to the largest unassigned polygon in the previous step, and so on. This process is undertaken at the municipal level to guarantee consistency. Finally, and for these two categories (A and B), we have made use of the *areal weighting* method to allocate the population to each cell.

[17] In some cases, however, there is no polygon within 200 m. of the coordinates. Then, a squared polygon around these coordinates is developed. In this regard, if an entity has less than 50 inhabitants, the population is distributed to the corresponding 1 km^2 cell. If the entity is larger than 50 inhabitants, a squared polygon is created for this purpose. The size of the squared polygon is proportional to the population of the entity.

Finally, the population in Category C, corresponding to disseminated buildings, was distributed as follows. We first assumed an average household size of eight individuals. For example, to allocate a population of 80 inhabitants living in disseminated buildings, ten households or units would need to be identified. Given that this population is scattered across isolated buildings, we randomly distributed the inhabitants within each municipality across the buildings identified as isolated around 1900, as described in the previous characterization.[18]

5.- The Spanish population grid for 1887: ESGRID1887

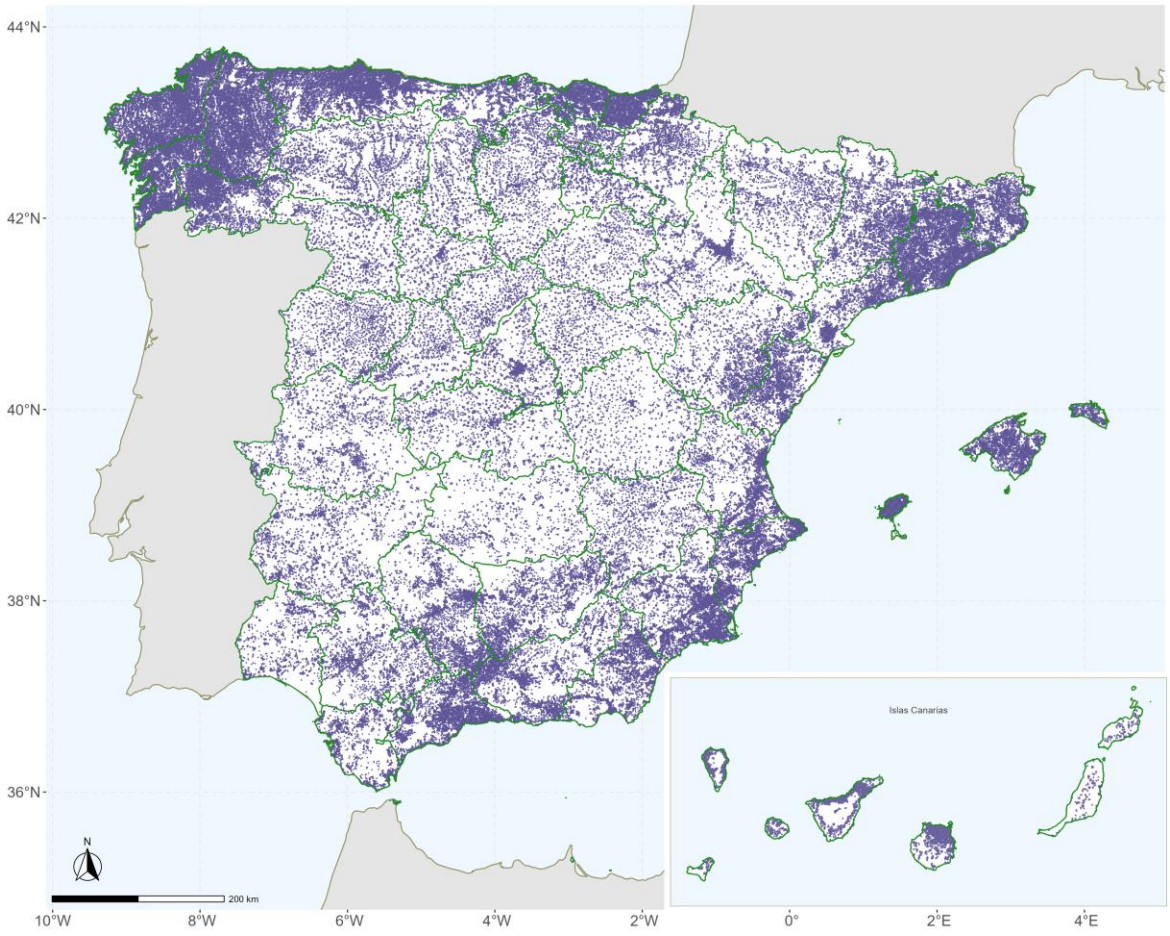
By combining the information, eliminating duplicated cells, and distributing the population within each polygon to the corresponding 1 km² cells using areal weighting, we obtain a total of 111,969 inhabited cells, representing 21.90% of the Spanish territory.

Map 2 illustrates the highly unequal occupation of the territory that characterized Spain at the end of the 19th century. Within this heterogeneity, the densest settlement is found along the Atlantic and Cantabrian coast, particularly in the coastal provinces of the Basque Country, Asturias, and Galicia. In these regions, dispersed settlement across numerous small population entities is the predominant pattern, with percentages of occupied cells ranging from 82.43% in Gipuzkoa, 71.73% in Bizkaia, 69.36% in Pontevedra, 68.05% in A Coruña, and 51.64% in Asturias (Table A1 in Appendix).

This dispersed settlement pattern is also observed along the Mediterranean coast, encompassing most of Catalonia, the Balearic Islands, large inland areas of the Valencian Community, the Region of Murcia, and Andalusian provinces such as Málaga and Granada. Notably, the proportion of occupied territory is particularly high in the province of Barcelona (66.51%), the Balearic Islands (52.54%), Alicante (47.04%), Málaga (43.08%), and Murcia (34.40%).

[18] Although this assumption can be understood as arbitrary, the 1887 Spanish Population Census provides information, by judicial district, on the household average size. The average for the whole Spanish judicial districts is 3.79 members, but we have amplified this threshold to 8 people to control for an excessive dispersion of population across territory.

Map 2. Inhabited 1 km^2 cells. Spain 1887.



Note: Grid-cells 1km^2

Source: NE1887, Cadastre and own elaboration.

In contrast, the occupation of the territory was much lower in the interior of the Peninsula, including Aragon, Castile and León, Castile-La Mancha, Extremadura, and large parts of Andalusia, with the provinces of Castile-La Mancha exhibiting the lowest percentages of inhabited territory. Among these, the provinces with the smallest proportion of inhabited area are Ciudad Real (6.12%), Cuenca (7.18%), Toledo (9.68%), and Guadalajara (9.81%) in Castile-La Mancha; Cáceres (9.99%) and Badajoz (10.18%) in Extremadura; Huelva (10.50%) in Andalusia; Soria (10.66%); and Zaragoza (10.75%) and Huesca (12.13%) in Aragon. All these provinces show percentages of inhabited cells well below the Spanish average.

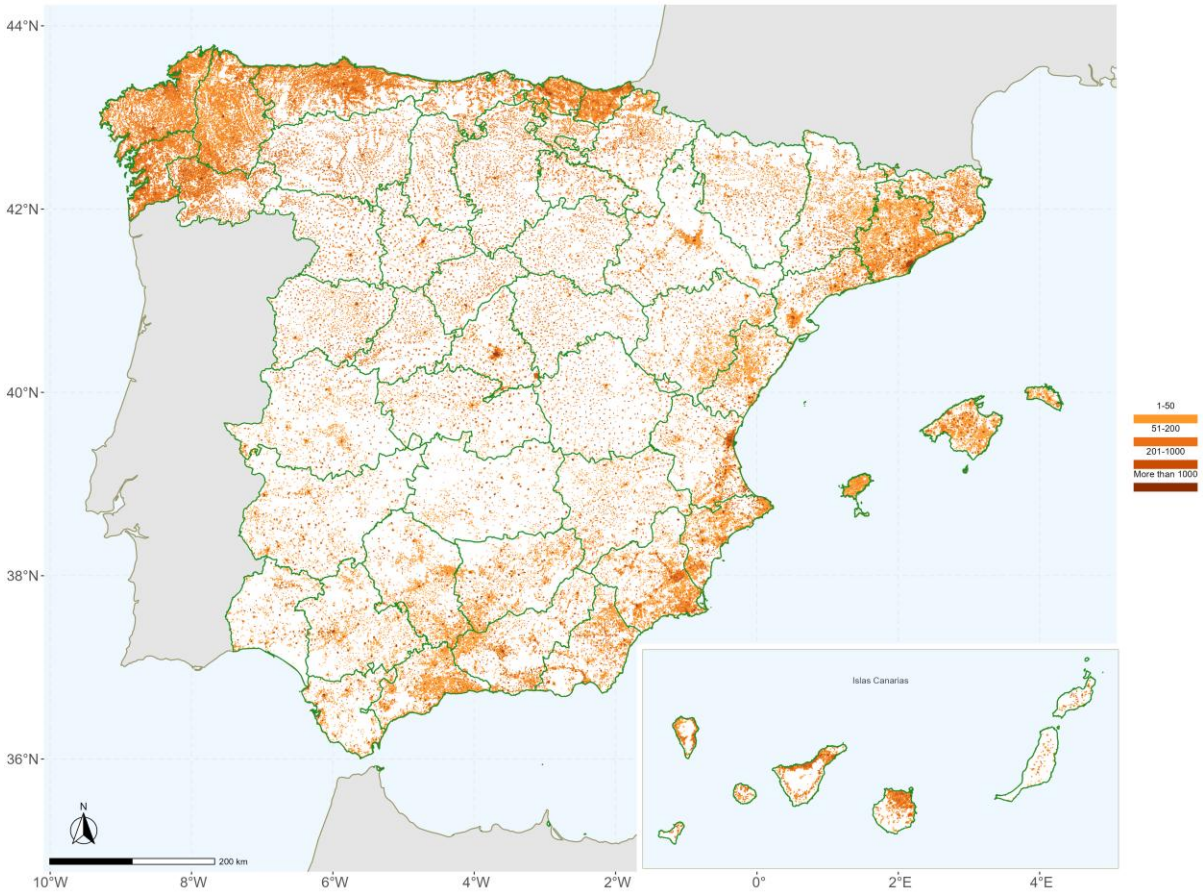
However, considering land occupation alone does not fully capture aspects relevant to the long-term presence of depopulation problems. The capacity of a region to support agglomeration economies, sustain knowledge generation, reduce the sunk costs of human capital accumulation,

and ensure access to public services, transport, or communication networks depends not only on the proportion of occupied territory but also on the population volume per cell and the spatial distribution of densely inhabited cells—that is, the urban or rural character of the environment as experienced by its inhabitants.

Table A2 provides additional information on provincial average population per occupied cell. Data on experienced density reinforce the observation of substantial territorial inequalities prior to the onset of the growth and agglomeration processes typical of modern economic development. For Spain as a whole, the average population per occupied cell was 157 inhabitants (precisely 156.83). At the upper end of the distribution, Madrid recorded 588 inhabitants per 1 km² cell, followed by Valencia (309), Valladolid (286), and Seville (247). In contrast, provinces such as Lugo (70 inhabitants), the Balearic Islands (106), A Coruña (108), Asturias (109), and Gipuzkoa (112) show low population density per occupied cell.

Map 3, which differentiates population volume per inhabited cell by color, further illustrates the pronounced territorial inequalities in 1887 and allows these disparities to be located geographically. Overall, the map highlights that very few territories combined the two elements that confer an urban character: a high number of inhabitants per km² and the aggregation of a sufficiently large number of cells with these characteristics. In this regard, Spain in 1887 can be characterized as predominantly rural, with a limited number of urban areas and considerable geographical distance between them.

Map 3. Population by1 km^2 inhabited cell. Spain, 1887



Note: Grid-cells 1km^2

Source: NE1887, Cadastre and own elaboration.

6.- A comparison between settlement patterns in ESGRID1887 and GEOSTAT2021

Comparing the new spatial evidence on Spanish settlement patterns in the late 19th century with that provided by GEOSTAT2021 reveals several important insights. First, although the population increased by a factor of 2.66 between 1887 and 2021 (from 17,560,340 to 47,400,798), the number of inhabited 1 km² cells increased only slightly, from 111,969 (21.90% of the territory) to 115,410 (22.57% of the territory). In other words, the number of inhabited cells grew by just 3.06%. Under these conditions, experienced population density (i.e., population per inhabited cell) increased by a factor of 2.62, rising from 156.83 inhabitants per cell in 1887 to 410.72 in 2021.

However, Table 5 shows that this overall result reflects two opposing dynamics. First, in 2021, a substantial percentage of inhabited cells were uninhabited in 1887. Second, and of comparable magnitude, a significant portion of the territory that was inhabited in 1887 has become depopulated. Specifically, of the 115,410 cells inhabited in 2021, 34,909 were uninhabited in 1887

(30.24%). Conversely, 31,468 of the 111,969 cells inhabited in 1887 (28.10%) are uninhabited in 2021. Thus, over more than 130 years, two seemingly opposing trends have occurred: an expansion of the inhabited area, and the depopulation of a substantial part of the territory.

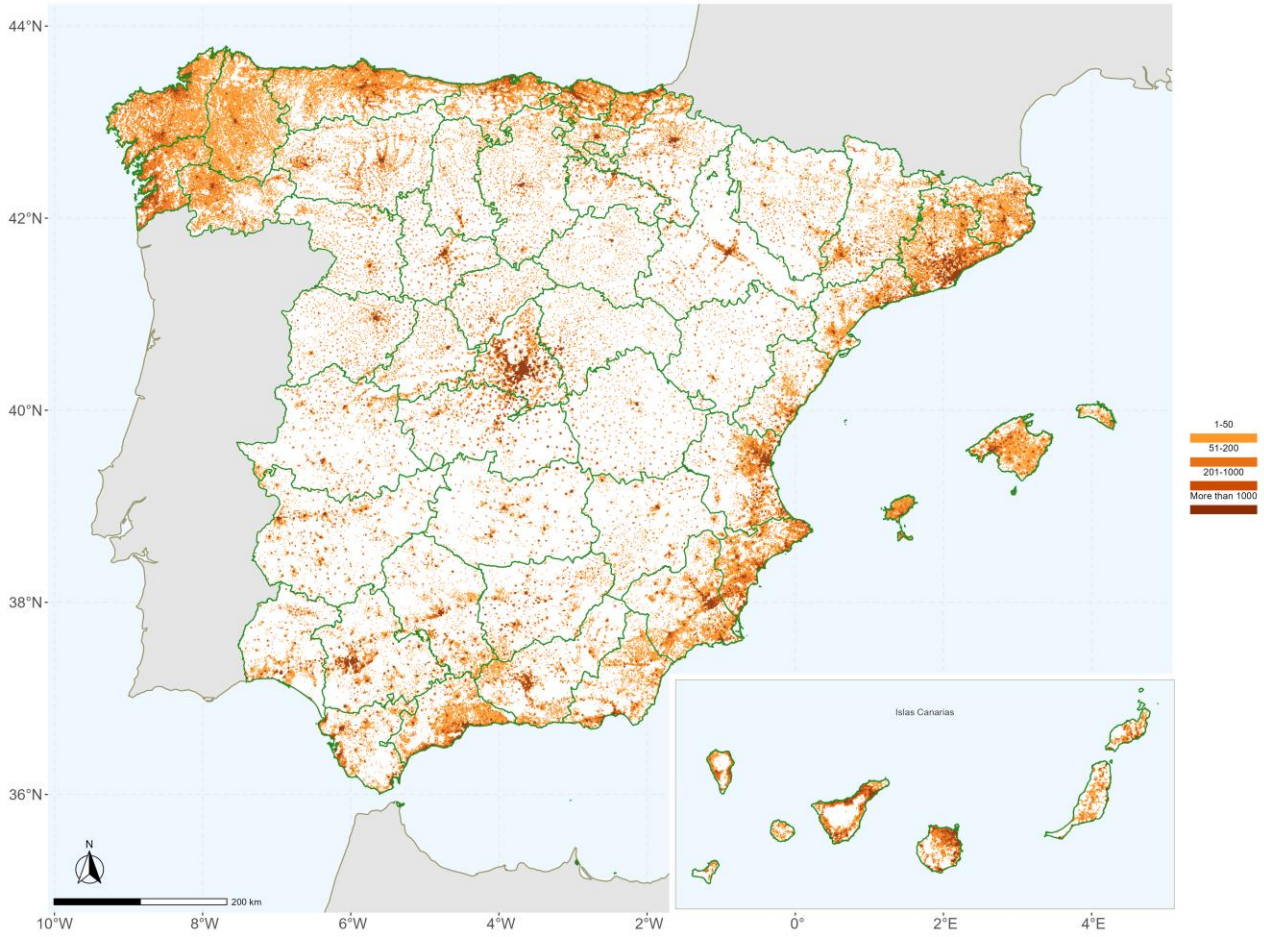
Table 5. Cross comparison. GRID1887 vs. GEOSTAT2021

		1887		
		inhabited	**uninhabited**	**Total**
2021	**inhabited**	80.501	34.909	**115.410**
	uninhabited	31.468	364.416	**395.884**
	Total	**111.969**	**399.325**	**511.294**

Source: Own elaboration and GEOSTAT2021.

Comparing Map 4, which displays population per 1 km² cell in GEOSTAT2021, with Map 3, which presents the same information for 1887, allows us to locate this dual dynamic across the territory. Part of the increase in the number of occupied cells is associated with the expansion of metropolitan areas of large cities, such as Madrid, Valencia, Zaragoza, Alicante, and Seville, as well as the concentration of population in other provincial capitals. In contrast, the reduction in the number of occupied cells appears to result from the decline of dispersed settlement. This reduction, however, has been uneven, affecting regions where dispersed settlement was common in 1887 to different extents. Specifically, the decrease in areas occupied by dispersed settlements was concentrated along the Mediterranean coast, while the Cantabrian coast was much less affected.

Map 4. Population by1 km^2 inhabited cell. Spain, 2021



Note: Grid-cells 1km^2
Source: GEOSTAT2021, EUROSTAT.

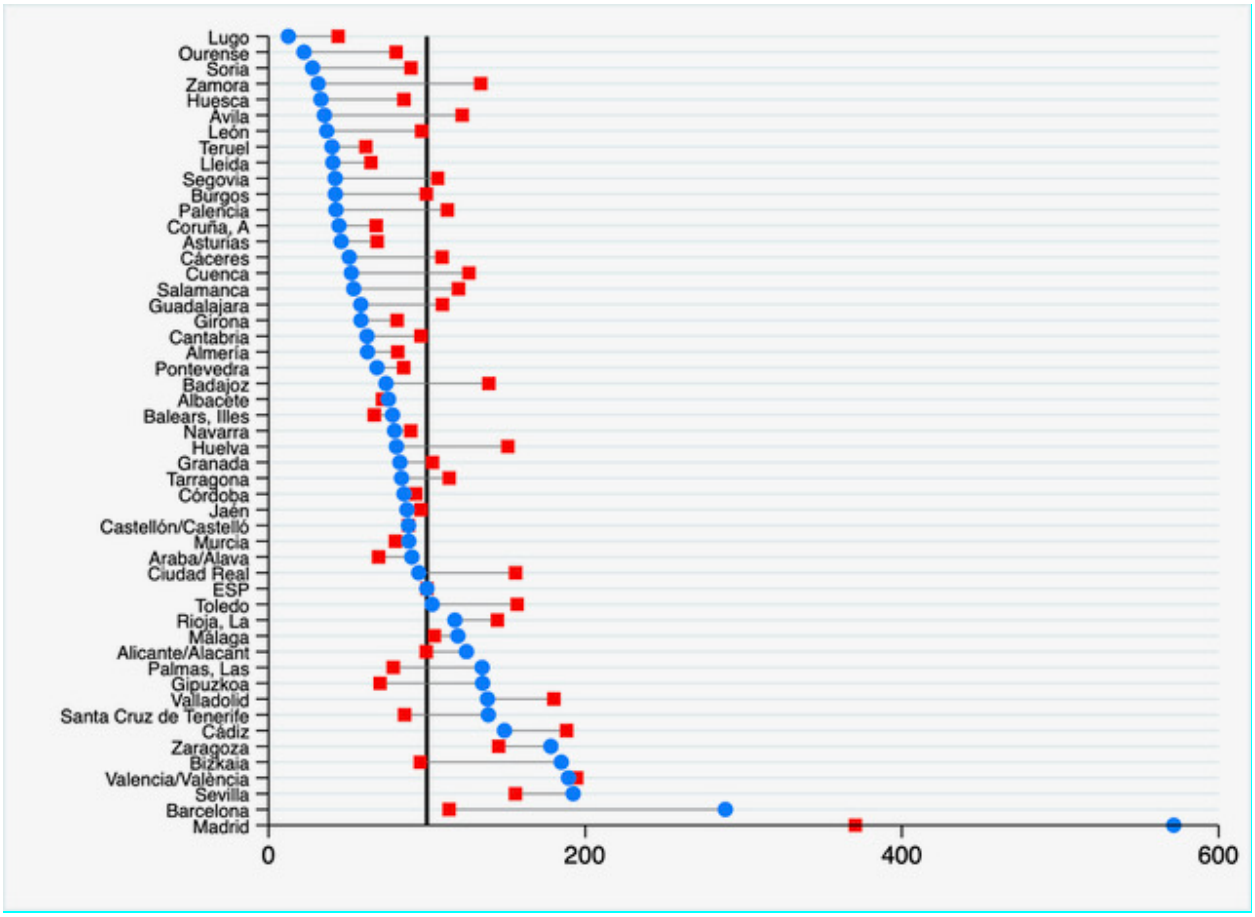
Table A3 illustrates the heterogeneity that characterizes the evolution of population settlement across Spanish provinces over the period analyzed. On one hand, the provinces that experienced the greatest loss of inhabited territory in 1887 were generally those with a relatively extensive dispersed habitat. Examples include Gipuzkoa, which saw its inhabited area decline by 15.4%, Teruel (11.4%), Jaén (8.5%), and Castellón (7.1%). In other words, the reduction of dispersed settlements largely explains the loss of occupied territory.

Conversely, the provinces that experienced growth in inhabited area were led by large cities in regions with initially low land occupation, such as Madrid (22% growth) and Valencia (8.8%), as well as by provinces that developed a strong tourism sector, regardless of their initial land occupation. This includes the Balearic Islands (12.4%), Girona (14.3%), Tenerife (15.3%), Alicante (15.6%), and Las Palmas (22.3%). Overall, the combined effect of these dynamics has reinforced a pattern of extensive and growing coastal occupation, alongside a gradual depopulation of the interior, with the exception of the nuclei around provincial capitals.

Regarding the evolution of experienced population density, the period from 1887 to 2021 has also profoundly altered the relative population size of inhabited cells. Figure 3 presents population per inhabited cell by province, normalized to the Spanish average for both years. In general, provinces that experienced growth in occupied area also saw an increase in population per inhabited cell relative to the Spanish average. Among the large cities, Madrid illustrates this trend, with occupancy per inhabited cell increasing from 3.71 times the Spanish average in 1887 to 5.71 in 2021. Provinces such as Barcelona, Zaragoza, and Seville follow a similar trajectory, albeit at lower multiples. A comparable dynamic is observed in provinces with a strong tourism sector, including Málaga, Alicante, Tenerife, and Las Palmas, which started below the Spanish average in 1887 but registered substantial growth in both occupied area and population per inhabited cell by 2021.

At the other extreme, provinces characterized in 1887 by low population per inhabited cell have, in many cases, seen this relative deficit persist or even widen by 2021. This includes provinces with highly dispersed settlements and few inhabitants per occupied cell, such as Lugo and Orense. It also includes provinces where population contraction did not significantly reduce the occupied area but led to a notable decline in population per inhabited cell, as in Soria, Zamora, and Ávila.

Figure 3. Population by1 km^2 inhabited cell in 1887 and 2021. Spain=100



Note: Mean size of inhabited cell (ESP=100) in 1887 (red) and 2021 (blue). Excluding (1) cells intersecting provinces and (2) the territories of Ceuta and Melilla.

Source: Own elaboration and GEOSTAT2021.

7.- Concluding remarks

Throughout this paper, we have introduced a novel methodology to develop historical population grid data for Spain in the late 19th century. To this end, we digitized information on population entities, including de facto and de jure population, as recorded in the NE1887. Digital tools were then employed to link the entities existing in 1887 with those in contemporary gazetteers, which provide georeferencing. As a result, it was possible to locate a total of 58,837 unique population entities, representing approximately 55% of those listed in the NE1887 and encompassing 90.6% of the Spanish population. Furthermore, by programming an algorithm that utilizes information from Spanish cadastres, we were able to delineate the outlines of pre-1900 residential buildings forming these population entities. The combination of these tasks enabled the construction of a

population grid—a spatial data infrastructure for the entirety of Spain in the 19th century—constituting a novel and pioneering contribution in an international context.

Based on this new evidence, our study sheds light on the evolution of Spain's population distribution from the end of the 19th century to the present, tracing the transition from a pre-industrial to a modern economy. By using grid cells instead of municipalities, we have been able to more accurately capture population dynamics and identify lines of research that can refine our understanding of the timing and explanatory factors behind the depopulation of significant portions of the Spanish territory.

The new evidence highlights the substantial heterogeneity of population settlement in Spain prior to the surge of economic development in the second half of the 19th century. A granular approach reveals the importance of dispersed settlements in large areas of the Atlantic, Cantabrian and Mediterranean peripheries, as well as in some mountainous regions. In contrast, much of the interior was characterized by a concentration of population in the main population entities. At the aggregate level, the average occupation of the territory was 21.6%; however, this figure masks the extreme heterogeneity evident both in terms of the percentage of inhabited cells and experienced population density.

The comparison with the most recent spatial population data, GEOSTAT2021, is particularly revealing. Over 135 years, some expansion of populated areas has occurred, but the overall balance results from two opposing dynamics. Approximately one third of the cells inhabited in 2021 were uninhabited in 1887, whereas one third of the cells inhabited in 1887 are uninhabited in 2021. This demonstrates that the configuration of depopulated Spain reflects both a loss of population per municipality and a reduction in the occupied area within municipalities. The new evidence thus identifies an additional, previously underexplored aspect of the depopulation process: the emptying of territory. Understanding this phenomenon will require consideration of explanatory factors not yet extensively addressed in the literature.

This work also contributes to debates regarding the timing of depopulation in significant parts of Spain. The new evidence shows that the limited occupation of territory was not merely a legacy of a distant past; rather, a substantial portion of currently uninhabited land was densely occupied at the end of the 19th century. Moreover, the comparison of the 1887 and 2021 grids supports arguments in the literature linking depopulation to productive transformations and the agglomeration advantages associated with the transition from an agrarian to an industrial economy.

Finally, the construction of this granular population data infrastructure opens new avenues for research on the chronology of territorial emptying and the concentration of population in municipal centers. In particular, the evidence suggests the potential importance of state administrative presence and service provision as factors driving population concentration in primary settlements. Overall, the development of historical population grids appears to be a highly fruitful research

avenue, as it illuminates a "black box" that has previously limited the scope and aims of demographic and territorial research.

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APPENDIX

Table A1. Surface and Inhabited surface by province in 1887

Province	CCAA	Total 1km^2 cells	Inhabited 1 km^2 cells	Inhabited Share
Ciudad Real	Castilla-La Mancha	19251	1179	6,12
Cuenca	Castilla-La Mancha	16679	1199	7,19
Toledo	Castilla-La Mancha	14802	1433	9,68
Guadalajara	Castilla-La Mancha	11738	1151	9,81
Cáceres	Extremadura	19544	1953	9,99
Badajoz	Extremadura	21361	2175	10,18
Huelva	Andalucía	10124	1063	10,50
Soria	Castilla y León	9901	1055	10,66
Zaragoza	Aragón	16558	1780	10,75
Huesca	Aragón	15370	1864	12,13
Valladolid	Castilla y León	7683	932	12,13
Zamora	Castilla y León	10331	1263	12,23
Ávila	Castilla y León	7679	973	12,67
Salamanca	Castilla y León	12142	1643	13,53
Albacete	Castilla-La Mancha	14475	1983	13,70
Palencia	Castilla y León	7633	1046	13,70
Segovia	Castilla y León	6619	909	13,73
Madrid	Madrid, Comunidad de	7602	1157	15,22
Burgos	Castilla y León	13631	2119	15,55
Sevilla	Andalucía	13520	2182	16,14
León	Castilla y León	15103	2469	16,35
Rioja, La	Rioja, La	4702	769	16,35
Teruel	Aragón	14284	2429	17,01
Cádiz	Andalucía	7390	1384	18,73
Navarra	Navarra, Comunidad Foral de	10146	2118	20,88
Córdoba	Andalucía	13320	2791	20,95
Palmas, Las	Canarias	4509	976	21,65
Jaén	Andalucía	13094	2843	21,71
Valencia/València	Comunitat Valenciana	10534	2373	22,53
Lleida	Cataluña	11880	2745	23,11
Granada	Andalucía	12315	2926	23,76
Almería	Andalucía	8707	2603	29,90
Araba/Álava	País Vasco	2676	813	30,38
Tarragona	Cataluña	6217	1890	30,40
Cantabria	Cantabria	5174	1580	30,54

Castellón/Castelló	Comunitat Valenciana	6504	2061	31,69
Santa Cruz de Tenerife	Canarias	3755	1245	33,16
Murcia	Murcia, Región de	11192	3850	34,40
Girona	Cataluña	5977	2362	39,52
Málaga	Andalucía	7167	3088	43,09
Ourense	Galicia	7190	3110	43,25
Alicante/Alacant	Comunitat Valenciana	5791	2724	47,04
Asturias	Asturias, Principado de	10518	5432	51,64
Balears, Illes	Balears, Illes	5611	2948	52,54
Lugo	Galicia	9596	6100	63,57
Barcelona	Cataluña	7471	4969	66,51
Coruña, A	Galicia	8291	5642	68,05
Pontevedra	Galicia	4641	3219	69,36
Bizkaia	País Vasco	2123	1523	71,74
Gipuzkoa	País Vasco	1918	1581	82,43
	ESP	511.294		
	Excluded cells	1.918		
		509.376	109.622	21,52

Note: Excluding (1) cells intersecting provinces and (2) the territories of Ceuta and Melilla.
Source: Own elaboration.

Table A2. Inhabited surface and average population per inhabited 1 km^2 cell by province in 1887

prv_id	Province	CCAA	Inhabited 1 km^2 cells	Average population per inhabited 1 km^2 cell
28	Madrid	Madrid, Comunidad de	1.157	588
46	Valencia/València	Comunitat Valenciana	2.373	309
11	Cádiz	Andalucía	1.384	299
47	Valladolid	Castilla y León	932	286
45	Toledo	Castilla-La Mancha	1.433	249
13	Ciudad Real	Castilla-La Mancha	1.179	248
41	Sevilla	Andalucía	2.182	247
21	Huelva	Andalucía	1.063	240
50	Zaragoza	Aragón	1.780	231
26	Rioja, La	Rioja, La	769	229
6	Badajoz	Extremadura	2.175	221
49	Zamora	Castilla y León	1.263	213
16	Cuenca	Castilla-La Mancha	1.199	201
5	Ávila	Castilla y León	973	194
37	Salamanca	Castilla y León	1.643	190
43	Tarragona	Cataluña	1.890	181
8	Barcelona	Cataluña	4.969	181
34	Palencia	Castilla y León	1.046	179
19	Guadalajara	Castilla-La Mancha	1.151	174
10	Cáceres	Extremadura	1.953	174
40	Segovia	Castilla y León	909	169
29	Málaga	Andalucía	3.088	166
18	Granada	Andalucía	2.926	164
9	Burgos	Castilla y León	2.119	158
3	Alicante/Alacant	Comunitat Valenciana	2.724	158
24	León	Castilla y León	2.469	153
39	Cantabria	Cantabria	1.580	153
23	Jaén	Andalucía	2.843	153
48	Bizkaia	País Vasco	1.523	152
14	Córdoba	Andalucía	2.791	147
42	Soria	Castilla y León	1.055	143
31	Navarra	Navarra, Comunidad Foral de	2.118	142
12	Castellón/Castelló	Comunitat Valenciana	2.061	140
38	Santa Cruz de Tenerife	Canarias	1.245	136
22	Huesca	Aragón	1.864	136
36	Pontevedra	Galicia	3.219	135
4	Almería	Andalucía	2.603	129
17	Girona	Cataluña	2.362	129
32	Ourense	Galicia	3.110	128
30	Murcia	Murcia, Región de	3.850	127
35	Palmas, Las	Canarias	976	125

2	Albacete	Castilla-La Mancha		1.983	114
20	Gipuzkoa	País Vasco		1.581	112
1	Araba/Álava	País Vasco		813	110
33	Asturias	Asturias, Principado de		5.432	109
15	Coruña, A	Galicia		5.642	108
7	Balears, Illes	Balears, Illes		2.948	106
25	Lleida	Cataluña		2.745	103
44	Teruel	Aragón		2.429	97
27	Lugo	Galicia		6.100	70
			ESP	**109.622**	**159**

Note: Excluding (1) cells intersecting provinces and (2) the territories of Ceuta and Melilla.
Source: Own elaboration.

Table A3. Total 1 km^2 cells and Inhabited 1 km^2 cells by province in 1887 and 2021

prv_id	Provincia	CCAA	Total 1 km^2 cells	Inhabited 1 km^2 cells in1887	Inhabited 1 km^2 cells in 2021	Change between 2021 and 1887 (%)
20	Gipuzkoa	País Vasco	1.918	1.581	1.285	-15,4
44	Teruel	Aragón	14.284	2.429	801	-11,4
23	Jaén	Andalucía	13.094	2.843	1.726	-8,5
12	Castellón/Castelló	Comunitat Valenciana	6.504	2.061	1.600	-7,1
2	Albacete	Castilla-La Mancha	14.475	1.983	1.226	-5,2
14	Córdoba	Andalucía	13.320	2.791	2.168	-4,7
42	Soria	Castilla y León	9.901	1.055	770	-2,9
8	Barcelona	Cataluña	7.471	4.969	4.756	-2,9
50	Zaragoza	Aragón	16.558	1.780	1.315	-2,8
26	Rioja, La	Rioja, La	4.702	769	647	-2,6
18	Granada	Andalucía	12.315	2.926	2.682	-2,0
34	Palencia	Castilla y León	7.633	1.046	899	-1,9
16	Cuenca	Castilla-La Mancha	16.679	1.199	903	-1,8
48	Bizkaia	País Vasco	2.123	1.523	1.488	-1,6
22	Huesca	Aragón	15.370	1.864	1.623	-1,6
37	Salamanca	Castilla y León	12.142	1.643	1.468	-1,4
31	Navarra	Navarra, Comunidad Foral de	10.146	2.118	1.977	-1,4
25	Lleida	Cataluña	11.880	2.745	2.591	-1,3
33	Asturias	Asturias, Principado de	10.518	5.432	5.311	-1,2
19	Guadalajara	Castilla-La Mancha	11.738	1.151	1.032	-1,0
9	Burgos	Castilla y León	13.631	2.119	2.029	-0,7
10	Cáceres	Extremadura	19.544	1.953	1.837	-0,6
40	Segovia	Castilla y León	6.619	909	878	-0,5
47	Valladolid	Castilla y León	7.683	932	905	-0,4
6	Badajoz	Extremadura	21.361	2.175	2.177	0,0
49	Zamora	Castilla y León	10.331	1.263	1.300	0,4
13	Ciudad Real	Castilla-La Mancha	19.251	1.179	1.251	0,4
5	Ávila	Castilla y León	7.679	973	1.042	0,9
27	Lugo	Galicia	9.596	6.100	6.215	1,2
45	Toledo	Castilla-La Mancha	14.802	1.433	1.625	1,3
41	Sevilla	Andalucía	13.520	2.182	2.428	1,8
36	Pontevedra	Galicia	4.641	3.219	3.313	2,0
32	Ourense	Galicia	7.190	3.110	3.272	2,3
30	Murcia	Murcia, Región de	11.192	3.850	4.104	2,3
1	Araba/Álava	País Vasco	2.676	813	877	2,4
4	Almería	Andalucía	8.707	2.603	2.813	2,4
24	León	Castilla y León	15.103	2.469	2.955	3,2
29	Málaga	Andalucía	7.167	3.088	3.411	4,5
15	Coruña, A	Galicia	8.291	5.642	6.050	4,9
21	Huelva	Andalucía	10.124	1.063	1.572	5,0
43	Tarragona	Cataluña	6.217	1.890	2.323	7,0
11	Cádiz	Andalucía	7.390	1.384	2.006	8,4

46	Valencia/València	Comunitat Valenciana	10.534	2.373	3.297	8,8
7	Balears, Illes	Balears, Illes	5.611	2.948	3.644	12,4
39	Cantabria	Cantabria	5.174	1.580	2.260	13,1
17	Girona	Cataluña	5.977	2.362	3.218	14,3
38	Santa Cruz de Tenerife	Canarias	3.755	1.245	1.819	15,3
3	Alicante/Alacant	Comunitat Valenciana	5.791	2.724	3.629	15,6
28	Madrid	Madrid, Comunidad de	7.602	1.157	2.833	22,0
35	Palmas, Las	Canarias	4.509	976	2.022	23,2
		ESP	**511.294**			
		Excluded cells	**1.918**			
			509.376	**109.622**	**113.373**	0,7

Note: Excluding (1) cells intersecting provinces and (2) the territories of Ceuta and Melilla.

Source: Own elaboration and GEOSTAT 2021.