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Unlocking the value of geospatial data: early insights from the EU Open Data Directive

Marco Minghini[1], Jordi Escriu[1], Alexander Kotsev[1], Joeri Robbrecht[2], Jiri Pilar[3], Hannes Reuter[4]

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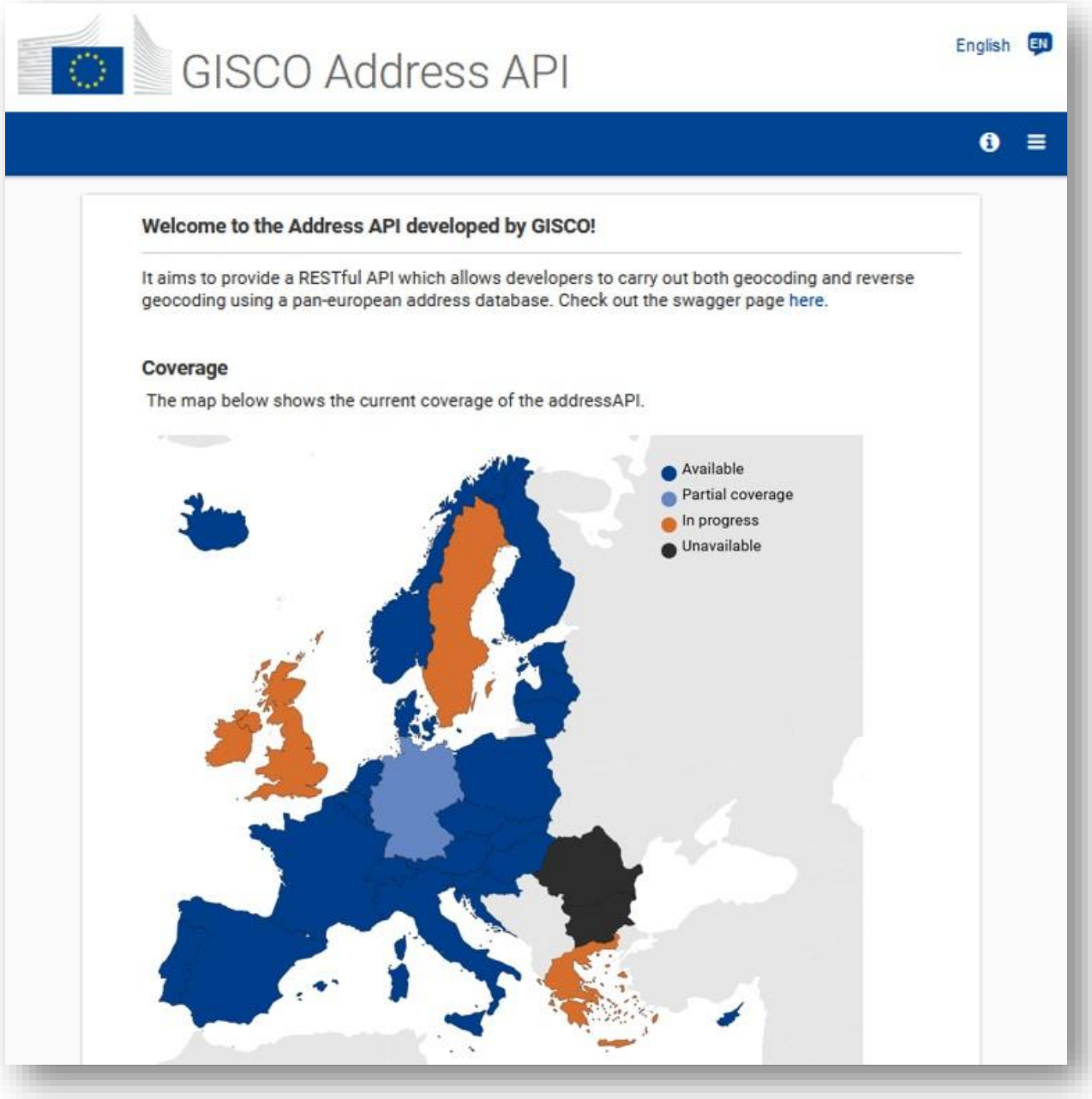
[3] European Commission, Directorate-General for Communications Networks, Content and Technology (DG CNECT)
[4] European Commission, Directorate-General Eurostat (DG ESTAT)

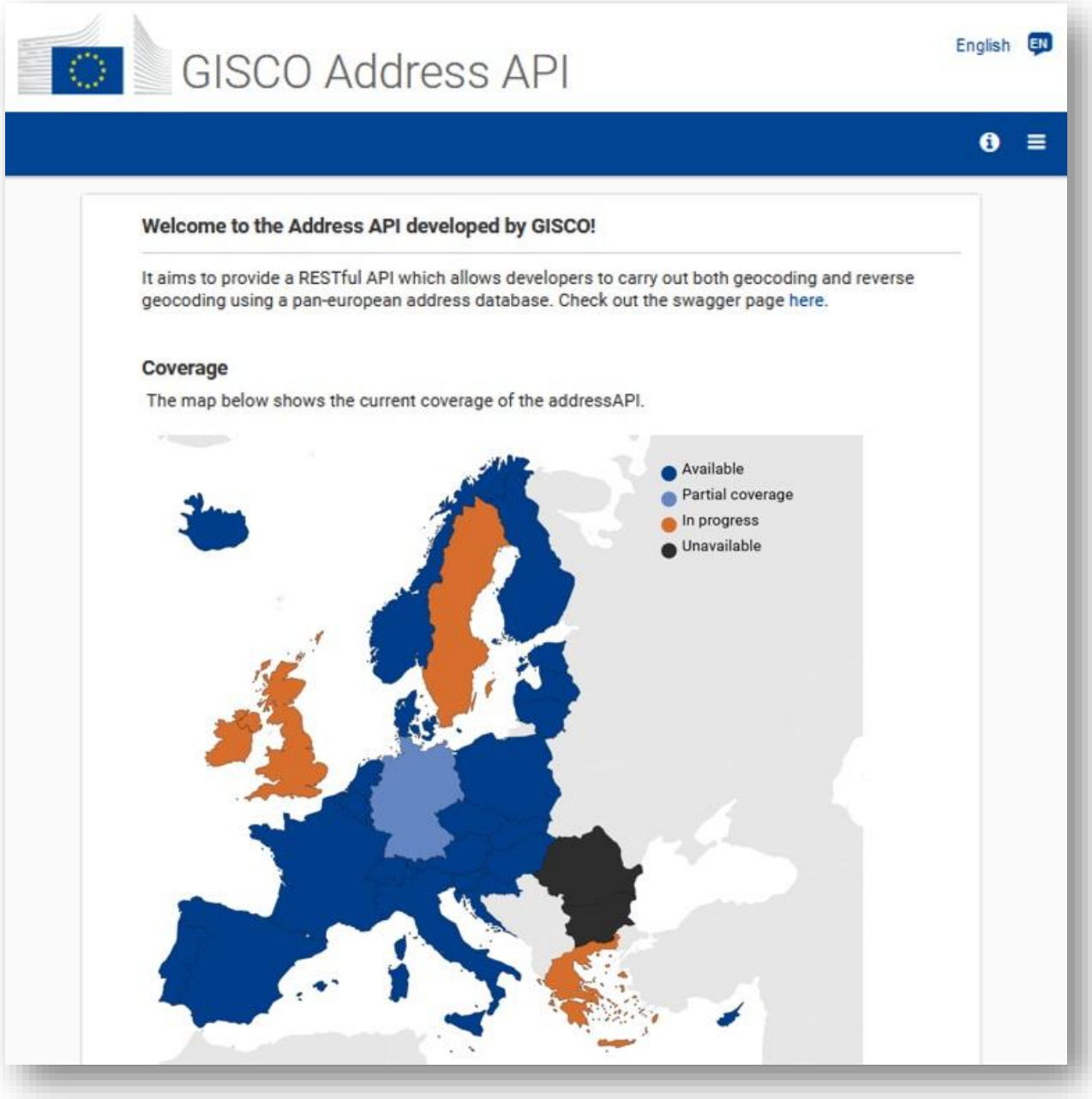
FOSS4G EUROPE MOSTAR 2025

17 July 2025



- Almost complete coverage of address data from Member States public sector organisations

Source: Updates from the ESTAT GISCO team. Presented at the 82nd INSPIRE MIG-T meeting, 27 June 2025. https://europa.eu/!9cvpwP (accessed 9 July 2025)



- Almost complete coverage of address data from Member States public sector organisations
- How did we get here?

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INSPIRE Directive (2007)

DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 March 2007

establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

- Aims to create a European SDI to support EU environmental policies
- Provides a comprehensive framework for sharing geospatial data in the EU
  - data discoverability (metadata), accessibility (network services) & interoperability (data models)
- Annual monitoring & reporting process
- Evaluation in 2022 triggered a possible revision, currently ongoing (more later)

https://eur-lex.europa.eu/eli/dir/2007/2

European Commission

INSPIRE data scope

- Organised around 34 spatial data themes for environmental applications

ANNEX: 1

- Addresses
- Administrative units
- Cadastral parcels
- Coordinate reference systems
- Geographical grid systems
- Geographical names
- Hydrography
- Protected sites
- Transport networks

ANNEX: 2

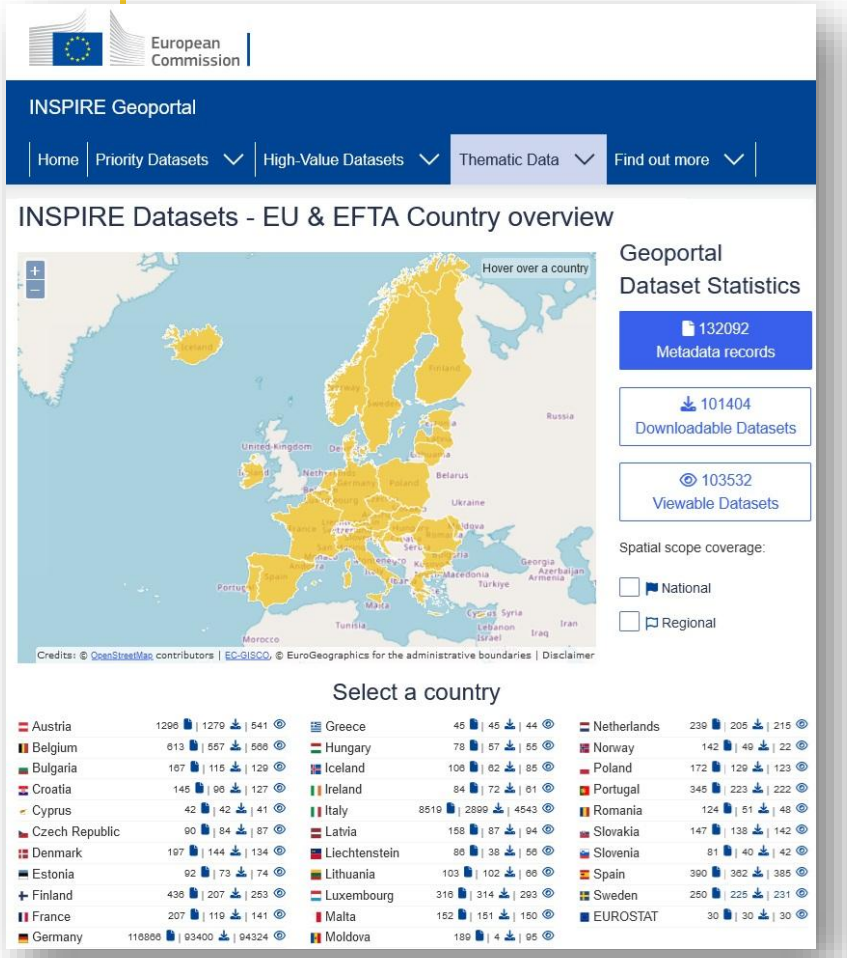
- Elevation
- Geology
- Land cover
- Orthoimagery

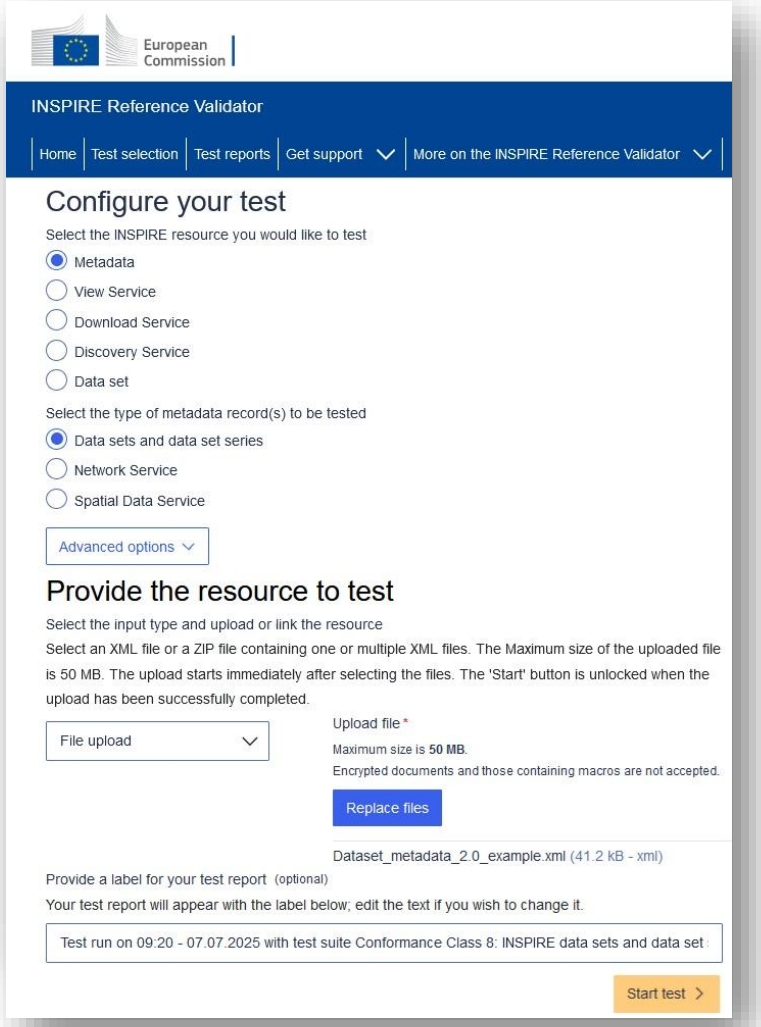
ANNEX: 3

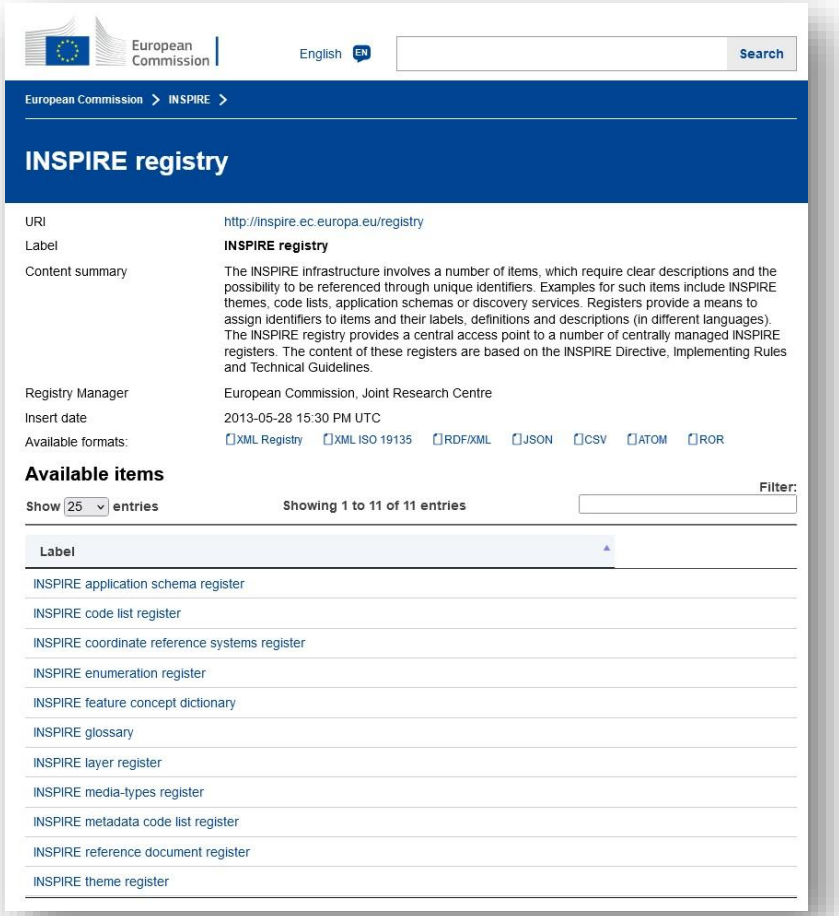
- Agricultural and aquaculture facilities
- Area management / restriction / regulation zones & reporting units
- Atmospheric conditions
- Bio-geographical regions
- Buildings
- Energy resources
- Environmental monitoring facilities
- Habitats and biotopes
- Human health and safety
- Land use
- Meteorological geographical features
- Mineral resources
- Natural risk zones
- Oceanographic geographical features
- Population distribution and demography
- Production and industrial facilities
- Sea regions
- Soil
- Species distribution
- Statistical units
- Utility and governmental services

https://knowledge-base.inspire.ec.europa.eu/tools/inspire-themes_en

INSPIRE infrastructure

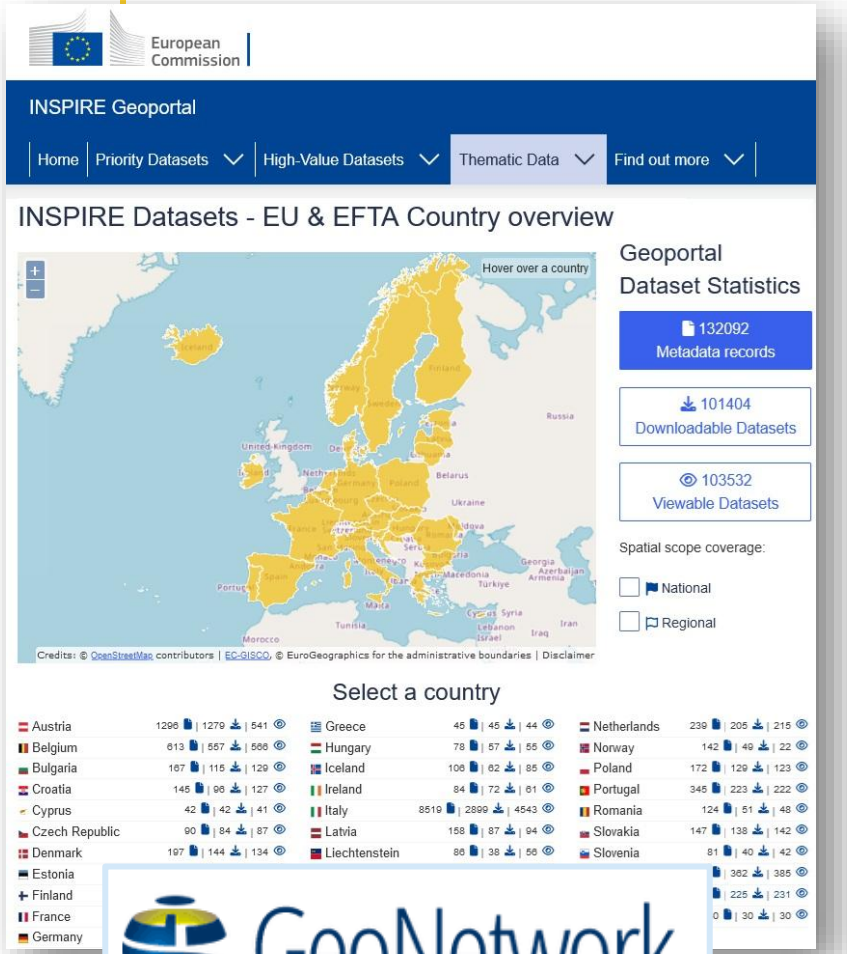


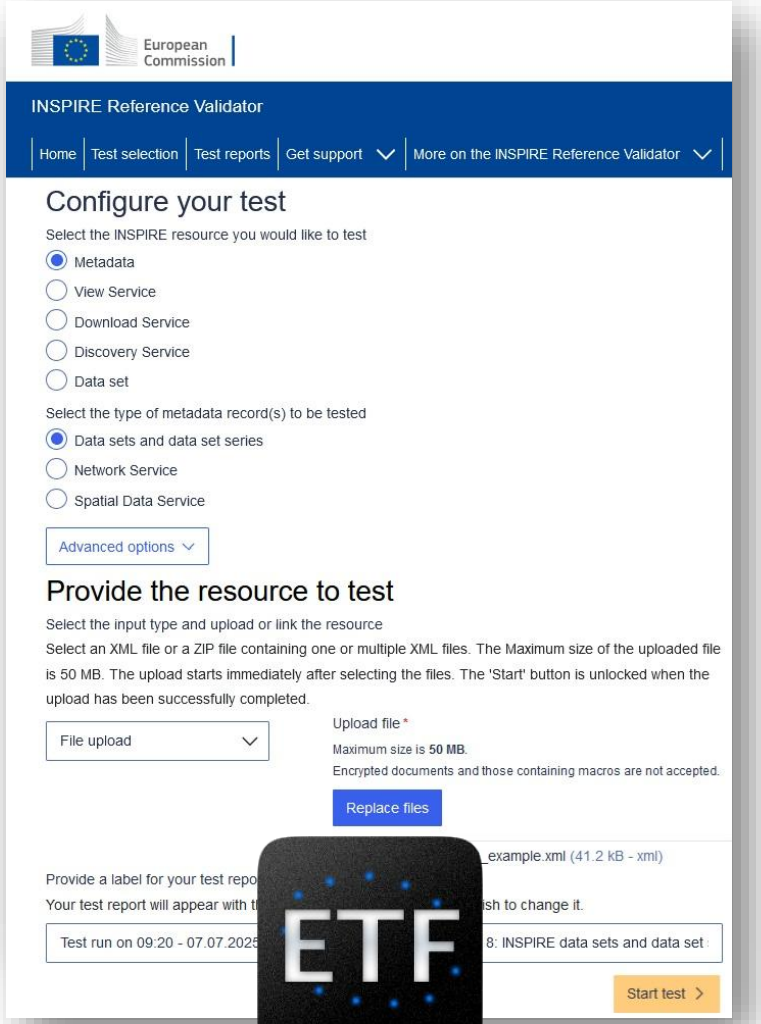


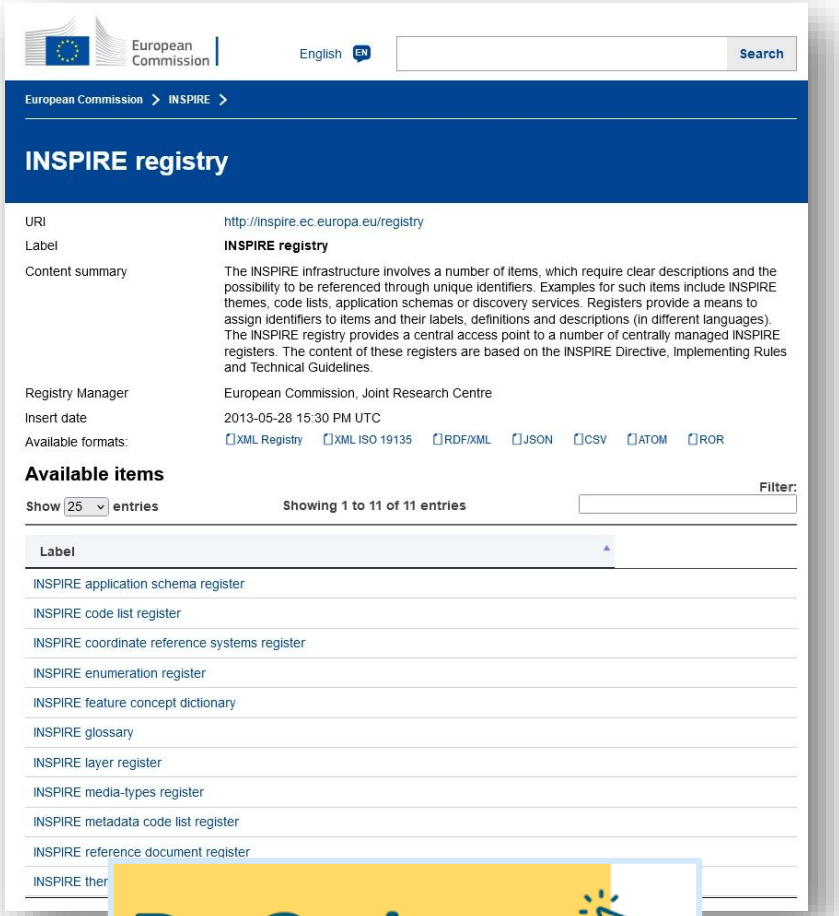


https://inspire-geoportal.ec.europa.eu https://inspire.ec.europa.eu/validator https://inspire.ec.europa.eu/registry

INSPIRE infrastructure (open source)







GeoNetwork opensource

ETF

Re3gistry

https://inspire-geoportal.ec.europa.eu https://inspire.ec.europa.eu/validator https://inspire.ec.europa.eu/registry

Open Data Directive (2019)

DIRECTIVE (EU) 2019/1024 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 20 June 2019
on open data and the re-use of public sector information
(recast)

- Aims to promote the reuse of data from public sector organisations
  - including for commercial applications, to stimulate societal innovation
- Introduces the concept of high-value datasets
  - datasets the re-use of which is associated with important socio-economic benefits
- To be made available
  - for free, under open access licenses (CC BY 4.0 or less restrictive)
  - in machine-readable formats, via APIs and (when relevant) as a bulk download

http://data.europa.eu/eli/dir/2019/1024/oj

Implementing Act on high-value datasets

- The Directive defines 6 thematic categories of high-value datasets

Geospatial	***Earth observation and environment***	***Meteorological***	***Statistics***	***Companies and company ownership***	***Mobility***

- The Implementing Act (2023) defines
  - the list of high-value datasets for each thematic category
  - the requirements for their provision: key attributes, granularity, formats, license, etc.

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  - datasets were on purpose defined to match the INSPIRE scope

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- Three out of the 6 categories include (static) geospatial datasets
  - datasets were on purpose defined to match the INSPIRE scope
- First reporting in February 2025, then every two years

Implementing Act on high-value datasets

- An example: the Geospatial category

1.1. **Datasets in scope**

The geospatial thematic category includes datasets within the scope of the INSPIRE data themes Administrative units, Geographical names, Addresses, Buildings and Cadastral parcels as defined in Annex I and Annex III to Directive 2007/2/EC of the European Parliament and of the Council ([1]). In addition, it includes Reference parcels and Agricultural parcels as defined in Regulation (EU) No 1306/2013 of the European Parliament and of the Council ([2]) and of Regulation (EU) No 1307/2013 of the European Parliament and of the Council ([3]) and the related delegated and implementing acts ([4]). Their granularity, geographical coverage and the key attributes are listed in the table below. If datasets are not available at the scale indicated in the table below, but are available at higher spatial resolution(s) ([5]), they shall be provided at the available spatial resolution.

scope

Datasets	Administrative units	Geographical names	Addresses	Buildings	Cadastral parcels	Reference parcels	Agricultural parcels
Granularity	All levels of generalisation available with a granularity up to the scale of 1:5 000. From municipalities to countries; maritime units.	N/A	N/A	All levels of generalisation available with a granularity up to the scale of 1:5 000.	All levels of generalisation available with a granularity up to the scale of 1:5 000.	A level of accuracy that is at least equivalent to that of cartography at a scale of 1:10 000 and, as from 2016, at a scale of 1:5 000, as referred to in Article 70(1) of Regulation (EU) 1306/2013.	A level of accuracy that is at least equivalent to that of cartography at a scale of 1:10 000 and, as from 2016, at a scale of 1:5 000, as referred to in Article 70(1) of Regulation (EU) 1306/2013.
Geographical coverage	Single or multiple datasets that shall cover the entire Member State when combined.						

Implementing Act on high-value datasets

- An example: the Geospatial category

Datasets	Administrative units	Geographical names	Addresses	Buildings	Cadastral parcels	Reference parcels	Agricultural parcels
Key attributes	Unique identifier; Unit type (administrative or maritime unit); Geometry ([6]); Boundary status; National identification code; Identification code of the upper administrative level; Official name; Country code; Name in multiple languages (only for countries with more than one official language) including a language with Latin characters, when feasible.	Unique identifier; Geometry; Name in multiple languages (only for countries with more than one official language) including a language with Latin characters, when feasible; Type.	Unique identifier; Geometry; Address locator (e.g. house number); Thoroughfare (street); name; Administrative units (e.g. municipality, province, country; Postal descriptor (e.g. post code); Date of last update.	Unique identifier; Geometry (footprint of the building); Number of floors; Type of use.	Unique identifier; Geometry (boundary of cadastral parcels or basic property units ([7])); Parcel or basic property unit code; A reference to the administrative unit of lowest administrative level to which this parcel or basic property unit belongs.	Unique identifier; Geometry (boundary and area); Land cover ([8]); organic ([9]); Stable landscape elements ([10]) ("EFA-layer"); areas with natural/specific constraints.	Unique identifier; Geometry (boundary and area of each agricultural parcel); Land uses (crops or crop groups); Organic; Individual landscape element; Permanent grassland.

European Commission

Implementing Act on high-value datasets

- An example: the Geospatial category

1.2. **Arrangements for the publication and re-use**

(a) The datasets shall be made available for re-use:

— under the conditions of the Creative Commons BY 4.0 licence or any equivalent or less restrictive open licence; **license**

— in a publicly documented, Union or internationally recognised open, machine-readable format; **format**

— through application programming interfaces ('APIs') ([11]) and bulk download; **access mode**

— in their most up-to-date version.

metadata

(b) The metadata describing the datasets within the scope of the INSPIRE data themes shall contain at least the metadata elements set out in Commission Regulation (EC) No 1205/2008. ([12])

(c) For the implementation of the Reference parcels and Agricultural parcels datasets, Member States shall take into consideration the ongoing implementation of Directive 2007/2/EC as well as the obligation foreseen by Article 67(3) and 67(5) of Regulation (EU) 2021/2116.

Comparison between the requirements under the INSPIRE and Open Data Directives

	INSPIRE Directive	Open Data Directive
Scope	34 spatial data themes	almost all the 34 INSPIRE data themes
Update	most up-to-date datasets to be made available	for most of the data themes, historical data also to be made available
Granularity	no formal requirements	all existing datasets up to the scale of 1:5,000 to be made available
Access and use	no requirements on conditions	open license (CC BY 4.0 or any equivalent or less restrictive license)
Discoverability	custom ISO metadata profile	INSPIRE metadata profile
Accessibility	at least bulk download through network services (including OWS)	APIs (also including OWS) and bulk download (depending on the dataset)
Data model	custom data models for each theme	list of key attributes to be included

The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

Monitoring – INSPIRE Directive

COMMISSION IMPLEMENTING DECISION (EU) 2019/1372

of 19 August 2019

implementing Directive 2007/2/EC of the European Parliament and of the Council as regards monitoring and reporting

- Measuring the FAIRness of Member States implementations

European Commission

Monitoring – INSPIRE Directive

COMMISSION IMPLEMENTING DECISION (EU) 2019/1372

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implementing Directive 2007/2/EC of the European Parliament and of the Council as regards monitoring and reporting

- Measuring the FAIRness of Member States implementations
- 19 indicators divided in 5 categories
  - availability of spatial data and services
  - conformity of metadata
  - conformity of spatial data sets
  - accessibility of spatial data sets
  - conformity of network services

European Commission

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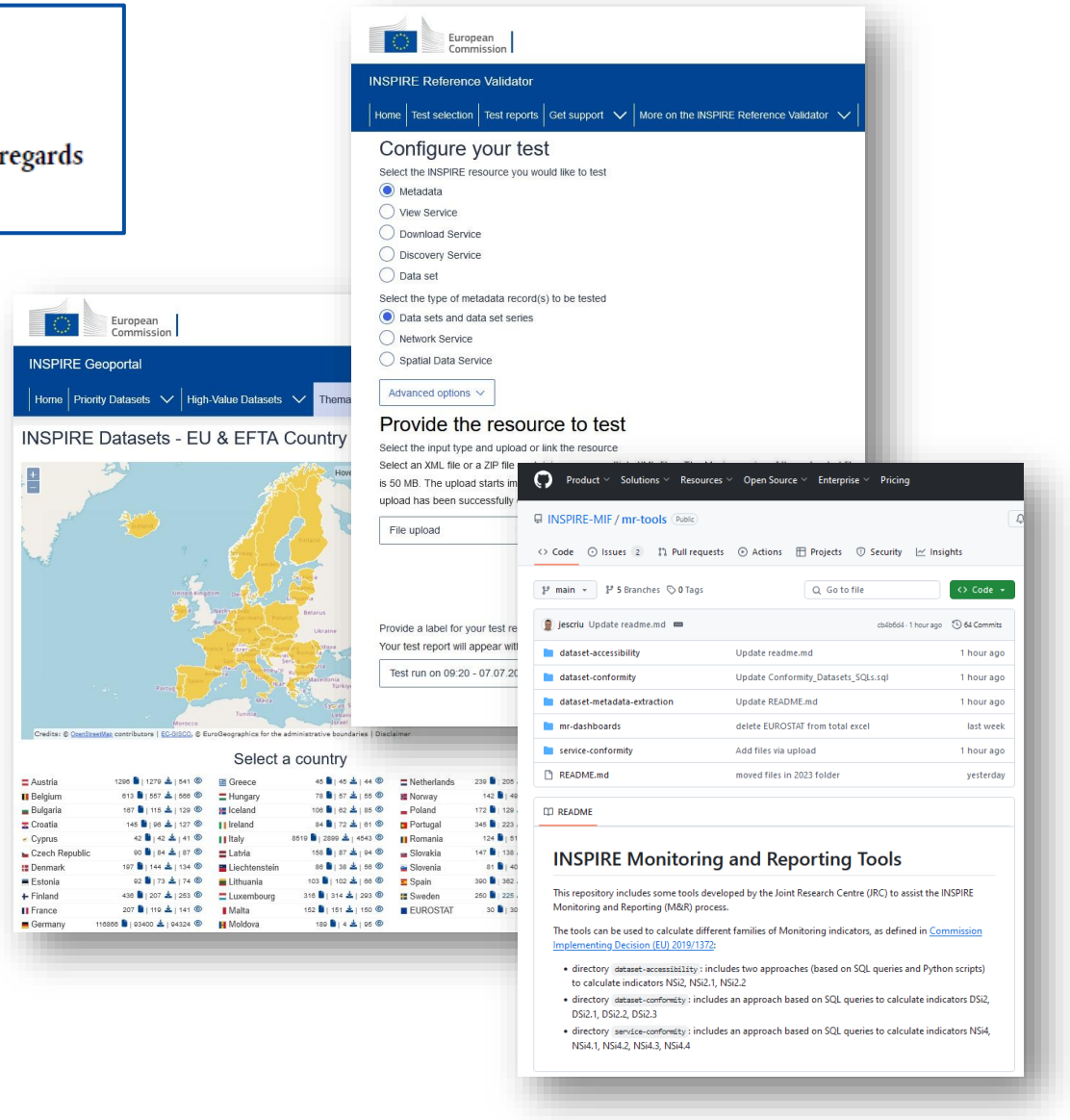
- 19 indicators divided in 5 categories
  - availability of spatial data and services
  - conformity of metadata
  - conformity of spatial data sets
  - accessibility of spatial data sets
  - conformity of network services
- Fully automated process based on the INSPIRE infrastructure



Monitoring results – INSPIRE Directive

- Median values of all indicators in the years 2019-2024:
  - overall: slow but continuous improvement

YEAR	DSi2	DSi2.1	DSi2.2	DSi2.3
2019	38%	73%	33%	35%
2020	43%	75%	47%	38%
2021	70%	87%	67%	62%
2022	73%	91%	71%	70%
2023	61%	68%	58%	59%
2024	61%	78%	64%	59%

conformity of spatial data sets

availability of spatial data and services

YEAR	DSi1.1	DSi1.2	DSi1.3	DSi1.4	DSi1.5
2019	164	142	47	0	74
2020	161	182	51	0	94
2021	167	192	55	2	109
2022	157	193	58	0	101
2023	158	205	49	0	100
2024	158	210	51	0	103

YEAR	NSi2	NSi2.1	NSi2.2
2019	16%	32%	20%
2020	32%	44%	42%
2021	45%	57%	54%
2022	50%	62%	56%
2023	56%	67%	63%
2024	66%	73%	74%

accessibility of spatial data sets

conformity of metadata

YEAR	MDi1.1	MDi1.2
2019	38%	38%
2020	55%	67%
2021	78%	92%
2022	89%	90%
2023	87%	92%
2024	88%	92%

YEAR	NSi4	NSi4.1	NSi4.2	NSi4.3	NSi4.4
2019	49%	50%	46%	51%	0%
2020	71%	67%	67%	83%	0%
2021	92%	100%	94%	92%	100%
2022	92%	100%	93%	91%	0%
2023	80%	100%	93%	91%	50%
2024	80%	80%	89%	92%	50%

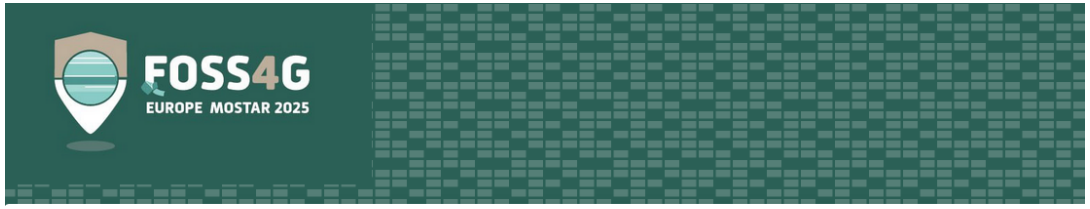
conformity of network services

Monitoring results – INSPIRE Directive

- Median values of all indicators in the years 2019-2024:
  - overall: slow but continuous improvement
  - however: indicators do not always reflect the real usability of the infrastructure!

https://isprs-archives.copernicus.org/articles/XLVIII-4-W13-2025/179/2025/isprs-archives-XLVIII-4-W13-2025-179-2025.pdf

Check my FOSS4G Europe 2025 Academic Track talk & paper!



Monitoring the FAIRness of geospatial data: Lessons learnt from the European Union

07-16, 16:30–17:00 (Europe/Sarajevo), PA01 (Quarticle)

The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XLVIII-4/W13-2025
FOSS4G (Free and Open Source Software for Geospatial) Europe 2025 – Academic Track, 14–20 July 2025, Mostar, Bosnia-Herzegovina

Monitoring the FAIRness of geospatial data: Lessons learnt from the European Union

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[1] European Commission, Joint Research Centre (JRC), Ispra, Italy – (marco.minghini, jordi.escriu, alexander.kotsev)@ec.europa.eu

Keywords: Data sharing, Data-driven, Geospatial, Monitoring, Spatial Data Infrastructures, Key Performance Indicators.

Abstract

The Findable, Accessible, Interoperable and Reusable (FAIR) principles were introduced to mitigate challenges in discovering, accessing and ultimately reusing data. They still represent the backbone of current, public sector-driven geospatial data infrastructures worldwide, and Key Performance Indicators (KPIs) are used to measure the progress towards their implementation. This work reflects on the experience of the European Union (EU) geospatial data infrastructure, driven by the INSPIRE and the Open Data Directive requirements. Analysing the results of the monitoring process in the last six years, we draw a number of lessons. First and foremost, the way in which KPIs are defined steers the development of an infrastructure against specific directions, and maximising the KPIs used to measure the FAIRness is not enough. A shift would be needed to more user-centric monitoring approaches, which originate from user needs and assess the actual value generated from data reuse. The analysis also demonstrated the importance of employing automated, transparent and reproducible monitoring processes powered by open source tools, as well as the need to define an inclusive governance approach grounded on a continuous involvement, dialogue and trust with the affected stakeholders.

Reporting – INSPIRE Directive

- Member States have to provide a summary report with a two-year frequency (*INSPIRE Directive*, amended by *Commission Decision 2024/2829*)

Article 21

1. Member States shall monitor the implementation and use of their infrastructures for spatial information. They shall make the results of this monitoring accessible to the Commission and to the public on a permanent basis.

2. No later than 15 May 2010 Member States shall send to the Commission a report including summary descriptions of:

(a) how public sector providers and users of spatial data sets and services and intermediary bodies are coordinated, and of the relationship with the third parties and of the organisation of quality assurance;

(b) the contribution made by public authorities or third parties to the functioning and coordination of the infrastructure for spatial information;

(c) information on the use of the infrastructure for spatial information;

(d) data-sharing agreements between public authorities;

(e) the costs and benefits of implementing this Directive.

Article 1

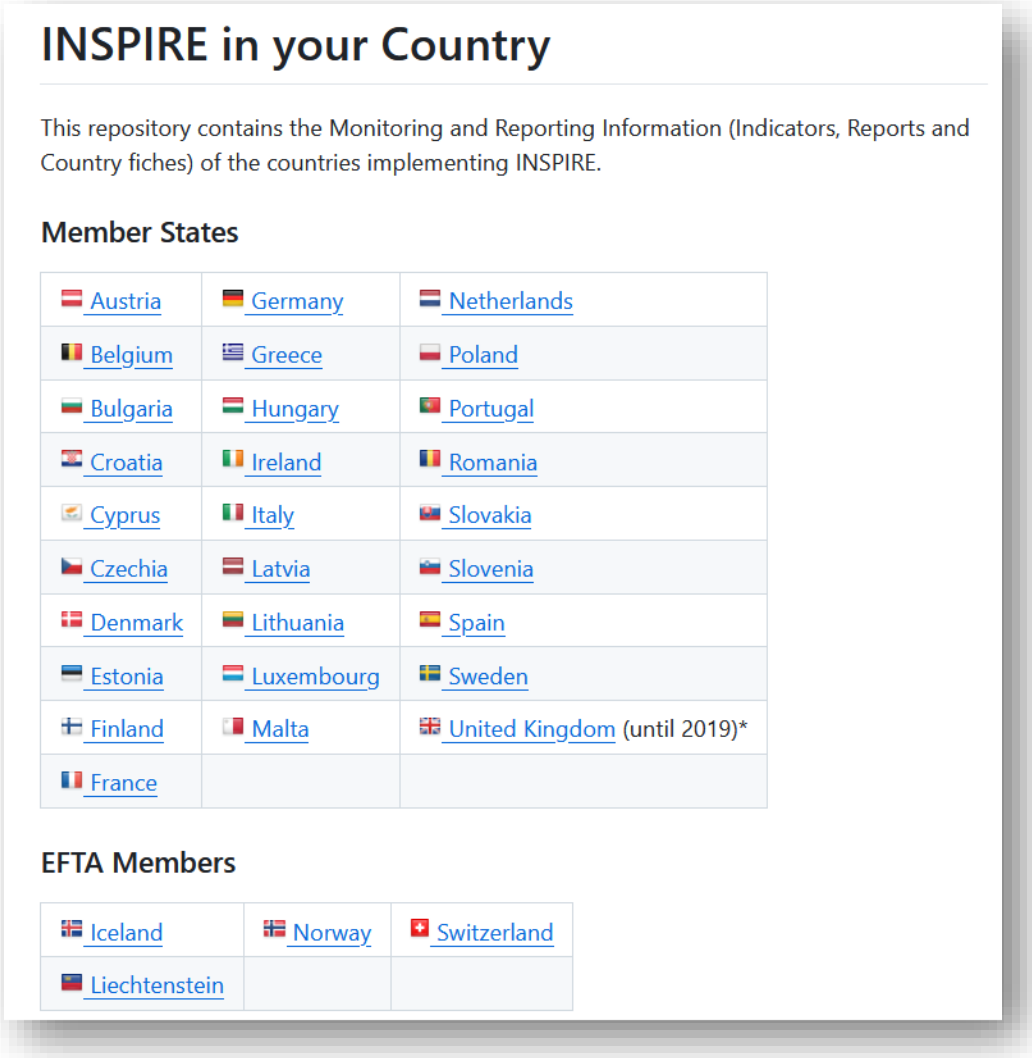
Amendment to Directive 2007/2/EC

In Article 21(2) of Directive 2007/2/EC, the introductory part is replaced by the following:

'No later than 31 March every two years, starting from 31 March 2025, Member States shall update, if necessary, a summary report. Those reports, which shall be made public by the Commission services, shall include summary descriptions of:'.

Reporting results – INSPIRE Directive

- Reports submitted by Member States and stored in the INSPIRE infrastructure



INSPIRE in your Country

This repository contains the Monitoring and Reporting Information (Indicators, Reports and Country fiches) of the countries implementing INSPIRE.

Member States

Austria	Germany	Netherlands
Belgium	Greece	Poland
Bulgaria	Hungary	Portugal
Croatia	Ireland	Romania
Cyprus	Italy	Slovakia
Czechia	Latvia	Slovenia
Denmark	Lithuania	Spain
Estonia	Luxembourg	Sweden
Finland	Malta	United Kingdom (until 2019)*
France		

EFTA Members

Iceland	Norway	Switzerland
Liechtenstein		

https://github.com/INSPIRE-MIF/INSPIRE-in-your-Country

Reporting – Open Data Directive

Reporting

1. By 2 years after entry into force of this Implementing Regulation Member States shall provide the Commission with a report on the measures they have carried out to implement this Implementing Regulation. Where appropriate, the information under paragraph 3 can be provided through references to relevant metadata.

2. Each Member State shall provide an updated version of the report upon the request of the Commission which should be made every 2 years.

3. The report shall contain the following information:

(a) a list of specific datasets at Member State level (and, where relevant, subnational level) corresponding to the description of each high-value dataset in the Annex to this Regulation and with online reference to metadata that follow existing standards, such as a single register or open data catalogue;

(b) persistent link to the licensing conditions applicable to the re-use of high-value datasets listed in the Annex to this Regulation, per dataset referred to in point a);

(c) persistent link to the APIs ensuring access to the high-value datasets listed in the Annex to this Regulation, per dataset referred to in point a);

(d) where available, guidance documents issued by the Member State on publishing and reusing their high-value datasets;

(e) where available, the existence of data protection impact assessments carried out in accordance with Article 35 of Regulation (EU) 2016/679;

(f) the number of public sector bodies exempted in accordance with Article 14(5) of Directive (EU) 2019/1024.

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(f) the number of public sector bodies exempted in accordance with Article 14(5) of Directive (EU) 2019/1024.

- In February 2025
  - reports submitted by 24 Member States, still under processing
  - heterogeneous picture – geospatial high-value datasets not in all cases coinciding with those reported under INSPIRE (1)
- Monitoring and reporting processes take time!
  - legal, organisational and technical efforts needed

(1) Cross-comparison of environmental datasets made available and accessible under HVD and INSPIRE: Preliminary findings. Presented at the 20th INSPIRE MIG meeting, 5 May 2025. https://europa.eu/!xCmvVb (accessed 9 July 2025)

What has really changed?

- Several geospatial datasets traditionally ‘closed’ are finally open!
  - Italy:
    - cadastral parcels – formerly available at €40 per vector sheet, i.e. €12M for the ~300,000 total sheets (2)
    - National Archive of Urban Street Numbers (2)
  - Germany
    - orthophotos at 20cm resolution
  - … and many others!

(2) Weckmüller D. (2024) Evolution of land monitoring services based on Earth Observation in Italy. http://dx.doi.org/10.13140/RG.2.2.14557.12001

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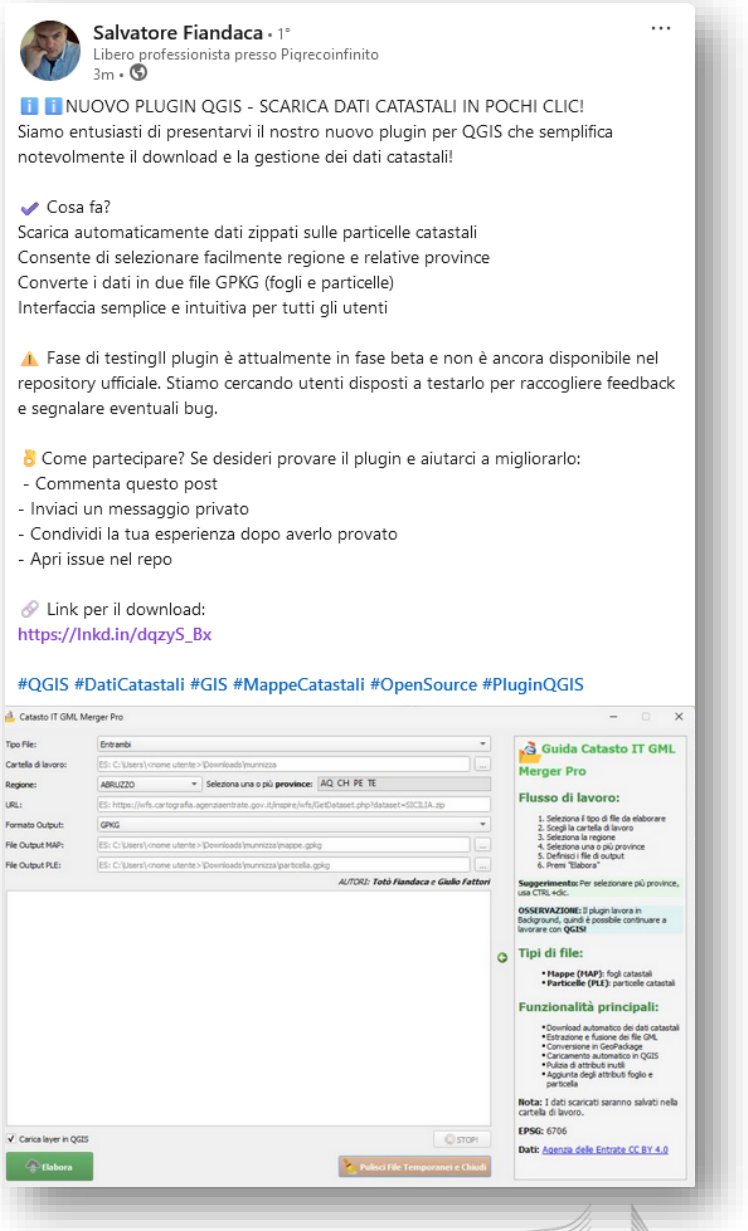

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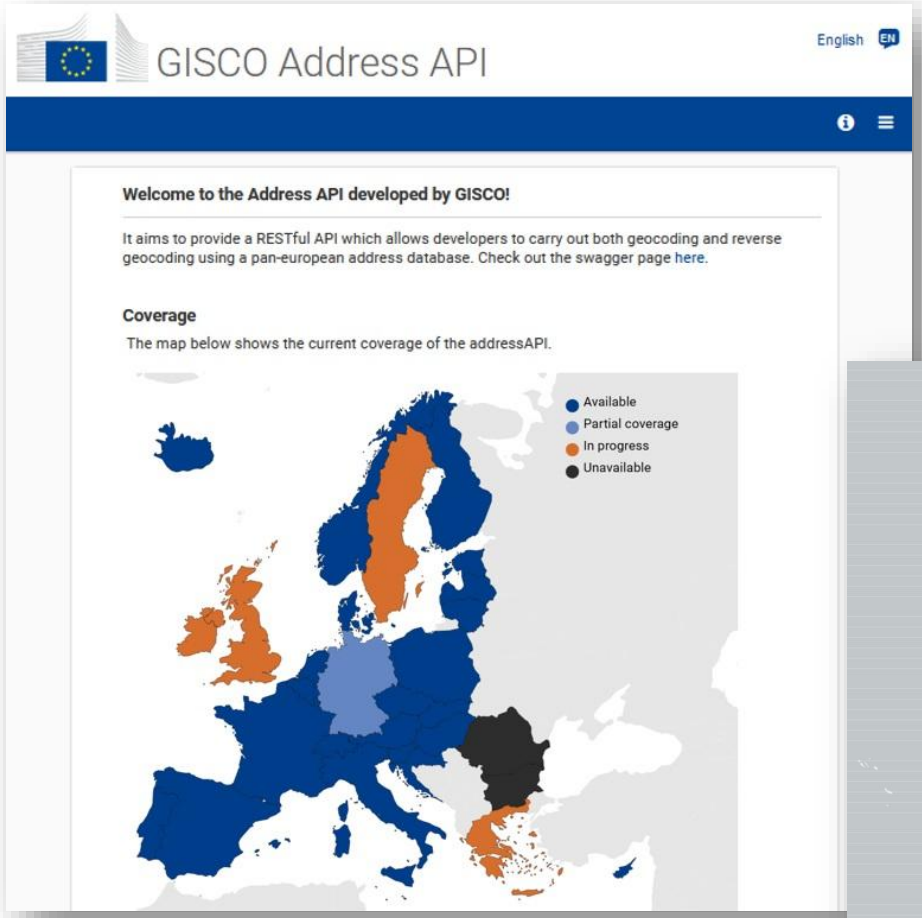
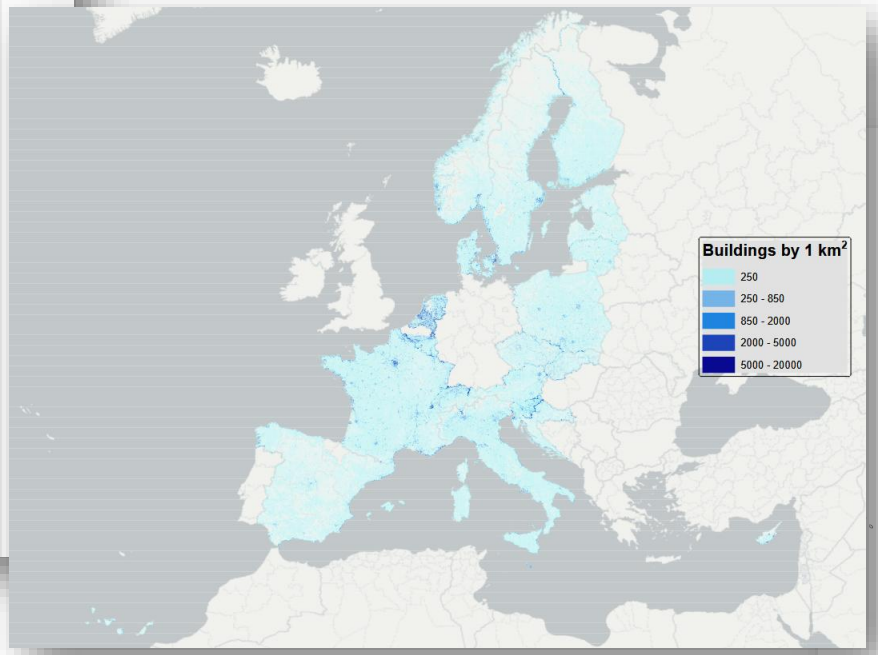
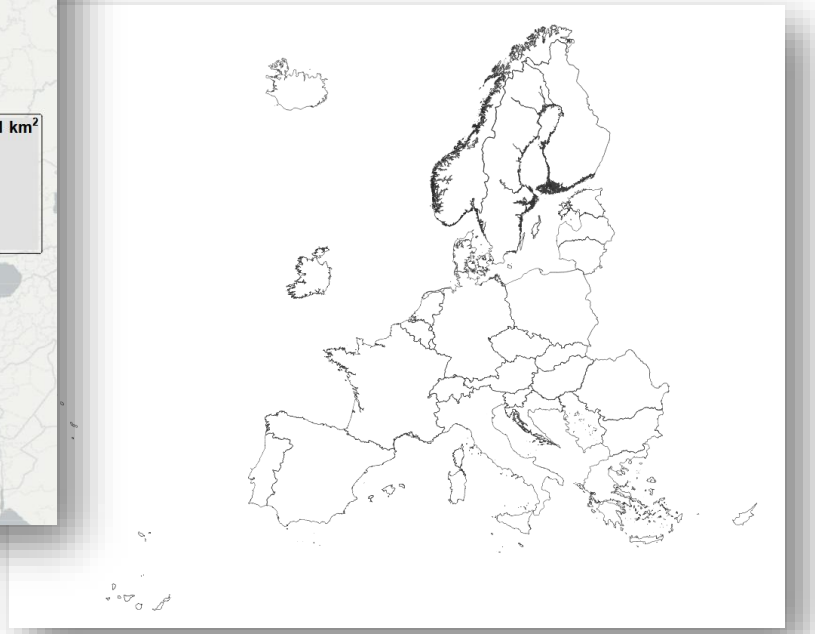


- Increasing availability of high-value datasets for building the SDI/reference geographic information of the European Commission & EU bodies & related services for policy support (3)





(3) Updates from the ESTAT GISCO team. Presented at the 82nd INSPIRE MIG-T meeting, 27 June 2025. https://europa.eu/!9cvpwP (accessed 9 July 2025)

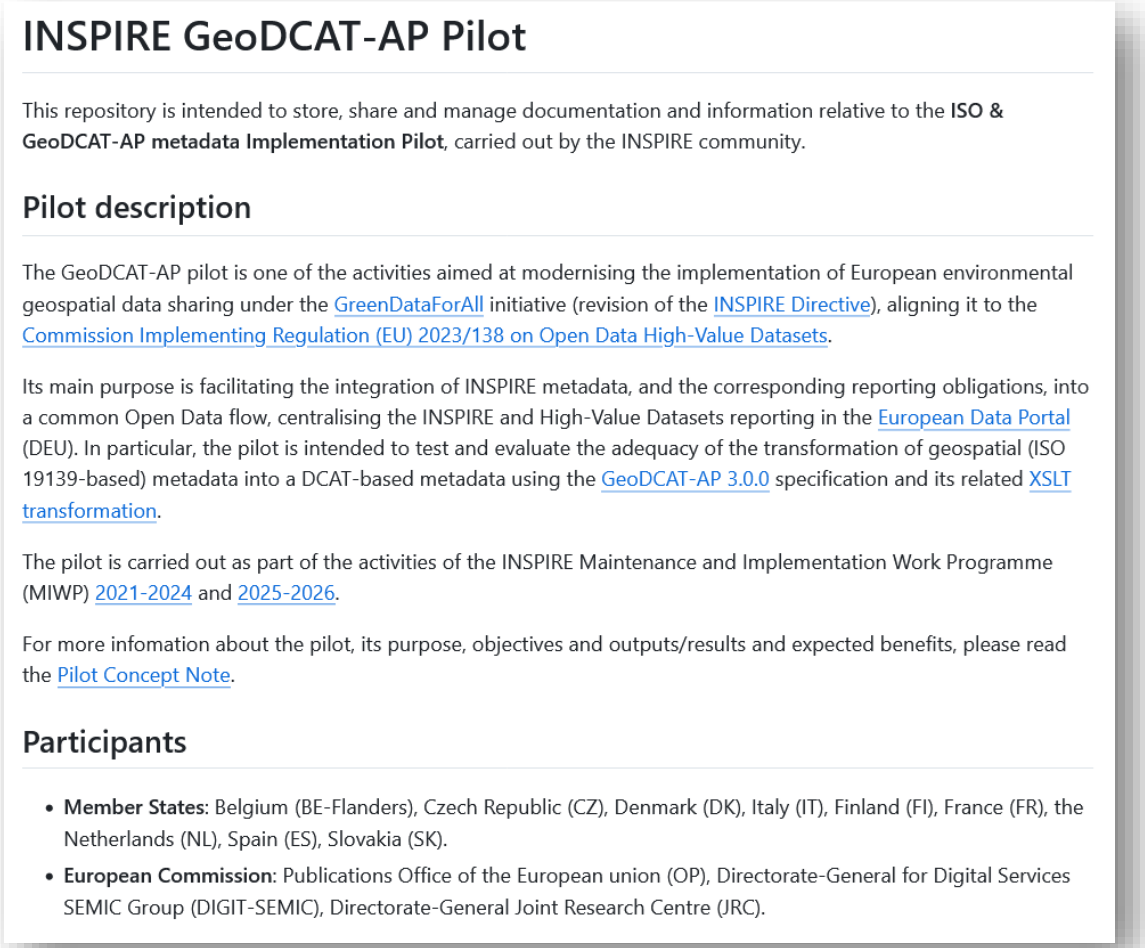
Alignment – Legal perspective

- GreenData4All initiative
  - make public sector environmental data more accessible & aligned to user needs, to effectively contribute to the European Green Deal data space
  - make the existing legal framework on geospatial data (INSPIRE Directive) future-proof and aligned with EU horizontal data legislation
- INSPIRE evaluation (2022)
  - strong contribution to improving data sharing in the EU
  - still relevant for addressing data sharing obstacles
  - implementation gaps remain, organisational & technical issues
  - potential for modernisation/simplification
- INSPIRE possible revision

https://europa.eu/!V6CRtk

Alignment – Technical perspective

- Ongoing work to facilitate integration between requirements from the INSPIRE and Open Data Directives
  1. pilot with 9 Member States and 4 European Commission services, to
     - define a good practice for tagging high-value datasets in metadata
     - develop, test and assess the suitability of a transformation of geospatial INSPIRE metadata (based on ISO 19139) to metadata based on DCAT – particularly GeoDCAT-AP 3.0.0 and its XSLT transformation



INSPIRE GeoDCAT-AP Pilot

This repository is intended to store, share and manage documentation and information relative to the **ISO & GeoDCAT-AP metadata Implementation Pilot**, carried out by the INSPIRE community.

Pilot description

The GeoDCAT-AP pilot is one of the activities aimed at modernising the implementation of European environmental geospatial data sharing under the GreenDataForAll initiative (revision of the INSPIRE Directive), aligning it to the Commission Implementing Regulation (EU) 2023/138 on Open Data High-Value Datasets.

Its main purpose is facilitating the integration of INSPIRE metadata, and the corresponding reporting obligations, into a common Open Data flow, centralising the INSPIRE and High-Value Datasets reporting in the European Data Portal (DEU). In particular, the pilot is intended to test and evaluate the adequacy of the transformation of geospatial (ISO 19139-based) metadata into a DCAT-based metadata using the GeoDCAT-AP 3.0.0 specification and its related XSLT transformation.

The pilot is carried out as part of the activities of the INSPIRE Maintenance and Implementation Work Programme (MIWP) 2021-2024 and 2025-2026.

For more infomation about the pilot, its purpose, objectives and outputs/results and expected benefits, please read the Pilot Concept Note.

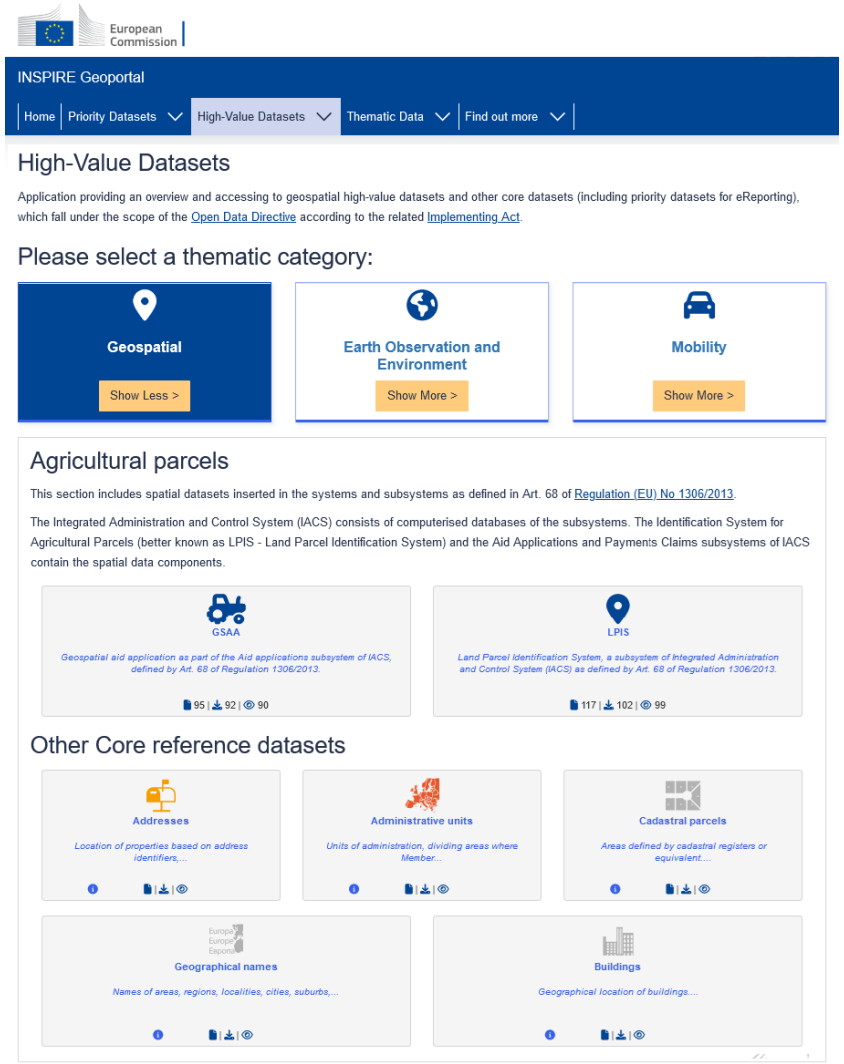
Participants

- **Member States**: Belgium (BE-Flanders), Czech Republic (CZ), Denmark (DK), Italy (IT), Finland (FI), France (FR), the Netherlands (NL), Spain (ES), Slovakia (SK).
- **European Commission**: Publications Office of the European union (OP), Directorate-General for Digital Services SEMIC Group (DIGIT-SEMIC), Directorate-General Joint Research Centre (JRC).

https://github.com/INSPIRE-MIF/GeoDCAT-AP-pilot

Alignment – Technical perspective

- Ongoing work to facilitate integration between requirements from the INSPIRE and Open Data Directives
  2. INSPIRE Geoportal section providing access to geospatial high-value datasets
  3. discussion on including ad hoc geospatial capabilities in the European open data portal



https://inspire-geoportal.ec.europa.eu/srv/eng/catalog.search#/hvdshome

Thank you!

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