EuroSDR Workshop on Historical and Time Stamped Geographical Data for SDGs

Instituto Geográfico Nacional

Organismo Autónomo Centro Nacional de Información Geográfica

Implementation of SDG Indicators in Spain: the role of High Resolution and Historical Land Use/Land Cover information together with Settlements reference data

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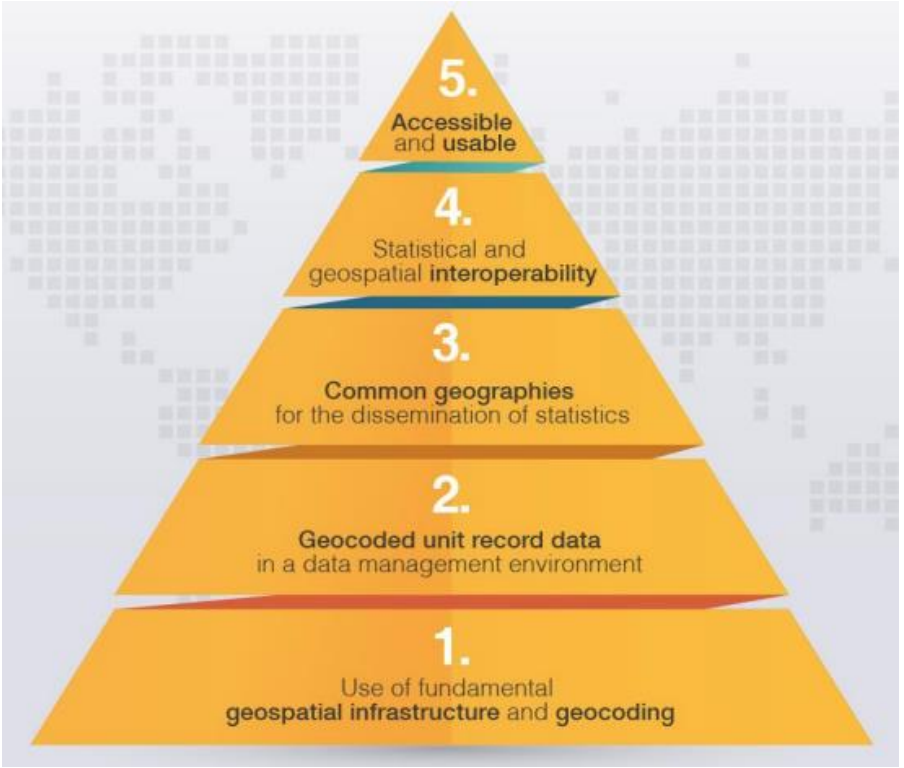
GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE
INSTITUTO GEOGRÁFICO NACIONAL

Zagreb, April 2024

CONTENTS

GEOSTATISTICS & SDGs INTEGRATION

- UN-GGIM: **Global Statistical Geospatial Framework:** enables a range of data to be integrated from both statistical and geospatial communities
- Principles for National Mapping Agencies
  - Set a geospatial infrastructure for the geolocation of statistical data in an official manner → UN-GGIM global fundamental geoespatial data themes
  - **Link geospatial and statistical data by means of permanent coding (geocoding)**

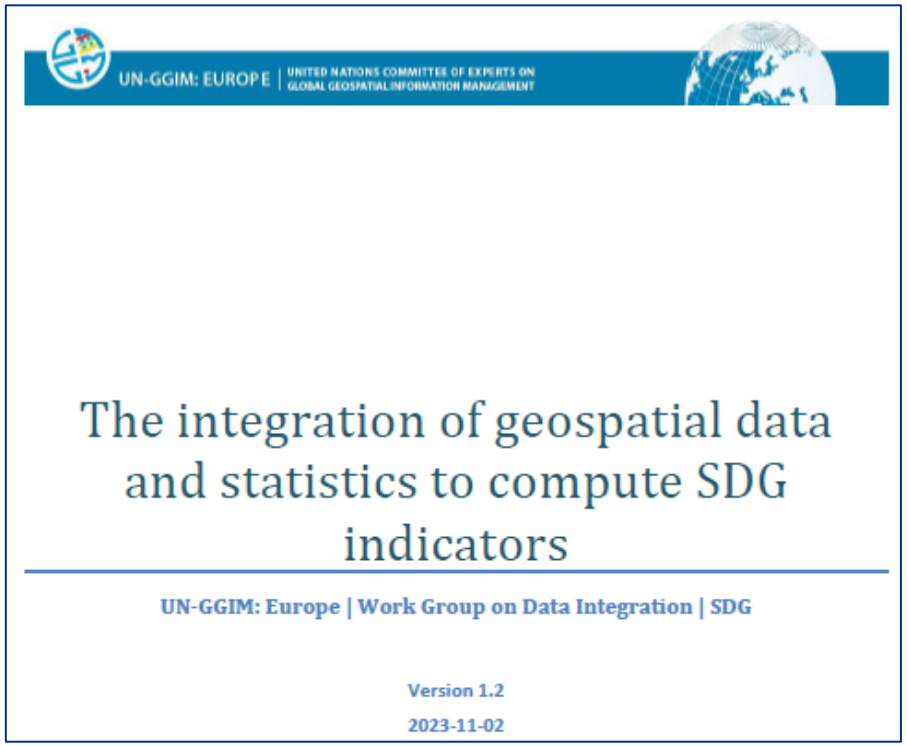


Statistics Division

UN-GGIM

Background on SDGs

- UN-SDG Indicators **Metadata Repository** https://unstats.un.org/sdgs/metadata/
- UN-GGIM Europe: **Work Plan SDG** https://un-ggim-europe.org/working-groups/low-sustainable-development-goals/
- Ministry of Social Rights, Consumer Affairs and 2030 Agenda https://www.mdsocialesa2030.gob.es/agenda2030/index.htm
- **National Statistics Institute (INE)** https://www.ine.es/dyngs/ODS/es/index.htm



SPANISH AGREEMENT BETWEEN IGN & INE

- **Development of a strategy to compute SDGIs within Spain**
- Collaborate on the geocoding of addresses and settlements
- **Support statistical publications of INE in the INSPIRE framework**
- **Improve thematic maps with INE data**
- **Shared production of Spanish gazetteer**
- International cooperation with Eurostat, UN-GGIM, EuroGeographics and other agencies

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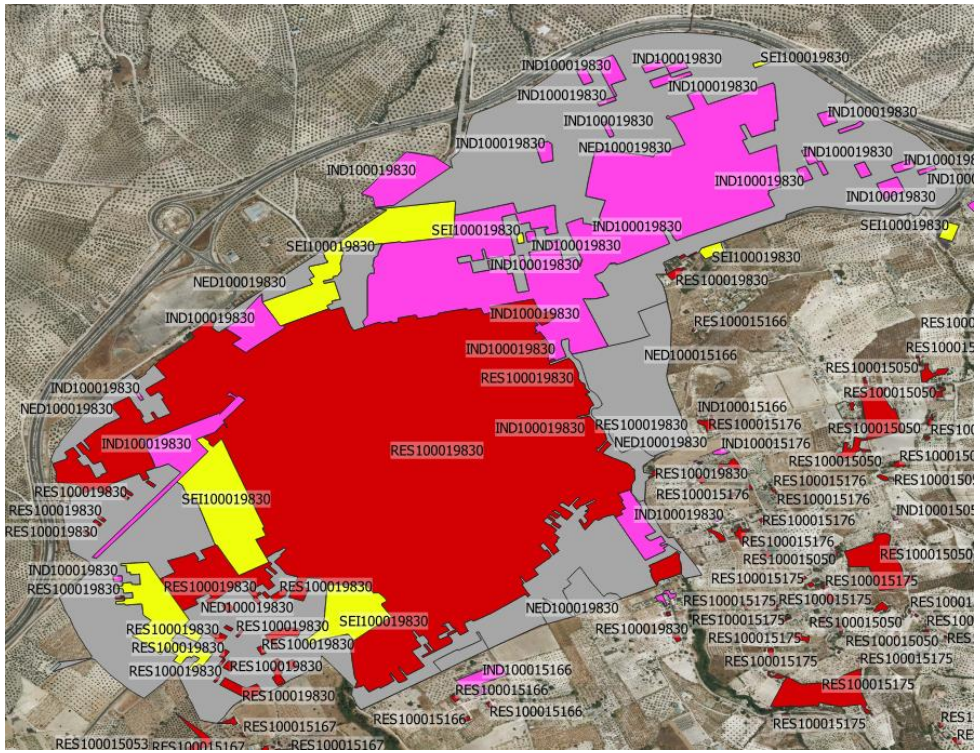
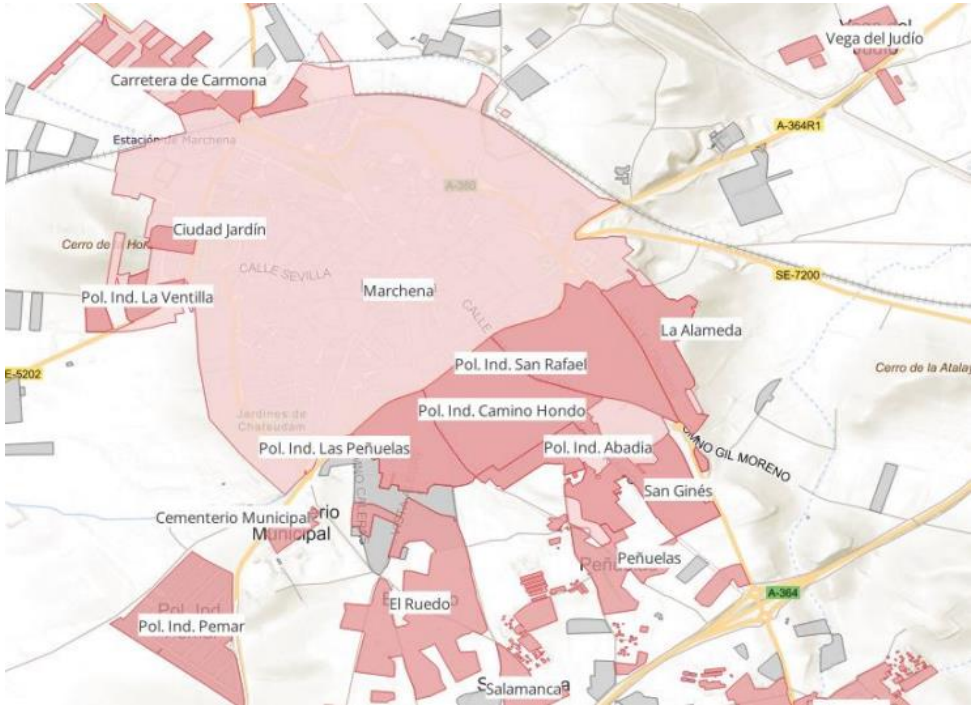
SETTLEMENTS DATASET (IGR-POBLACIONES)

- Set of HR georeferenced data on Settlements
- Framework
  - UN-GGIM Global Fundamental Geospatial Data Themes
  - Directive INSPIRE 2007/2/CE
  - Directive 2019/1024 on open data
- Collaborative project among different public Administrations and very statistics-oriented
- Goal: Maintain the location and geometrical representation of settlements over cadastral parcel and identify them with statistical info and official name



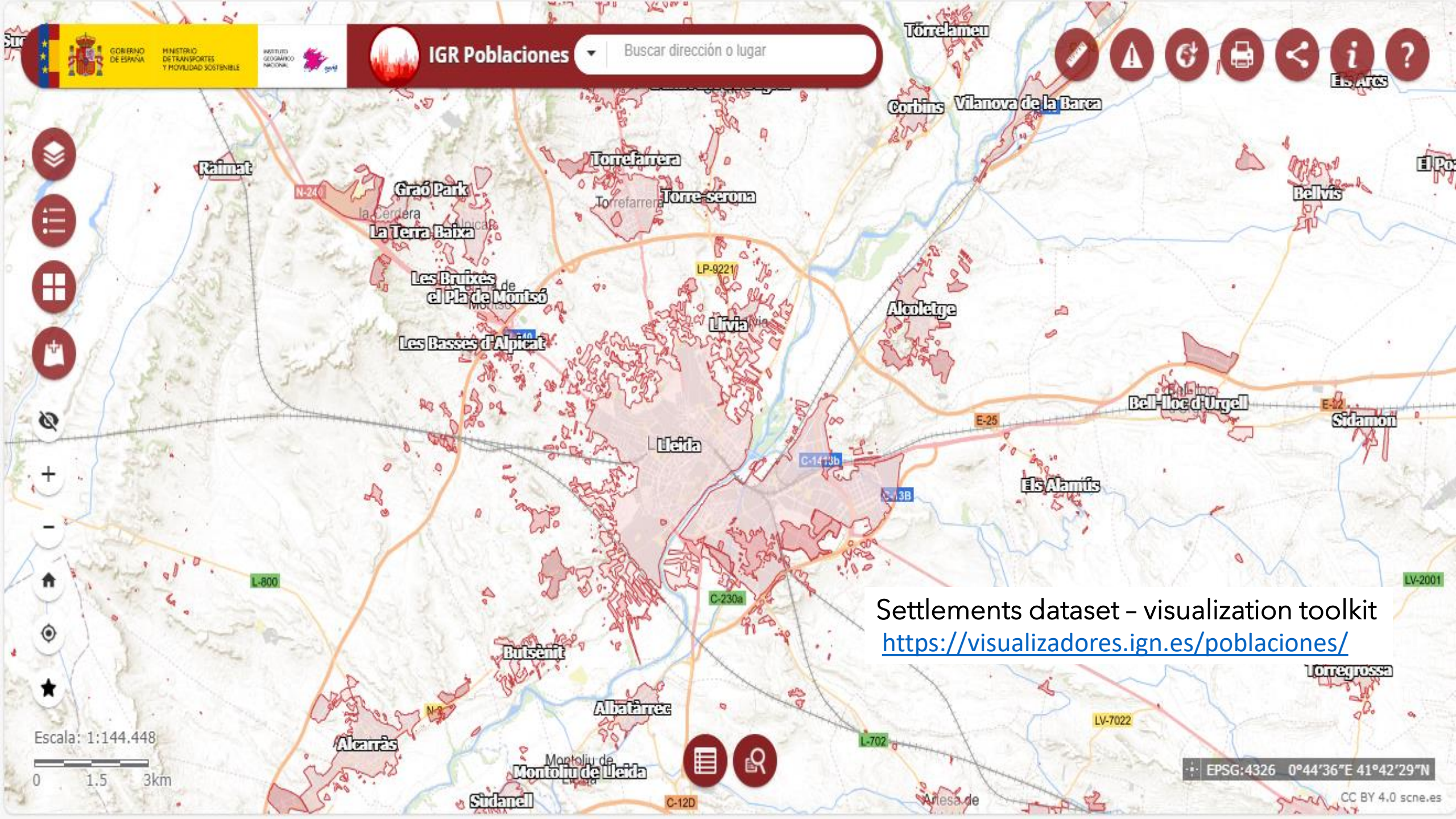
SETTLEMENTS DATASET (IGR-POBLACIONES)

- **Automatic data integration process from official data suppliers**:
  - geometries (Cadaster),
  - LU (Cadaster + SIOSE)
  - Statistical coding (INE)
  - names (National Gazetteer),
  - altitudes (LiDAR)
- Data model in agreement with INSPIRE framework and INE demands
- Intended for annual updating frequency



IGR Poblaciones

https://www.ign.es/web/seccion-poblaciones
poblaciones.ign@mitma.es
Download (CC-BY)
http://centrodedescargas.cnig.es/

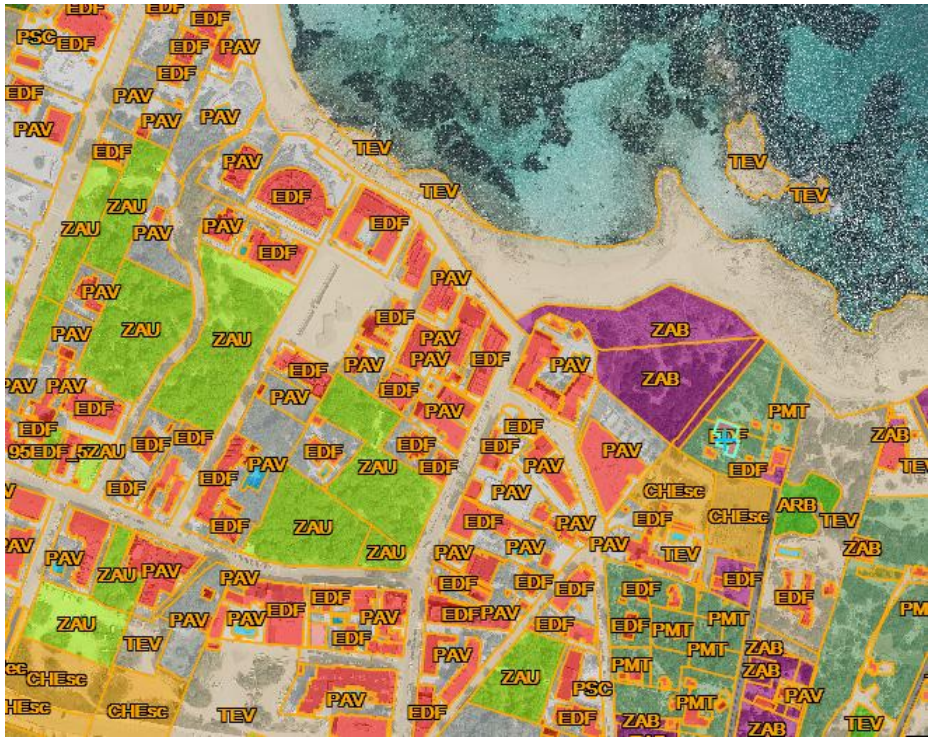


Settlements dataset – visualization toolkit

https://visualizadores.ign.es/poblaciones/

LC/LU DATASET (SIOSE)

- LC/LU Information System of Spain (SIOSE)
- Complete and continous database of all aspects of LC/LU domains: artificial areas, agricultural and natural environments
- Framework
  - Regulation 2021/696 establishing the Union Space Programme. Copernicus Programme. CLMS
  - Directive INSPIRE 2007/2/CE
  - Directive 2019/1024 related to open data
- Collaborative project among different public Administrations directed by IGN
- It serves as data source for INSPIRE and Copernicus Land Monitoring Service



Land Monitoring Service

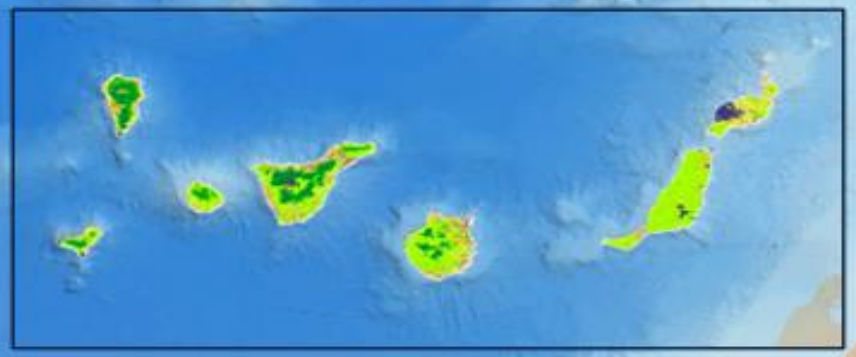
INSPIRE - Infrastructure for Spatial Information in Europe

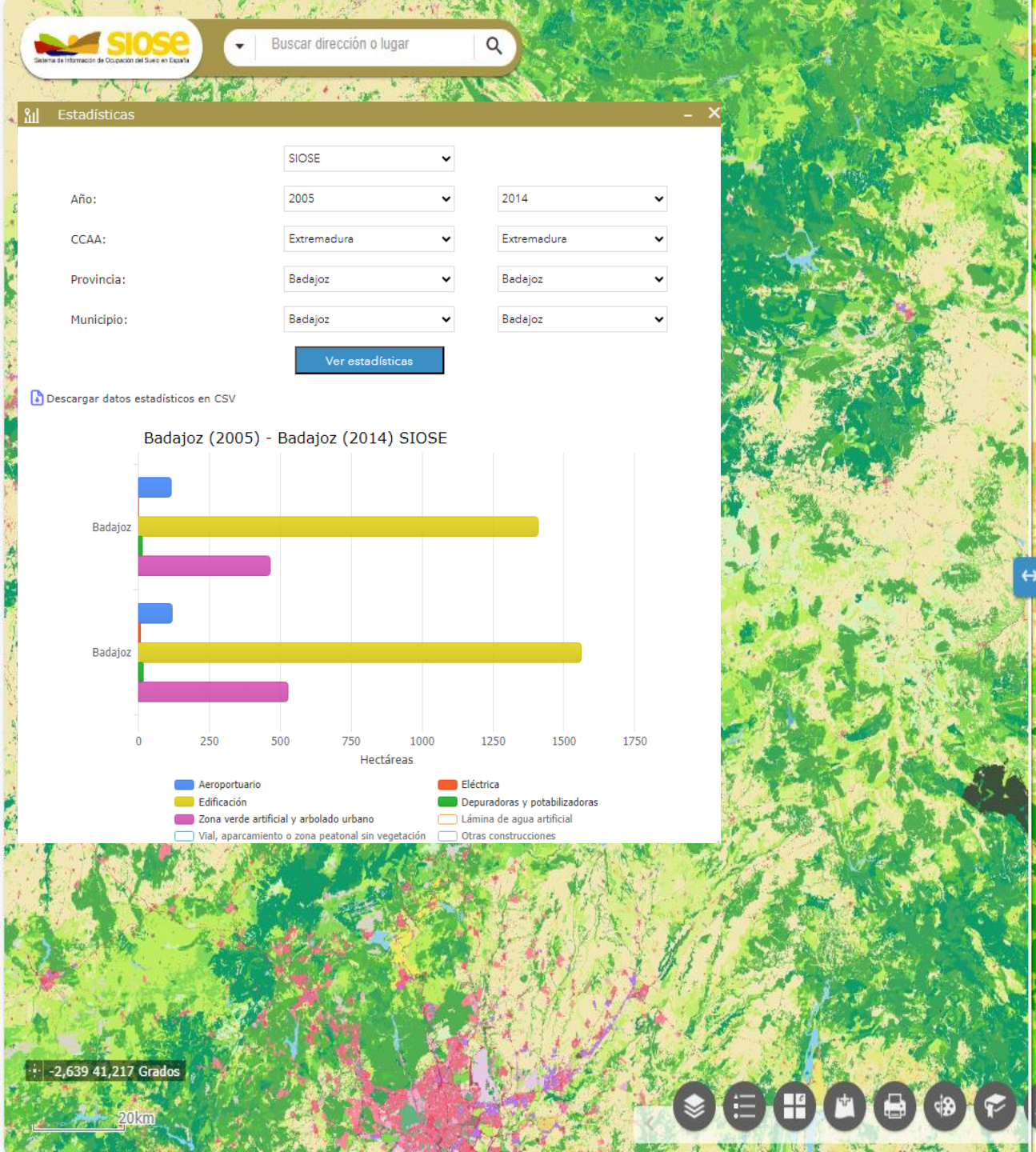
LC/LU DATASET (SIOSE)

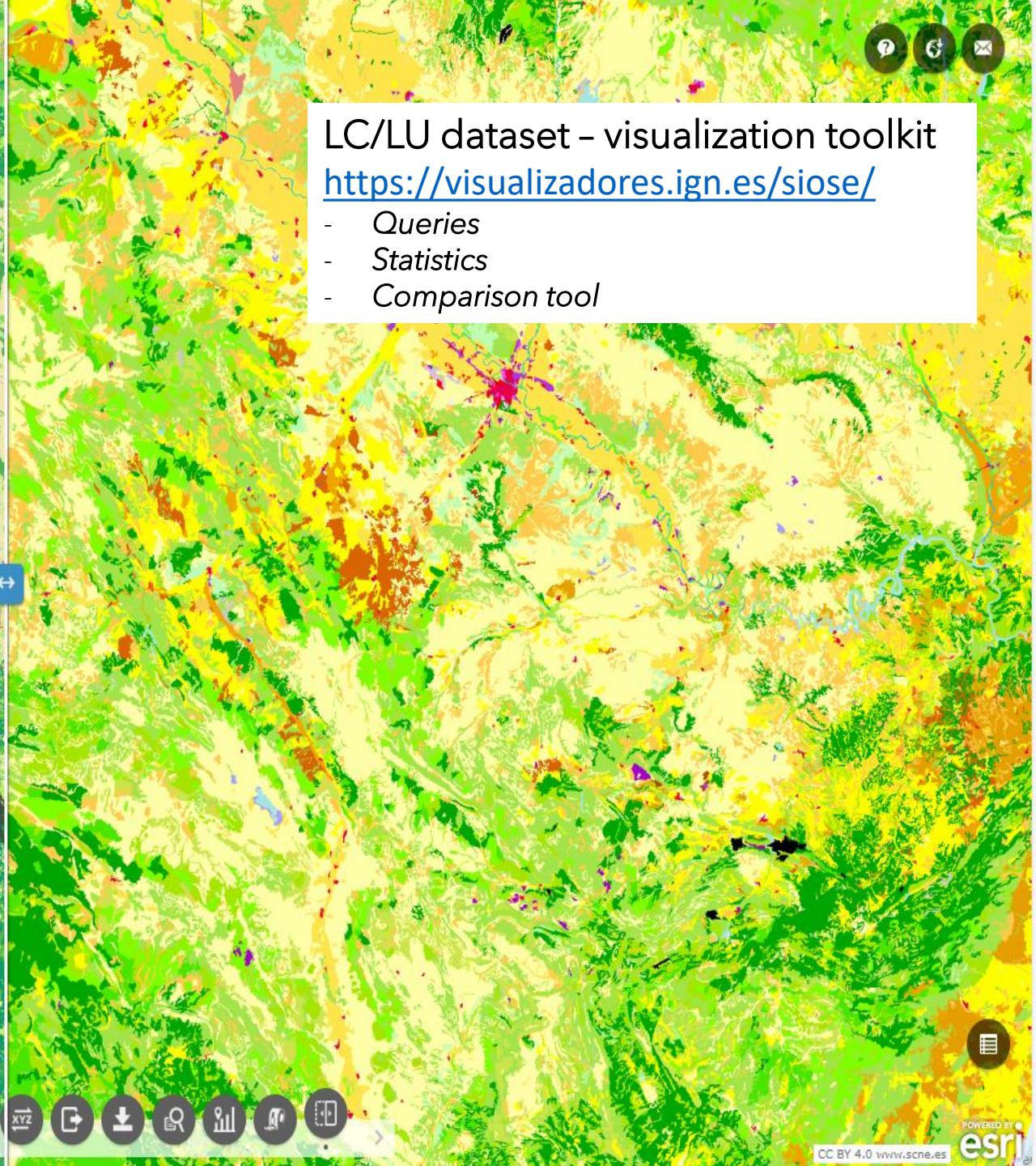
- **Automatic data integration process from official sources**: Cadaster, Land Parcel Identification System (SIGPAC), Farmers Declaration from CAP, National Forestry Map, RGI on Transport and Hidrography …
- Original dataset at 1:25,000 scale. Now scales range from 1:1,000 to 1:5,000
- OO Data model in agreement with INSPIRE framework and EAGLE
- Database updated every 3 years since 2005

SIOSE

http://www.siose.es/
siose@transportes.gob.es
Download (CC-BY)
http://centrodedescargas.cnig.es/




SIOSE
Buscar dirección o lugar
Estadísticas
SIOSE
Año:
2005
2014
CCAA:
Extremadura
Extremadura
Provincia:
Badajoz
Badajoz
Municipio:
Badajoz
Badajoz
Ver estadísticas
Descargar datos estadísticos en CSV
Badajoz (2005) - Badajoz (2014) SIOSE
Badajoz
Badajoz
0
250
500
750
1000
1250
1500
1750
Hectáreas
Aeroportuario
Edificación
Zona verde artificial y arbolado urbano
Vial, aparcamiento o zona peatonal sin vegetación
Eléctrica
Depuradoras y potabilizadoras
Lámina de agua artificial
Otras construcciones
-2,639 41,217 Grados
20km


LC/LU dataset – visualization toolkit
https://visualizadores.ign.es/siose/
- Queries
- Statistics
- Comparison tool
CC BY 4.0 www.scne.es
esri

SDGs INDICATORS

- Goal 11 is identified as a priority for Spain by IGN and INE
- Make cities and human settlements inclusive, safe, resilient and sustainable
- **Indicator 11.3.1: Ratio of land consumption rate to population growth**
- **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**
- SDGIs are computed for the whole country!

SDGI 11.3.1

- Ratio of land consumption rate (LCR) to population growth rate (PGR) for a certain period of time
- LCR is understood as the growth of urbanization or artificialization of the land.
- SDGI 11.3.1 represents a measure of land use efficiency (LUE), as established by the United Nations documentation

- Data: IGR-Pob + SIOSE + statistics from INE (inhabitants)
- Datasets from at least two epochs are needed (e.g. 2014 and 2017)

$$LCR = \frac{(A_{t+n} - A_t)/A_t}{T} \qquad PGR = \frac{\ln(Pop_{t+n}/Pop_t)}{y}$$

$$\text{SDGI } 11.3.1 = \frac{LCR}{PGR}$$

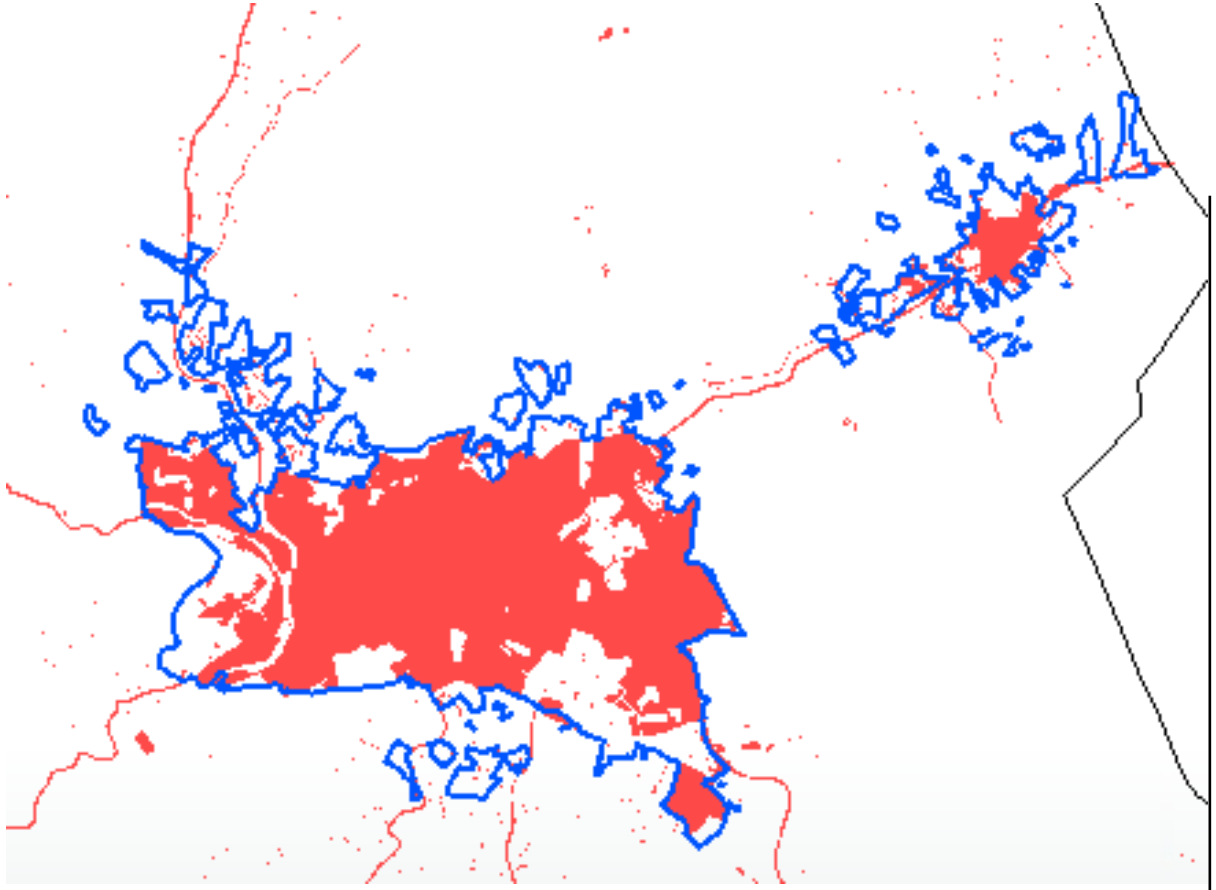
SDGI 11.7.1

- It refers to the average proportion of the built surface of cities that is dedicated to open spaces for the public use of all, broken down by sex, age and people with disabilities.
- Essentially, it refers to the availability of open public space and its accessibility by the population
- It is expressed as a percentage
- Data: IGR-Pob, HR SIOSE, statistics from INE

$$\mathrm{OBSPU}(\%) = \frac{\mathrm{TSOPS} + \mathrm{TSAS}}{\mathrm{TSC}} \cdot 100$$

COMPUTATION METHODOLOGY

1. Find the LUs associated with the chosen indicator
2. Extract geometries from HR SIOSE according to previous LU info
3. Intersect those geometries with Settlements dataset
4. Provide statistical info from INE (inhabitants)
5. Perform calculations and generate graphical results

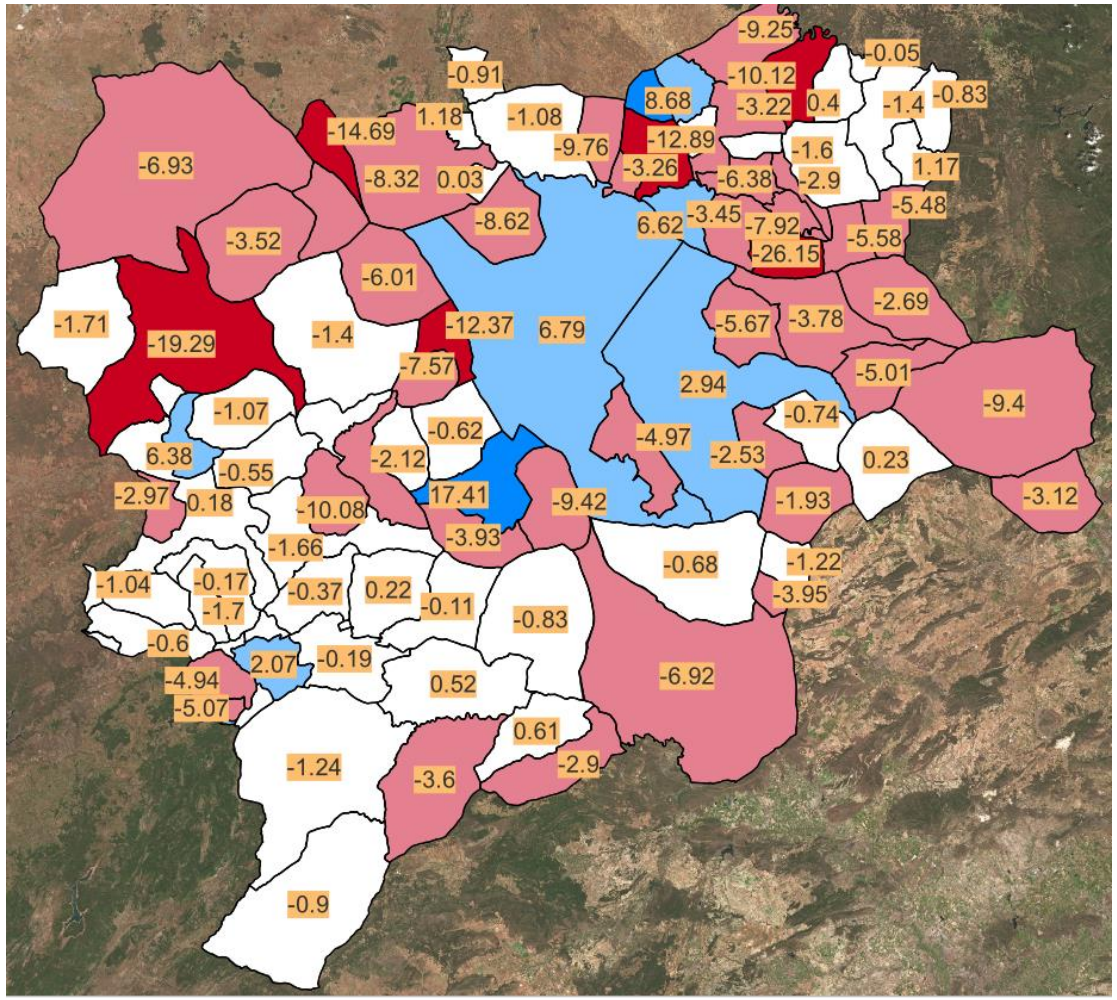


Delimitations from Settlements dataset

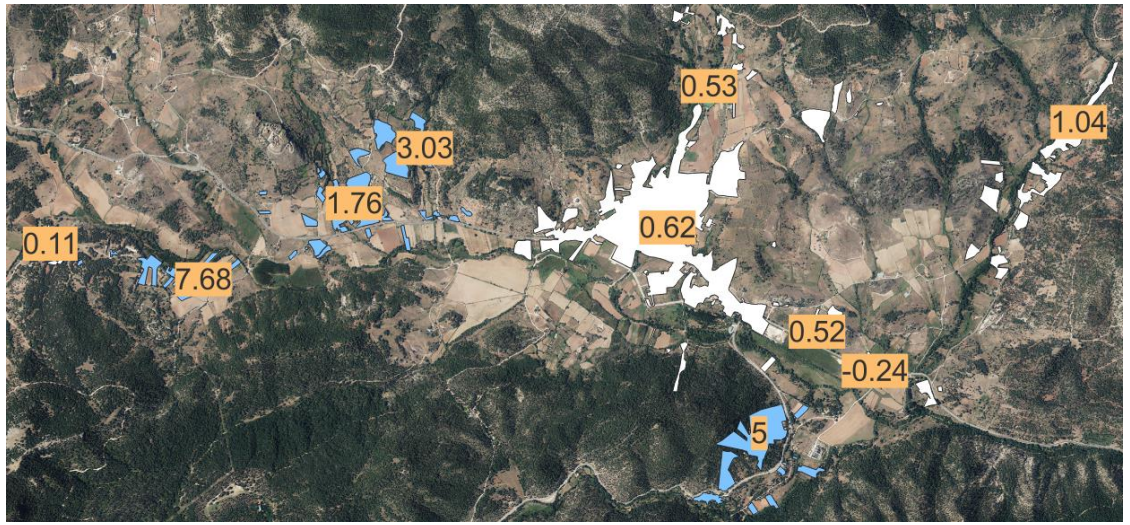
Geometries from HR SIOSE providing LU surfaces

RESULTS SDGI 11.3.1

Distribution per municipality

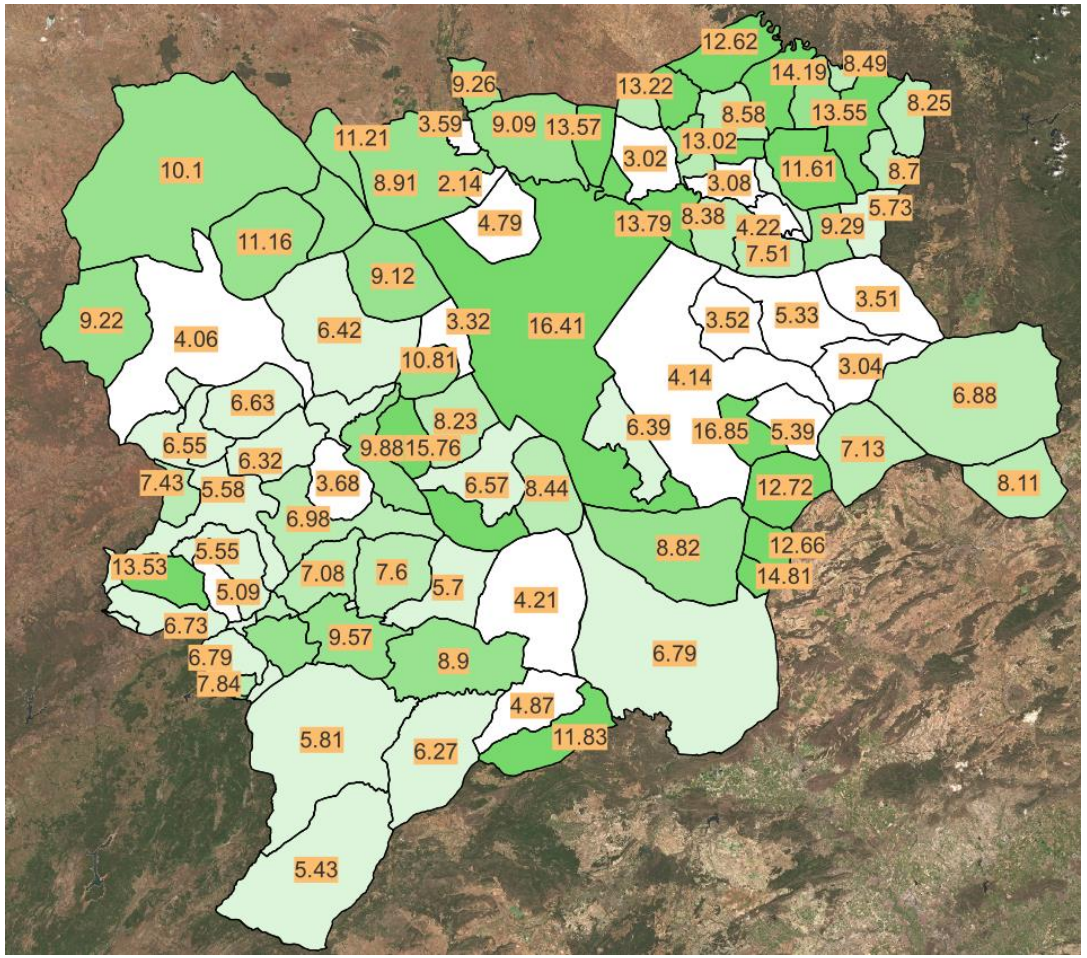


Distribution per settlement

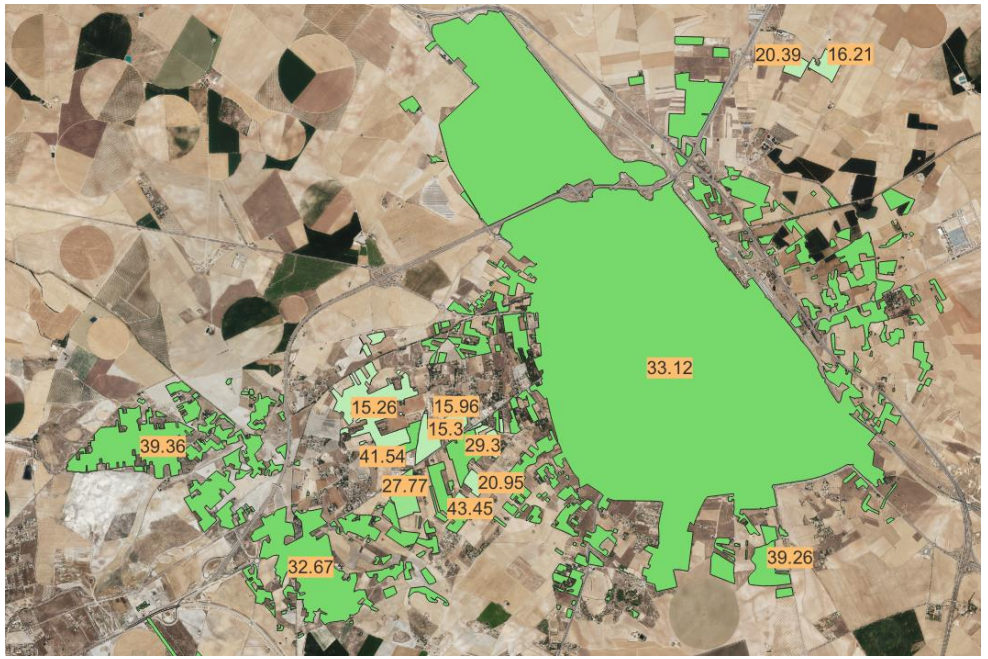


RESULTS SDGI 11.7.1

Distribution per municipality



Distribution per settlement



RESULTS

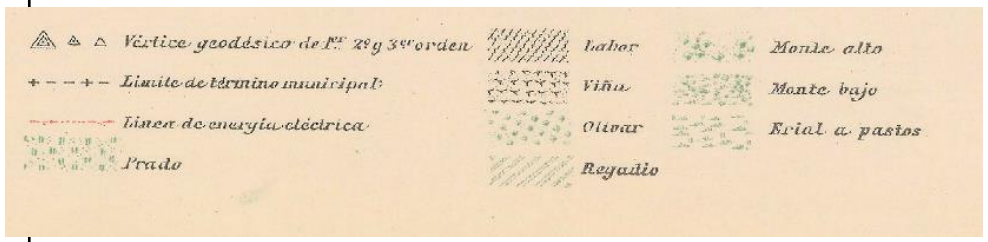
cpro	codine	idpob	nombre	LCPR/PGR	Habitantes2014	Hombres2014	Mujeres2014	Habitantes2017	Hombres2017	Mujeres2017
8	08019000101	900001720	Barcelona	-1,32	1602386	758316	844070	1620809	766625	854184
8	08020000101	900001930	La Barceloneta	-9,47	1148	558	590	1202	586	616
8	08020000102	900002405	Bartró	-5,72	9	3	6	10	4	6
8	08020000103	900002421	la Bassa Blanca	1,39	66	33	33	79	40	39
8	08020000104	900001788	Begues	-1,14	2715	1331	1384	2785	1373	1412
8	08020000105	900001692	Bon Solei	-5,77	120	66	54	127	71	56
8	08020000106	900002882	Cal Viudo	7,21	109	60	49	106	54	52
8	08020000107	900002403	Ca n'amell	-6,35	69	39	30	76	39	37
8	08020000108	900002581	La Costeta	-0,65	134	70	64	176	97	79
8	08020000109	900001735	Raval Sant Martí	31,5	136	70	66	134	69	65
8	08020000110	900001934	La Rectoria	16,65	161	86	75	156	81	75
8	08020000111	900002694	Santa Eulàlia	14,99	430	216	214	435	213	222
8	08020000112	900002967	Bon Solei II	1,06	112	58	54	98	48	50

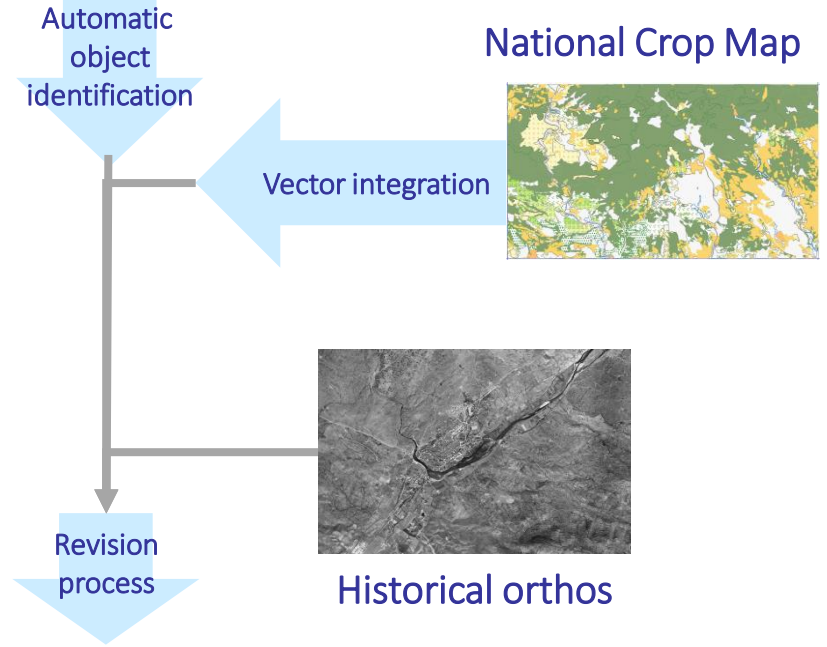
cpro	codine	idpob	nombre	SACUP	STAC_2017	STEP_2017	STDC_2017	Habitantes2014	Hombres2014	Mujeres2014	Habitantes2017	Hombres2017	Mujeres2017
8	08019000101	900001720	Barcelona	37,37	80503977,15	13022445,49	17062814,22	1602386	758316	844070	1620809	766625	854184
8	08020000101	900001930	La Barceloneta	30,15	338876,16	29908,56	72253,77	1148	558	590	1202	586	616
8	08020000102	900002405	Bartró		11219,34	771,92		9	3	6	10	4	6
8	08020000103	900002421	la Bassa Blanca	33,71	80596,31	2078,56	25091,57	66	33	33	79	40	39
8	08020000104	900001788	Begues	32,03	468693,35	38557,98	111582,26	2715	1331	1384	2785	1373	1412
8	08020000105	900001692	Bon Solei	37,11	163986,75	37171,82	23691,21	120	66	54	127	71	56
8	08020000106	900002882	Cal Viudo	36,23	43854,79	3948,29	11939,68	109	60	49	106	54	52
8	08020000107	900002403	Ca n'amell	32,73	99716,11	12599,81	20038,86	69	39	30	76	39	37
8	08020000108	900002581	La Costeta	48,42	215793,34	71413,06	33078,79	134	70	64	176	97	79
8	08020000109	900001735	Raval Sant Martí	25,03	92465,14	14323,24	8818,18	136	70	66	134	69	65
8	08020000110	900001934	La Rectoria	31,78	98055,03	11122,83	20036,38	161	86	75	156	81	75
8	08020000111	900002694	Santa Eulàlia	42,94	357000,29	80370,77	72913,86	430	216	214	435	213	222
8	08020000112	900002967	Bon Solei II	32,71	77568,69	2397,57	22974,87	112	58	54	98	48	50

HISTORICAL LC/LU

Historical National Topographic Map 1:50,000 (scanned)

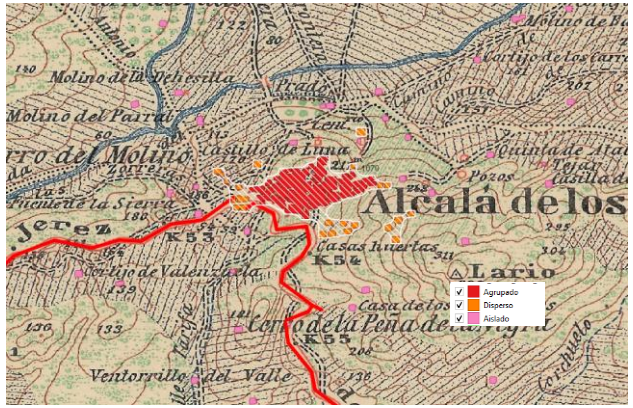
- **Goal**: Development of a methodology to obtain a historical LC/LU dataset
- **Strategy**: extract printing inks from scanned historical topographic maps (red, blue, green, black) + use of available vectorial info (crop map, hydro and transport networks)
- **Challenges**:
  - Limited scanning resolution (400 ppp)
  - Lack of color homogeneity
  - Different symbology
  - Different production date (60's, 70's, 80's)



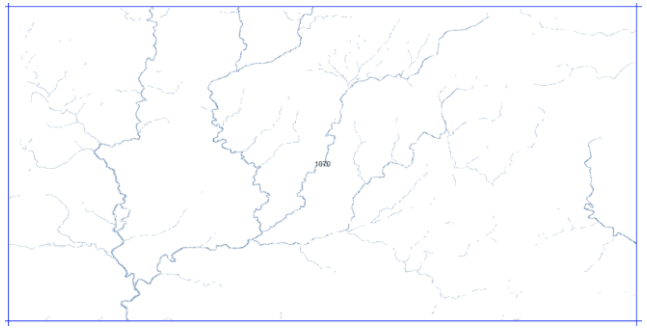


HISTORICAL LC/LU. AUTOMATIC RESULTS

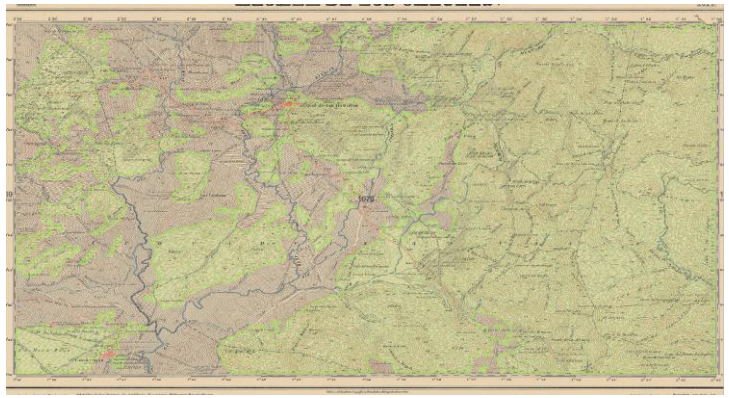
- Red ink: buildings and settlements



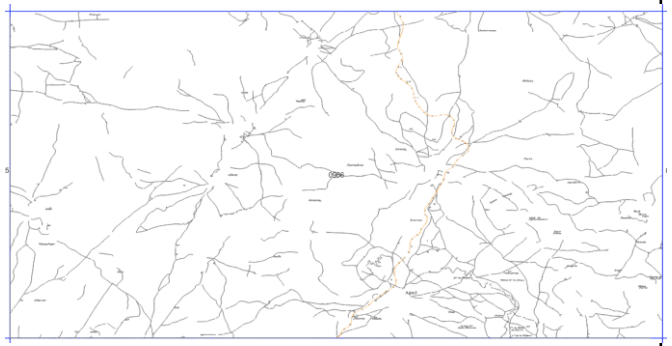
- Blue ink: rivers, lakes



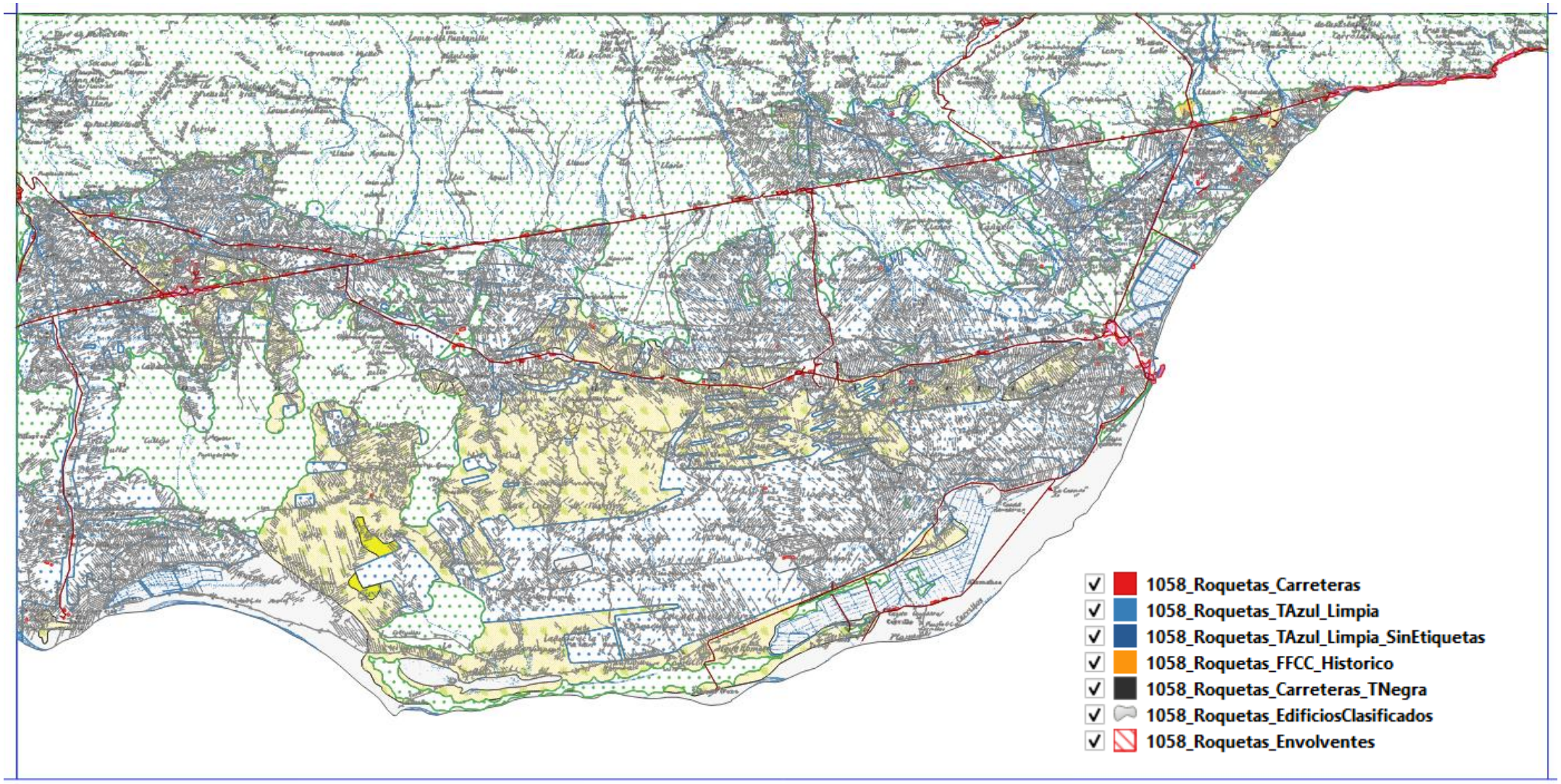
- Green ink: crop and forest



- Black ink: roads, train lines



HISTORICAL LC/LU



CONCLUSIONS

- This work is a real application of integration processes for geographical and statitical oficial data from IGN and INE
- The obtained level of detail is greater than the municipal level -> Results could be even computed at the population level if the inhabitants are georeferenced.
- Results related to number of inhabitants might get distorted in very small cities or rural areas (INE will establish > 20,000)
- Possibility of extending the work/methodology to other SDGIs under the IGN-INE agreement (SDGIs 2.4.1, 11.2.1, 15.4.2, …)

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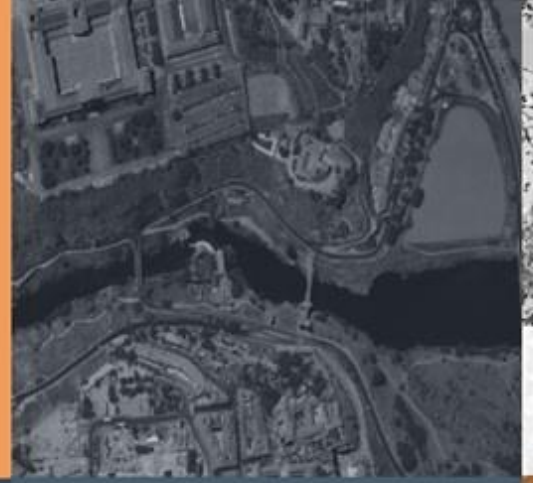

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Organismo Autónomo Centro Nacional de Información Geográfica

THANK YOU FOR YOUR TIME!

Samuel Parada (*sparada@transportes.gob.es*)

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