SPATIAL DATA INFRASTRUCTURES (SDI)

INTRODUCTION - THE INSPIRE DIRECTIVE

Master in Geospatial Engineering (2025/2026)

Curricular Unit Description

MODULES	TEACHING STAFF	DATES	SW
INTRODUCTION TO SDI	Ana Navarro, FCUL	18 Sep	GeMA/QGIS
METADATA	Ana Navarro, FCUL	25 Sep / 2 Oct	GeMA/QGIS
SPATIAL DATA SERVICES	Danilo Furtado, DGT	9 Oct / 16 Oct	GeoServer / GeoNetwork, QGIS
SPATIAL DATA HARMONIZATION	André Serronha, DGT	23 Oct / 30 Oct	QGIS / hale STUDIO/GAIA
DATA POLICY	Alexandra Fonseca, DGT	6 Nov	
XVI JIIDE 2025	Online Conference	12 a 14 Nov	
PROJECT DEVELOPMENT	Ana Navarro and DGT researchers	Nov / Dec	
PROJECT PRESENTATION	Ana Navarro and DGT researchers	To be scheduled	

Ciências ULisboa

d.gTerritório
Direção-Geral do Território

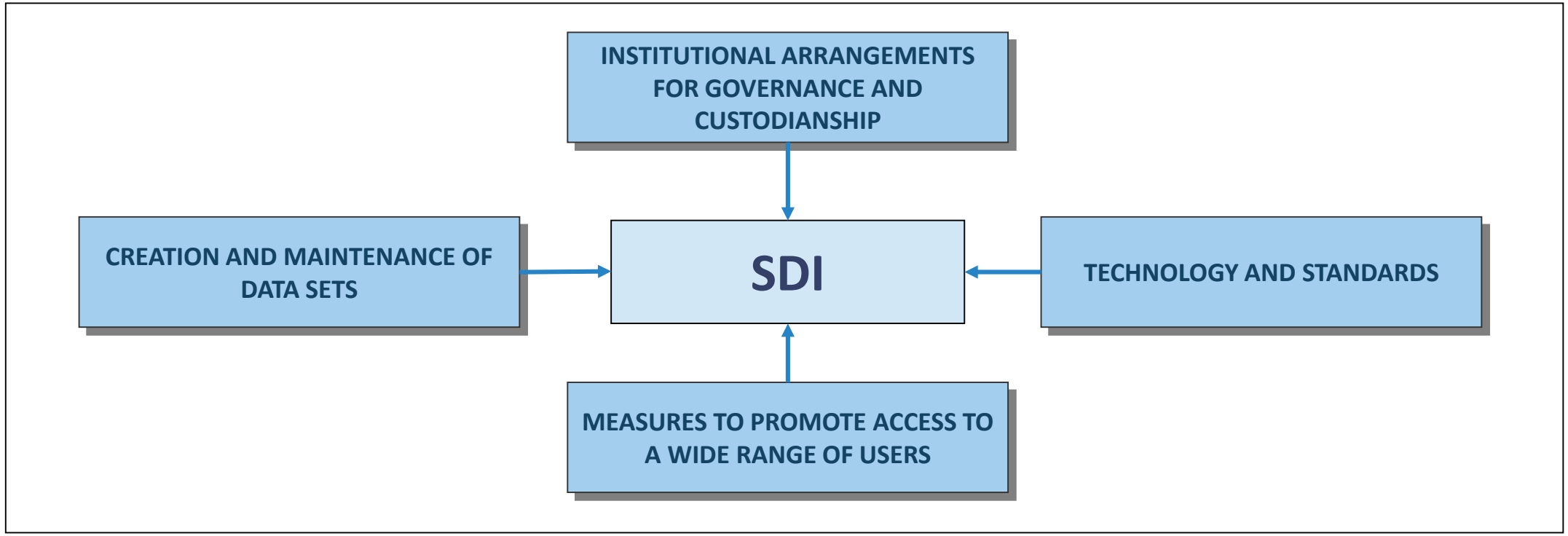
SDI Definition

- According to the Global Spatial Data Infrastructure (GSDI) Association´s Cookbook (Nebert, D.D. (editor), 2004) an SDI hosts geographic data and attibutes, sufficient documentation (metadata), a means to discover, visualize, and evaluate the data (catalogues and web mapping), and some method to provide access to the geographic data.
- Beyond this are additional services or software to support applications of the data.
- To make an SDI functional, it must also include the organisational agreements needed to coordinate and administer it on a local, regional, national, and or trans-national scale.

SDI Definition

- The description of GSDI classifies SDI components as data, metadata, services (technology), and organisational agreements.
- According to Craglia *et al*. (2003), SDI encapsulate policies, institutional and legal arrangements, technologies, and data that enable sharing and effective usage of geographic information.
- This definition adds an aspect of utmost importance – the effective usage of geographic data, which sets the requirement of interoperability.

SDI Components



Masser & Crompvoets (2015)

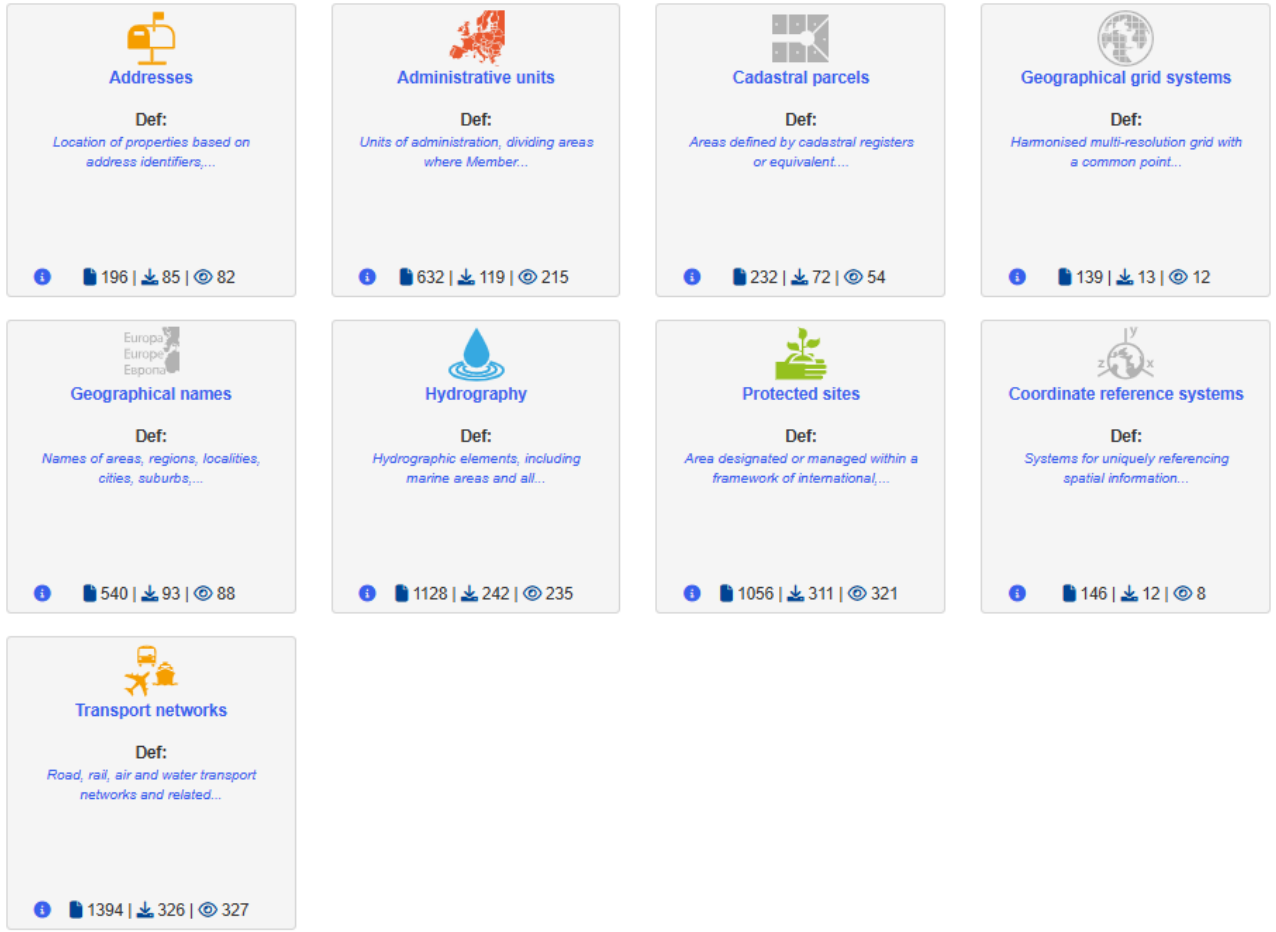
INSPIRE Directive

- The INSPIRE Directive aims to create a European Union spatial data infrastructure for the purposes of EU environmental policies and policies or activities which may have an impact on the environment.
- This European Spatial Data Infrastructure will enable the sharing of environmental spatial information among public sector organisations, facilitate public access to spatial information across Europe and assist in policy-making across boundaries.

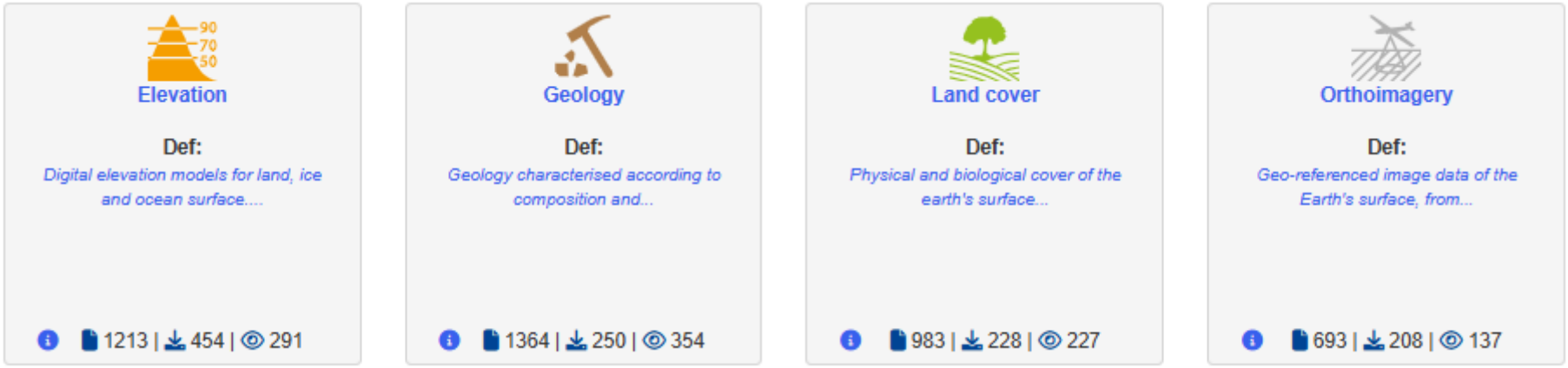
INSPIRE Directive

- INSPIRE is based on the infrastructures for spatial information established and operated by the Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications.
- The Directive came into force on the 15th of May 2007 and will be implemented in various stages, with full implementation required by 2021.

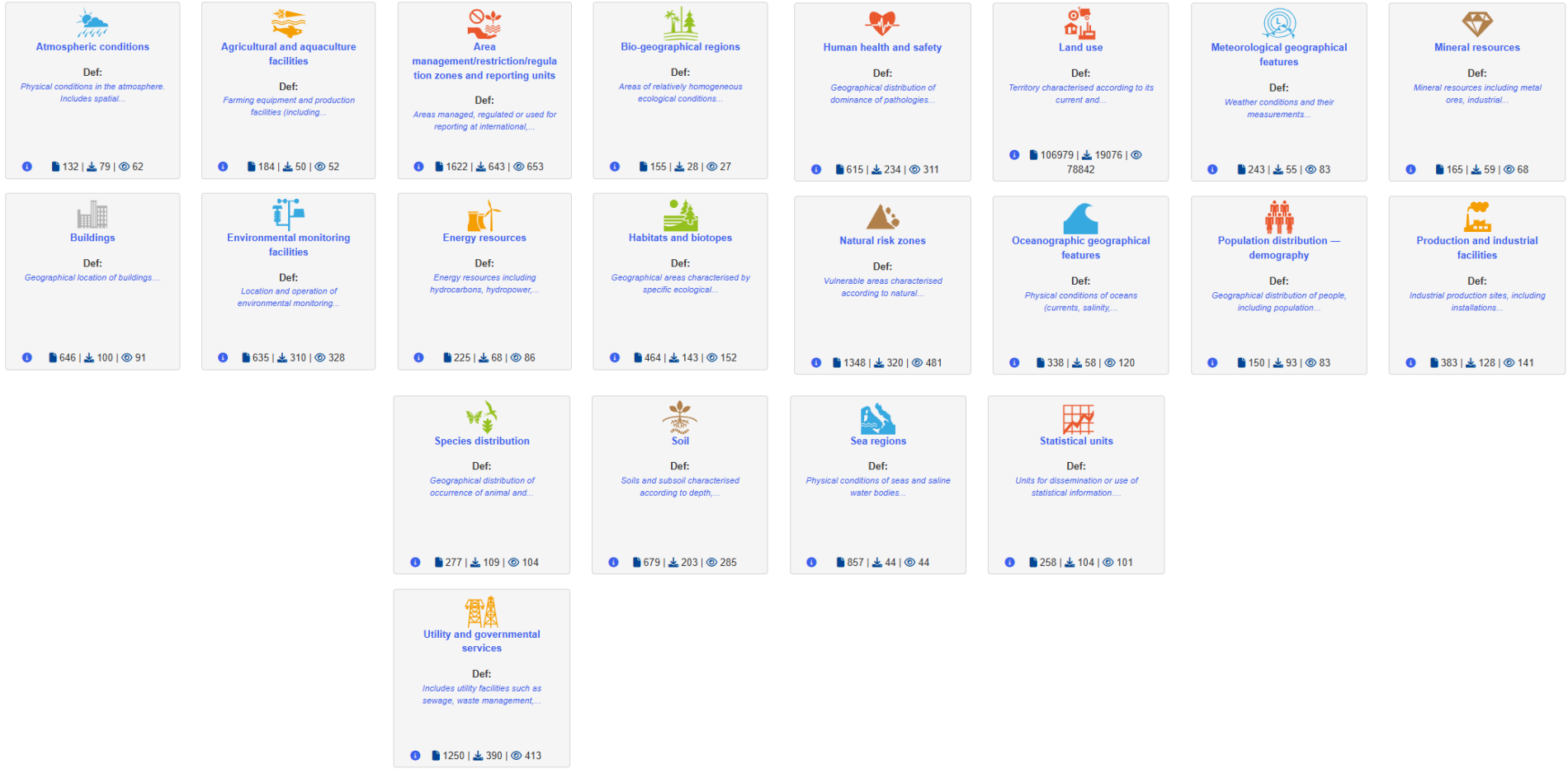
INSPIRE Themes – Annex 1



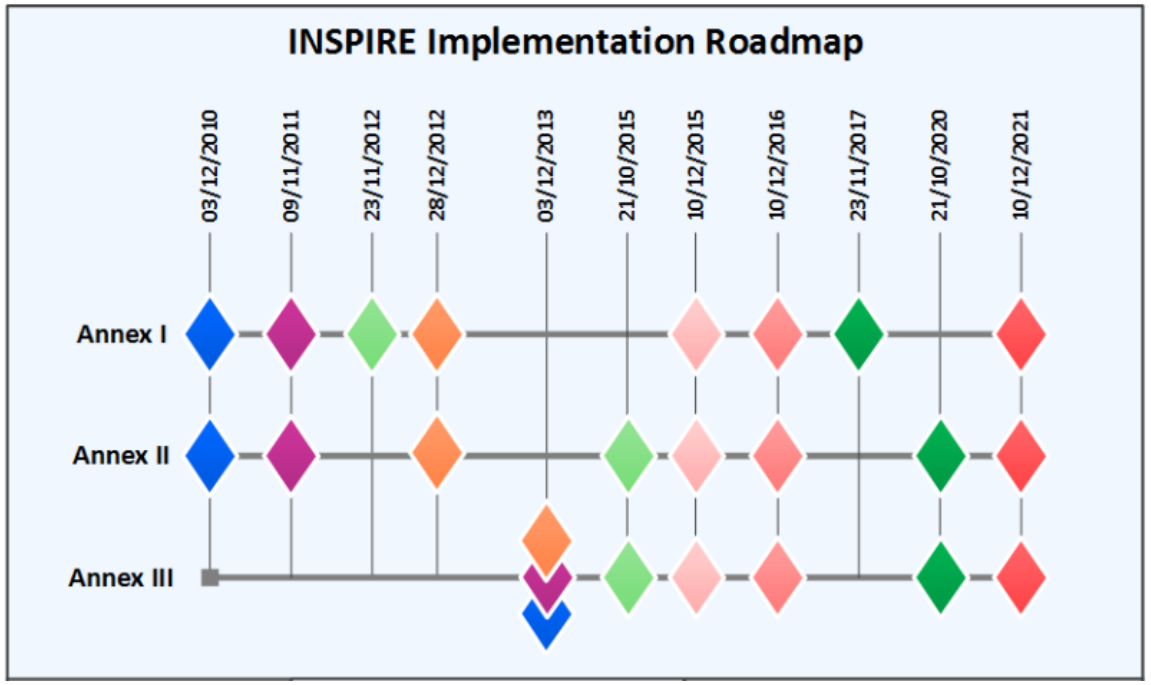
INSPIRE Themes – Annex 2



INSPIRE Themes – Annex 3



INSPIRE Roadmap



Discovery metadata shall be available for spatial data sets and services	Spatial data sets shall be available for **discovery and view** from the INSPIRE geo-portal (data does not yet need to be conformant to IR-ISDSS)	Spatial data sets shall be available for **download and transformation** (whenever applicable[1]) from the INSPIRE geo-portal (data does not yet need to be conformant to IR-ISDSS[2])
Newly collected and extensively restructured spatial data sets shall be **conformant** to IR-ISDSS (incl. **metadata for interoperability**) and available through network services	**All spatial data sets** shall be **conformant** to IR-ISDSS (incl. **metadata for interoperability**) and available through network services	
All invocable spatial data services shall be **conformant to Annex V of IR-ISDSS** (incl. **metadata**)	**Invocable spatial data services related to newly collected and extensively restructured spatial data sets** shall be **conformant to Annexes VI and** (where practicable) **VII of IR-ISDSS** (incl. **metadata**)	**All invocable spatial data services** shall be **conformant to Annexes VI and** (where practicable) **VII of IR-ISDSS** (incl. **metadata**)

IR-ISDSS = Implementing Rules on interoperability of spatial data sets and services (Commission Regulation (EU) No. 1089/2010), including its amendments Regulations (EU) No. 102/2011, 1253/2013 and 1312/2014

[1] Transformation Services only need to be provided if data sets are not made conformant with the IR-ISDSS by some other means (see Art. 7(3) of the INSPIRE Directive)

[2] With the exception of newly collected and extensively restructured Annex I data sets, which already have to be compliant with the IR-ISDSS by 23/11/2012

INSPIRE Principles

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be readily and transparently available.
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

INSPIRE Legislation

- The INSPIRE Directive was published in the Official Journal of the European Union on the 25th of April 2007 and entered into force on the 15th of May 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)

- To ensure that the spatial data infrastructures of the Member States were compatible and usable in a Community and transboundary context, the INSPIRE Directive required that common Implementing Rules (IR) be adopted in a number of specific areas.

INSPIRE Legislation

- These Implementing Rules were adopted as Commission Decisions or Regulations and are binding in their entirety.
- The Commission was assisted in the process of adopting such rules by a regulatory committee composed by representatives of the Member States and chaired by a representative of the Commission (known as the Comitology procedure).

INSPIRE Implementing Rules

METADATA	
DATA SPECIFICATIONS - INTEROPERABILITY OF SPATIAL DATA SETS AND SERVICES	
NETWORK SERVICES	DISCOVERY AND VIEW SERVICES
	DOWNLOAD AND TRANSFORMATION SERVICES
SPATIAL DATA SERVICES	
DATA AND SERVICE SHARING	
MONITORING AND REPORTING	

INSPIRE Technical Guidance

- In addition to the Implementing Rules, non-binding Technical Guidance documents describe detailed implementation aspects and relations with existing standards, technologies, and practices.
- The figure in the next slide illustrates the relationship between the INSPIRE Regulations containing Implementing Rules and their corresponding Technical Guidelines.

INSPIRE Technical Guidance

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English edition — Legislation — Volume 50, 25 April 2007

Contents — I Acts adopted under the EC Treaty/Euratom Treaty whose publication is obligatory — page

DIRECTIVES

* **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)** 1

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other Acts are printed in bold type and preceded by an asterisk.

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Edição em língua portuguesa — Legislação — 50.o ano, 25 de Abril de 2007

Índice — I Actos adoptados em aplicação dos Tratados CE/Euratom cuja publicação é obrigatória — Página

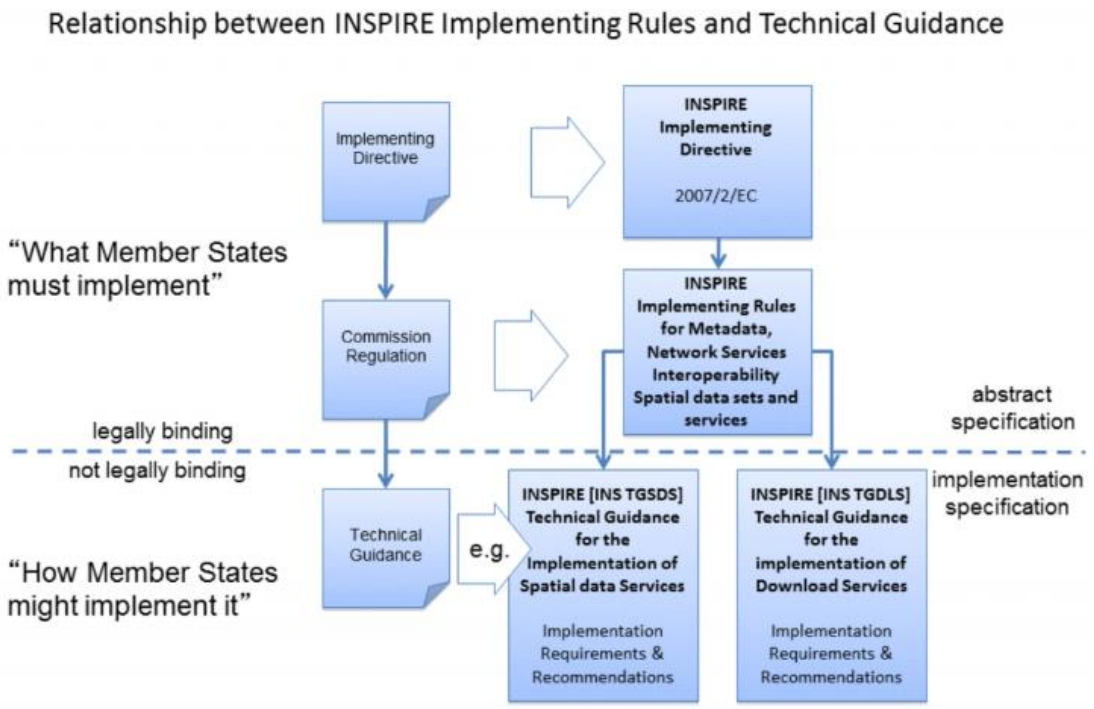
DIRECTIVAS

* **Directiva 2007/2/CE do Parlamento Europeu e do Conselho, de 14 de Março de 2007, que estabelece uma infra-estrutura de informação geográfica na Comunidade Europeia (Inspire)** 1

PT

Os actos cujos títulos são impressos em tipo fino são actos de gestão corrente adoptados no âmbito da política agrícola e que têm, em geral, um período de validade limitado.

Os actos cujos títulos são impressos em tipo negro e precedidos de um asterisco são todos os restantes.



INSPIRE - Infrastructure for Spatial Information in Europe

Technical Guidance for the implementation of INSPIRE dataset and service metadata based on ISO/TS 19139:2007

Title	Technical Guidance for the implementation of INSPIRE dataset and service metadata based on ISO/TS 19139:2007
Creator	Temporary MIWP 2021-2024 sub-group 2.3.1
Date of publication	2024-01-31
Subject	Technical Guidance for INSPIRE metadata for datasets and services
Status	Version 2.2.0 This document has been endorsed by the INSPIRE maintenance and implementation group (MIG).
Publisher	INSPIRE Maintenance and Implementation Group (MIG)
Type	Text
Description	Implementation specification for defining metadata for INSPIRE datasets and services in ISO/TS 19139 based XML format in compliance with the INSPIRE Implementing Rules for metadata.
Format	AsciiDoc
Licence	Creative Commons Attribution (cc-by) 4.0
Identifier	http://inspire.ec.europa.eu/id/document/tg/metadata-iso19139
Changelog	https://github.com/INSPIRE-MIF/technical-guidelines/releases/tag/v2024.1
Language	EN

Legislation - European Commission (europa.eu)

INSPIRE Directive Articles

In the INSPIRE Directive transposition to the Portuguese law (Decree-Law 180/2009, August 7th), Portuguese public institutions and local authorities that produce spatial data corresponding to the themes in the 3 annexes of the Directive should focus on:

METADATA CREATION AND MAINTENANCE

INTEROPERABILITY OF SPATIAL DATA SETS AND SERVICES

NETWORK SERVICES

SPATIAL DATA AND SERVICES SHARING

Article 5

METADA

“Member States shall ensure that metadata are created for the spatial data sets and services corresponding to the themes listed in Annexes I, II and III, and that those metadata are kept up to date”.

Article 7

INTEROPERABILITY OF SPATIAL DATA SETS AND SERVICES

“Member States shall ensure that all newly collected and extensively restructured spatial data sets and the corresponding spatial data services are available in conformity with the implementing rules within 2 years of their adoption, and that other spatial data sets and services still in use are available in conformity with the implementing rules within 7 years of their adoption.”

“Spatial data sets shall be made available in conformity with the implementing rules either through the adaptation of existing spatial data sets or through transformation services.”

Article 11

NETWORK SERVICES

“Member States shall establish and operate a network of the following services for the spatial data sets and services for which metadata have been created in accordance with the Directive: (a) discovery services; (b) view services; (c) download services; (d) transformation services; (e) services allowing spatial data services to be invoked.”

Article 17

DATA-SHARING

“Each Member State shall adopt measures for the sharing of spatial data sets and services between its public authorities.”

“Those measures shall enable those public authorities to gain access to spatial data sets and services, and to exchange and use those sets and services, for the purposes of public tasks that may have an impact on the environment.”

INSPIRE Geoportal

INSPIRE Geoportal

The INSPIRE Geoportal is the central European access point to the data provided by EU Member States and several EFTA countries under the INSPIRE Directive. The Geoportal allows:

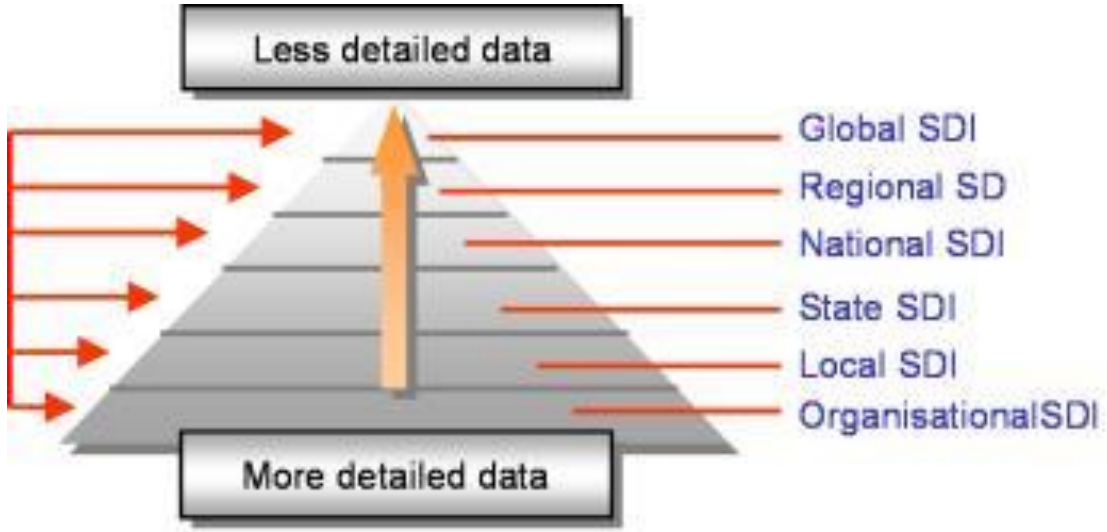
- monitoring the availability of INSPIRE data sets;
- discovering suitable data sets based on their descriptions (metadata);
- accessing the selected data sets through their view or download services.

The metadata used in the Geoportal are regularly harvested from the discovery services of EU Member States and EFTA countries.

SDI Hierarchy

An SDI can be established at global, supranational, national, regional, cross-border, or local levels.

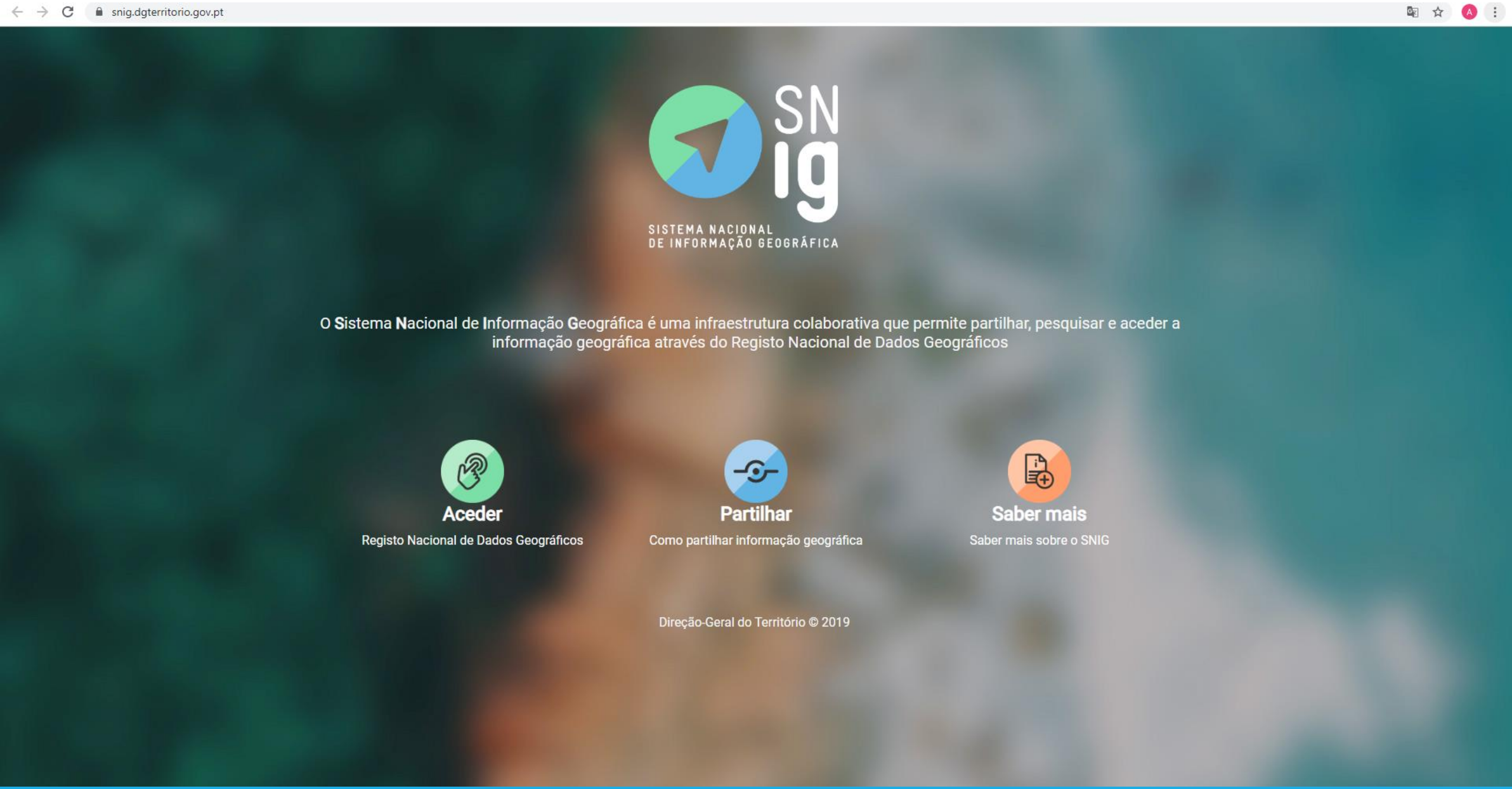
In an ideal case, these levels are interconnected, accomodating each other´s relevant components.



SNIG Geoportal

The Sistema Nacional de Informação Geográfica (SNIG) is the National Spatial Data Infrastructure that allows the registration and search of spatial data and data services produced by public and private entities in Portugal.

The SNIG geoportal, coordinated by the Directorate-General for the Territory (Direção-Geral do Território - DGT), allows the search, exploration, and visualization of spatial data through OGC (Open Geospatial Consortium) data services.

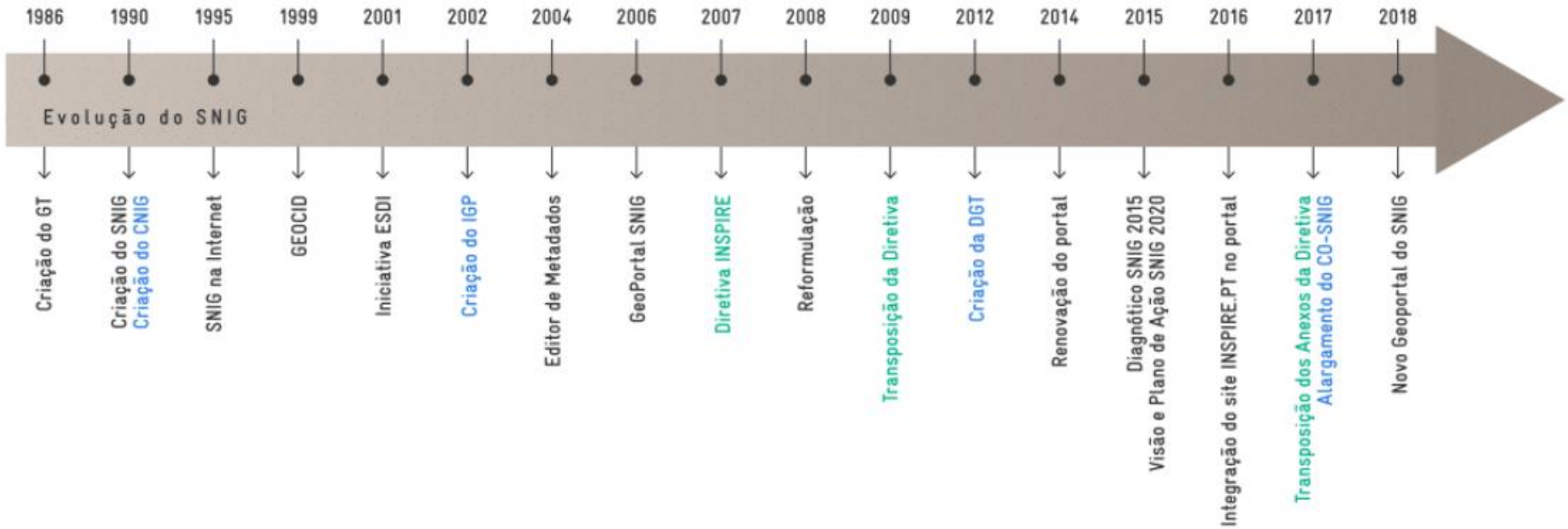

snig.dgterritorio.gov.pt
SNIG
SISTEMA NACIONAL
DE INFORMAÇÃO GEOGRÁFICA
O Sistema Nacional de Informação Geográfica é uma infraestrutura colaborativa que permite partilhar, pesquisar e aceder a informação geográfica através do Registo Nacional de Dados Geográficos
Aceder
Registo Nacional de Dados Geográficos
Partilhar
Como partilhar informação geográfica
Saber mais
Saber mais sobre o SNIG
Direção-Geral do Território © 2019

SNIG Geoportal

SNIG was created more than 30 years ago by Decree-Law 53/90, February 13th, and was the first SDI developed in Europe and the first to be made available on the Internet in 1995. In 2009, this decree-law was amended by the Decree-Law 180/2009, August 7th, reviewing SNIG and transposing the INSPIRE Directive into national law.

Two more amendments were added more recently, Decree-Law 84/2015, May 21st – modifies the composition of the SNIG advisory board (CO-SNIG) – and Decree-Law 29/2017, March 16th – proceeds to the second amendment to Decree-Law 180/2009, August 7th, by specifying the articulation between SNIG and other thematic, regional and local SDI and the spatial data themes referred to in the directive).

SNIG Evolution



Other SDI in Portugal

REGIONAL	IDEA.A Infraestrutura de Dados Espaciais dos Açores IDEAlg - Infraestrutura de Dados Espaciais do Algarve
LOCAL	Infraestrutura de Dados Espaciais de Águeda – IDEÁgueda GeoPortal do Municipio de Vale de Cambra
THEMATIC	Sistema Nacional de Informação do Mar (SNIMar) Sistema de Informação de Metadados Ambientais (SNIAmb) Sistema Nacional de Informação Territorial (SNIT) Sistema de Monitorização da Ocupação do Solo (SMOS)
INSTITUTIONAL	Infraestrutura de Dados e Informação Geoespacial Marinha do Instituto Hidrográfico (Hidrográfico+)

International Standards for SDI

A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.

International standards for geographic information have been developed and maintained by the International Organization for Standardization Technical Committee 211 (ISO/TC 211) and by the Open Geospatial Consortium (OGC) since 1994 when both organizations were created.

International Standards for SDI

A co-operative agreement between ISO/TC 211 and OGC formalizes their intention to co-operate and to enable the development of a series of agreed Industry Implementation Specifications based on ISO 15046 and other related standards.

OGC produces publicly available Industry Implementation Specifications through an open consensus based process among its members. ISO/TC 211 produces ISO International Standards for Geographical information/Geomatics through a national body balloting process.

This agreement facilitates the Industry Implementation Specifications produced by OGC to formally go through the process of becoming an ISO International Standard.

International Standards for SDI

	STANDARDS	ORGANIZATION
METADATA	ISO 19115 (Metadata) ISO 19119 (Services) ISO/TS 19139 (Metadata – XML schema implementation) OGC Catalogue Services	International Organization for Standardization (ISO) Open Geospatial Consortium (OGC)
REFERENCE MODEL	ISO 19101 (Reference model) ISO/TS 19103 (Conceptual schema language) ISO 19107 (Spatial schema) ISO 19108 (Temporal schema) ISO 19109 (Application schema) ISO 19111 (Spatial referencing by coordinates)	International Organization for Standardization (ISO)
SERVICES	OGC Web Map Services (WMS) OGC Web Feature Services (WFS) OGC Web Coverage Services (WCS)	Open Geospatial Consortium (OGC)

ISO

ISO is an independent, non-governmental international organization with a membership of 173 national standards bodies.

Through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market-relevant International Standards that support innovation and provide solutions to global challenges.

ISO has developed over 25 997 International Standards and related documents, covering almost every industry, from technology to food safety, to agriculture and healthcare.

OGC

OGC is an international not for profit organization committed to making quality open standards for the global geospatial community. These standards are made through a consensus process and are freely available for anyone to use to improve sharing of the world's geospatial data.

OGC standards are used in a wide variety of domains and has more than 450 members coming from across government, commercial organizations, NGOs, academic, and research institutes.

Metadata

A metadata record is a file of information, usually presented as an XML (eXtensible Markup Language) document, which captures the basic characteristics of a data or information resource.

Metadata must be compliant with ISO 19115-1:2014 (Geographic Information - Metadata) from ISO/TC 211. This standard provides information about the identification, the extent, the quality, the spatial and temporal aspects, the content, the spatial reference, the portrayal, distribution, and other properties of digital geographic data and services.

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Changelog	https://github.com/INSPIRE-MIF/technical-guidelines/releases/tag/v2024.1
Language	EN

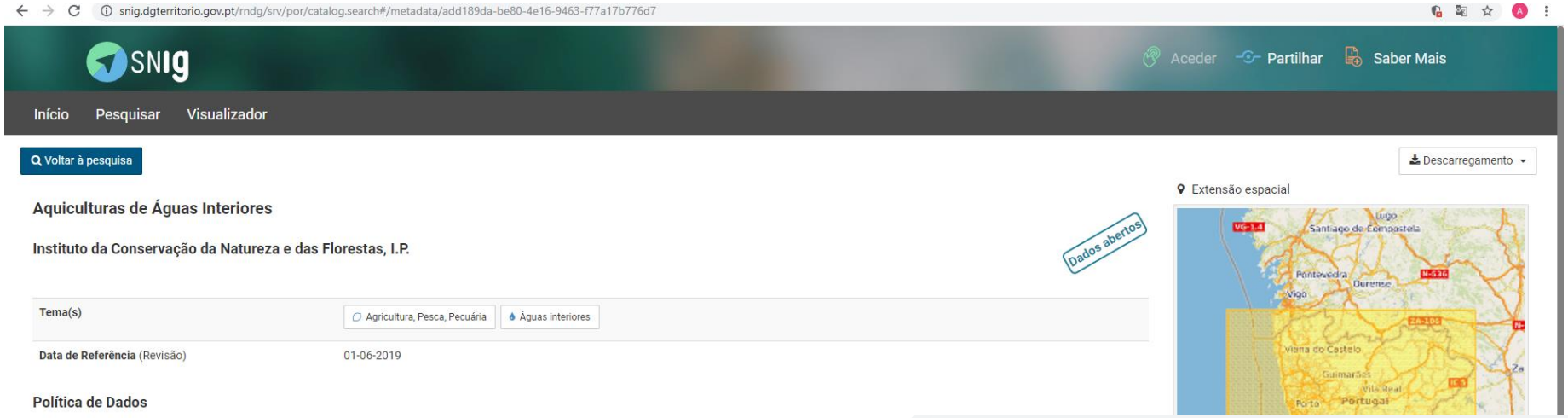
Annex B: Mapping of ISO 19115:2003 Core elements and INSPIRE Implementing Rules for metadata (informative)

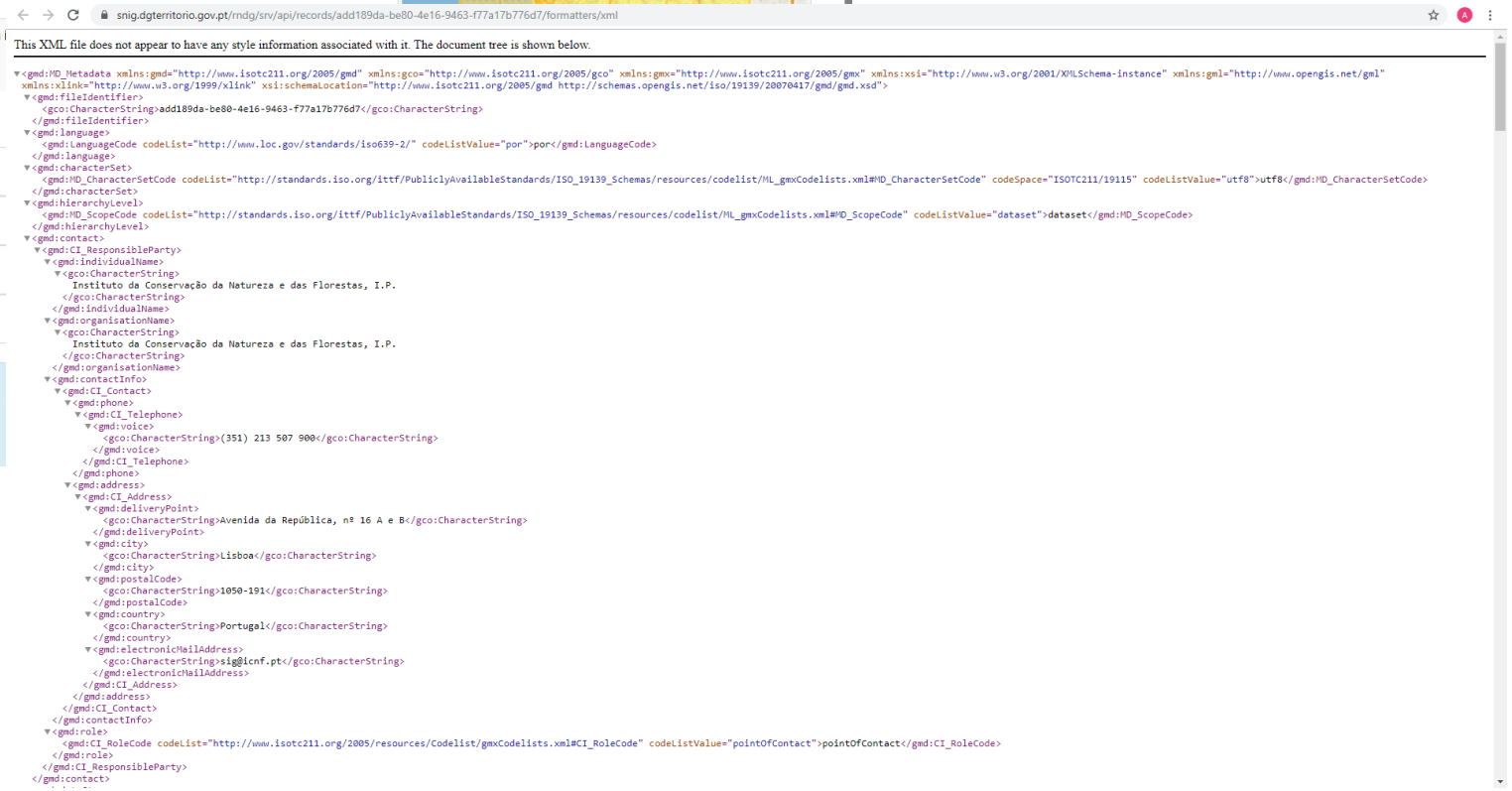
B.1. Spatial dataset and spatial dataset series

The table below compares the core elements of ISO 19115 (see Table 3 in 6.5 of EN ISO 19115:2003) to the requirements of INSPIRE for spatial dataset and spatial dataset series as defined in the Implementing Rules for metadata.

ISO 19115 Core	INSPIRE Implementing Rules for Metadata	Comments
Dataset title (M)	Part B 1.1 Resource Title	-
Dataset reference date (M)	Part B 5 Temporal Reference	ISO 19115 is more demanding. The metadata shall contain a date of publication, revision or creation of the resource, while in INSPIRE the Temporal Reference can also be expressed through Temporal Extent.
Dataset responsible party (O)	Part B 9 Responsible organisation	INSPIRE is more demanding by mandating both the name of the organisation, and a contact e-mail address
Geographic location of the dataset (C)	Part B 4.1 Geographic Bounding Box	INSPIRE is more restrictive. A Geographic bounding box is mandated
Dataset language (M)	Part B 1.7 Resource Language	ISO 19115 is more demanding. It mandates the dataset language, even if the resource does not include any textual information. The ISO 19115 Dataset language is defaulted to the Metadata language.
Dataset character set (C)	-	ISO 19115 is more demanding. The dataset character set has to be documented in ISO 19115 when ISO 10646-1 is not used. The ISO 19115 element maps to the conditional "Character Encoding" metadata element defined in Art. 13(5) of the Implementing Rules on interoperability of spatial data sets and services. This element is mandatory only if an encoding is used that is not based on UTF-8 (the dominant encoding of ISO 10646-1).
Dataset topic category (M)	Part B 2.1 Topic Category	-

technical-guidelines/metadata/metadata-iso19139 at main · INSPIRE-MIF/technical-guidelines · GitHub


snig.dgterritorio.gov.pt/rndg/srv/por/catalog.search#/metadata/add189da-be80-4e16-9463-f77a17b776d7
SNIG
Aceder
Partilhar
Saber Mais
Início
Pesquisar
Visualizador
Voltar à pesquisa
Descarregamento
Extensão espacial
Aquiculturas de Águas Interiores
Instituto da Conservação da Natureza e das Florestas, I.P.
Dados abertos
Tema(s)
Agricultura, Pesca, Pecuária
Águas interiores
Data de Referência (Revisão)
01-06-2019
Política de Dados
Restrições legais
Sem restrições. A utilização ou divulgação deste conjunto de dados geográficos requer sempre a
Sem restrições
Serviços de visualização e descarregamento
http://si.icnf.pt/wfs/aquicultura_aguas_interiores?service=wfs&version=1.1.0&request=GetCapabilities
http://si.icnf.pt/wms/aquicultura_aguas_interiores?service=wfs&version=1.1.1&request=GetCapabilities
http://si.icnf.pt/shp/aquicultura_aguas_interiores
http://si.icnf.pt/kml/aquicultura_aguas_interiores
Dados geográficos (geometria de pontos) e alfanuméricos (tabela de atributos) sobre os estabelecimentos de aquiculturas de águas interiores, e respetivos processos de licenciamento, constantes nos registos da Divisão de Gestão dos Recursos Cinegéticos e Aquícolas (DGRCA) do ICNF. Legislação principal: Decreto 44623 de 1962-10-10, com a redação do Decreto 312/70 de 1970-07-06, regulamentado pela Portaria 747/86 de 1986-12-16; Lei 7/2008 de 2008-02-15, alterada pelo Decreto-Lei 221/2015 de 2015-10-08 e regulamentada pelo Decreto-Lei 222/2015 de 2015-10-08.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</gmd:electronicMailAddress>
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</gmd:address>
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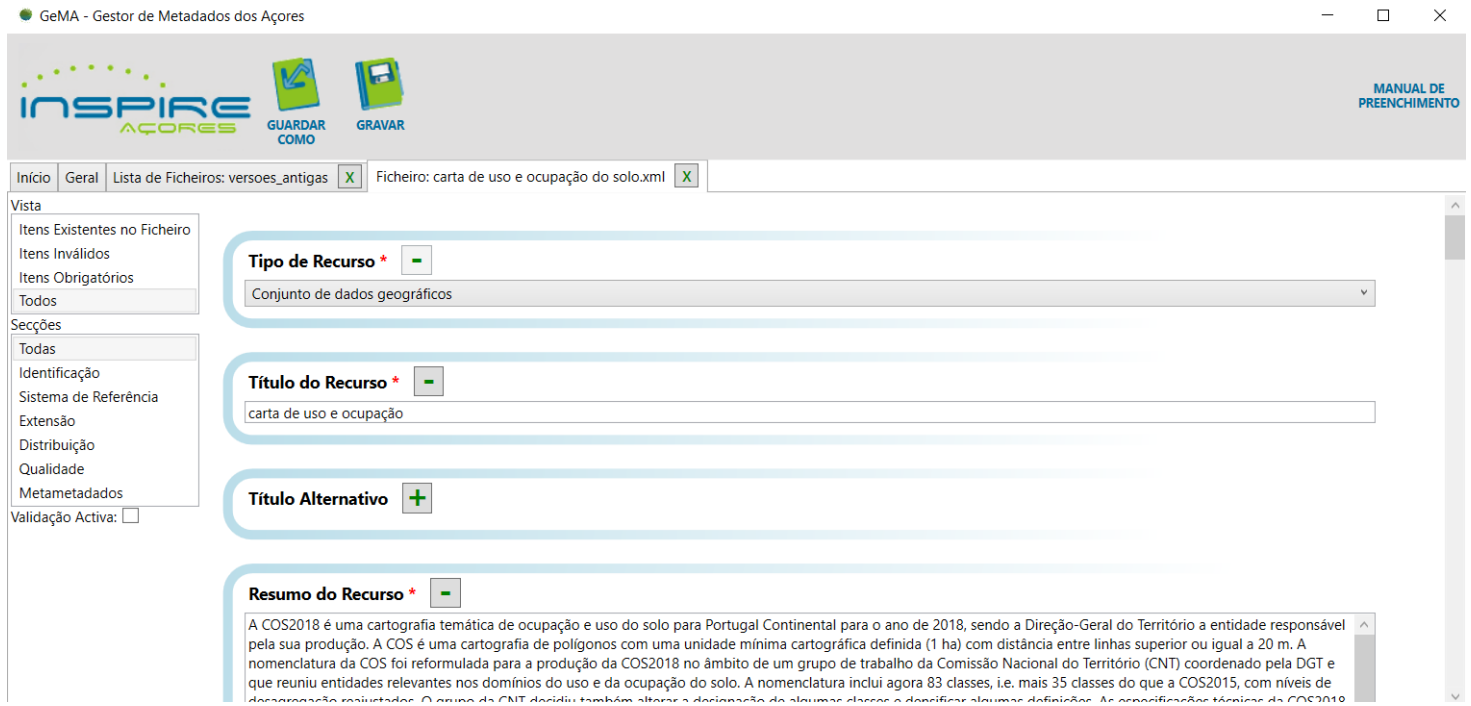
</gmd:role>
</gmd:CI_ResponsibleParty>
</gmd:contact>
Lugo
Santiago de Compostela
Pontevedra
Ourense
Vigo
Viana do Castelo
Guimarães
Vila Real
Porto
Portugal

Metadata Editor

A metadata editor is a tool that facilitates the documentation of resources, focusing on the description of geographic information resources.

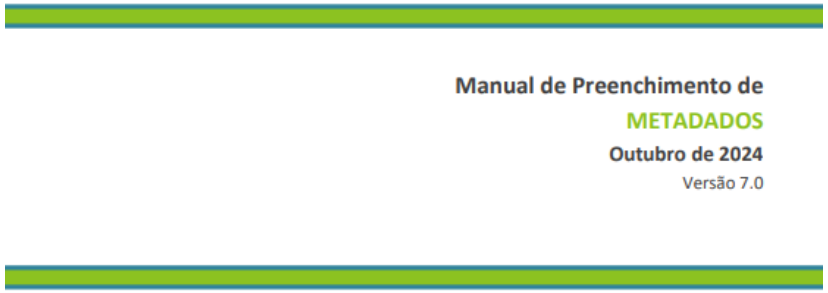
The actual metadata editor adopted by DGT is **GeMA** (Gestor de Metadados dos Açores) that creates, edits, converts formats, views, and validates metadata, according to INSPIRE rules.



Metadata Editor

GeMA Tutorials

- Instruções de instalação do GeMA;
- Manual de Utilização GeMA (Versão 7.0 – outubro 2024);
- Manual de Preenchimento Metadados (Versão 7.0 – outubro 2024).



https://idea.ambiente.azores.gov.pt/metadados/