Reportnet and data harvesting using INSPIRE infrastructure
(Feasibility study)

Report 1: Data harvesting using INSPIRE network services

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Contents

Acknowledgements

Terms and definitions

Access point

Access point (of a Spatial Data Service) is an URL for retrieving a detailed description of a Spatial Data Service, including a list of end points to allow its execution. [1]

Catalogue Service for the Web (CSW)

 OGC® Catalogue Services support the ability to publish and search collections of descriptive information (metadata records) for geospatial data, services, and related information. Metadata in catalogues represent resource characteristics that can be queried and presented for evaluation and further processing by both humans and software. Catalogue services are required to support the discovery and binding to registered information resources within an information community[1].

Direct access download service

Direct access download means a Download Service, which provides access to the spatial objects in spatial datasets, based upon a query. [2]

A direct access download service extends the functionality of a pre-defined dataset download service to include the ability to query and download subsets of datasets. The direct access download service allows more control over the download than the simple download of a pre-defined dataset or pre-defined part of a dataset. It can therefore be considered to be more „advanced" than the pre-defined dataset download. In this case, the spatial information is typically stored in a repository (e.g. a database) and only accessible through a middleware data management system (although the precise implementation may vary). The term direct access is used to mean the capability of a client application or client service to interact directly with the contents of the repository, e.g. by retrieving parts of the repository based upon a query. The query can be based upon spatial or temporal criteria, or by specific properties of the instances of the spatial object types contained in the repository. [1]

Download service

Download service is a service enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly. [3]

End point

End point (of a Spatial Data Service) is a URL used for directly calling an operation provided by the Spatial Data Service. [4]

These end points can be classified in four categories:

1. *Get Service Metadata* which provides information about the service, the available Spatial Datasets, and describes the service capabilities

2. *Get Spatial Dataset* which is an identifiable collection of spatial data

3. *Describe Spatial Dataset* which provides information describing spatial datasets making it possible to discover, inventory and use them.

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[1] https://www.opengeospatial.org/standards/cat

4. *Link Download Service* which allows the declaration of the availability of a Download Service for downloading Spatial Datasets.

Feature

'Feature' means abstraction of real world phenomena. [ISO 19101]

The INSPIRE Generic Conceptual Model[2] also provides additional explanation, as follows:

The term "(geographic) feature" as used in the ISO 19100 series of International Standards, in other specifications like IHO S-57, and in this document is synonymously with spatial object as used in this document. Unfortunately, "spatial object" is also used in the ISO 19100 series of International Standards, however with a different meaning: a spatial object in the ISO 19100 series is a spatial geometry or topology. [INSPIRE Generic Conceptual Model]

NOTE In the feasibility study, the terms 'feature' and 'spatial object' are used as synonyms.

Metadata

'Metadata' means information describing spatial datasets and spatial data services and making it possible to discover, inventory and use them. [3]

Pre-defined dataset download service

A pre-defined dataset download service provides for the simple download of pre-defined datasets (or pre-defined parts of a dataset) with no ability to query datasets or select user-defined subsets of datasets. A pre-defined dataset or a pre-defined part of a dataset could be (for example) a file stored in a dataset repository, which can be downloaded as a complete unity with no possibility to change content, whether encoding, the CRS of the coordinates, etc. [1]

Spatial data

'Spatial data' means any data with a direct or indirect reference to a specific location or geographical area. [3]

Spatial dataset

'Spatial dataset' means an identifiable collection of spatial data. [3]

Spatial data service

'Spatial data services' means the operations which may be performed, by invoking a computer application, on the spatial data contained in spatial data sets or on the related metadata. [3]

Spatial object

'Spatial object' means an abstract representation of a real-world phenomenon related to a specific location or geographical area. [3]

Web Feature Service (WFS)

WFS is a web service for geographic information specified by the International Organization for Standardization (ISO) in the standard ISO 19142 Web Feature Service (also as standard OGC Web

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[2] https://inspire.ec.europa.eu/documents/inspire-generic-conceptual-model

Feature Service 2.0). It specifies discovery operations, query operations, locking operations, transaction operations and operations to manage stored parameterized query expressions[3]. It supports ISO 19143 Filter Encoding (also as standard OGC Filter Encoding 2.0). In INSPIRE, the service could be used to implement pre-defined dataset download services and direct access download service.

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[3] https://www.iso.org/standard/42136.html

Executive summary

The feasibility study on data harvesting using INSPIRE infrastructure comes timely in view of the modernisation of the EEA's electronic infrastructure for reporting data collection, Reportnet, and contributes to the actions to streamline environmental reporting published by the European Commission as a result to the regulatory fitness check of environmental legislation. Firstly, data harvesting is proposed as a technological solution for the EU institutions to access data at national or local level without requesting Member States to actively report them. Secondly, the access to spatial data, an essential component in many environmental reporting obligations, is governed by the INSPIRE Directive adopted in 2007 that establishes the infrastructure for spatial information in Europe. INSPIRE provides the possibility to directly access spatial datasets, according to 34 INSPIRE spatial data themes, via standard web services (INSPIRE network services).

The scope of this feasibility study is therefore to explore and assess up to which extent the national services available through the INSPIRE infrastructure can actually contribute to streamline the reporting process, by automating as much as possible the collection of geospatial datasets pertaining to reporting obligations that are available through INSPIRE services.

Chapter 1 Introduction provides a wider EU policy context information behind the scope of the feasibility study. Its two main objectives are: (1) to demonstrate the viability of the harvesting workflow of complete datasets for reporting dataflow, and (2) to test the possibility to reference, find and download specific spatial objects required by environmental obligations through the INSPIRE infrastructure. Following-up on these two use cases, the feasibility study provides two reports:

- Data harvesting using INSPIRE network services, and
- Referencing spatial objects using INSPIRE network services.

The Natura 2000 network of sites has been selected as the thematic area due its well defined reporting data flow that requires also spatial data and due to the INSPIRE implementation roadmap, which requires the Natura 2000 sites to be fully available (harmonised) through the INSPIRE infrastructure already since 2017.

The INSPIRE Geoportal was used in the first place to identify INSPIRE web services. The **Chapter 2 Identification of web services** describes different methods to identify the INSPIRE downloadable datasets and services and presents the initial list of selected INSPIRE services. It also shows the variety of types and ways how the datasets and services are organised.

For a better understanding of service behaviour, a service monitoring environment was set up to monitor the services in a short period under different load. INSPIRE service quality criteria (availability, performance and capacity) as well as additional reliability criteria were used in the service evaluation. **Chapter 3 Service availability and performance** provides a summary of the results of tests, which shows the identified services are stable enough to be harvested, even though in some cases the workflow might need adjustments, such as launching the harvesting process several times, or in different days. Several solutions are also provided for an organisation of datasets and services that could ease the harvesting process.

Chapter 4 Initial data quality control describes a few tests that were used to ensure the content

of downloadable dataset corresponded to the reporting obligation. The quality control tests aimed at validating datasets against INSPIRE and reporting obligations requirements. The INSPIRE Validator ETF tool was used for validation of INSPIRE requirements, while custom tests were developed to test Natura 2000 specific requirements.

The existing reporting data flow (as defined in Reportnet 2.0) would need some adjustments to include data harvesting as a new method to collect data. **Chapter 5 Proposed workflow for data harvesting** describes first the general characteristics of the current workflow in Reportnet 2.0, including the workflow of Natura 2000 reporting data flow. The outcomes of individual steps in the feasibility study are then used to design a proposed workflow with data harvesting. That workflow still includes human interaction in the process (i.e. the study does not propose a completely automatic workflow) in particular to confirm that the correct (and/or official) datasets are going to be harvested.

Conclusions summarise the findings of the feasibility study use case on data harvesting using INSPIRE network services.

The annexes include detailed information about the services used (service end points), tests results and samples that could be reused again in further work, as follows:

Annex 1 List of service end points,

Annex 2 Service monitoring results, and

Annex 3 INSPIRE spatial data suitability.

The most relevant findings have been provided to the Requirements Catalogue for the Reportnet 3.0 development.

1 Introduction

1.1 Policy context

The European Commission's regulatory fitness and performance (REFIT) programme, which aims to ensure that EU legislation delivers results for citizens and businesses effectively, efficiently and at minimum cost, included also the fitness check of the EU environmental legislation, focusing on the reporting obligations, including the Directive for establishing an infrastructure for spatial information in the European Community (INSPIRE) [3]. Based on the REFIT outcomes[4], the European Commission defined several actions to streamline the environmental reporting [5]. Two actions (3 and 4) focus particularly on the streamlining of the reporting process, while the action 6 sets the priority for the implementation of the INSPIRE Directive to the geospatial datasets covered by the EU environmental legislation:

- Action 3: Modernise eReporting including through a more advanced Reportnet and by making best use of the existing infrastructure,

- Action 4: Develop and test tools for data harvesting at EU level, and

- Action 6: Promote full implementation of the INSPIRE Directive, giving priority to datasets most relevant for the implementation and reporting of EU environmental legislation.

These three actions act as key policy drivers behind the feasibility study on the use and harvesting INSPIRE services in Reportnet. The following sections provide details on these three actions.

Action 3 – Modernising eReporting through a more advanced Reportnet

Reportnet[5] is an infrastructure for supporting and improving data and information flows that are based on the EU environmental legislation, international agreements and the cooperation between the European Environment Agency (EEA) and the European Environment Information and Observation Network (Eionet)[6].

Reportnet has been developed since 2000 and has been in operational use since 2002. This means that initial design is now almost 20 years old. Over time, the reporting needs have changed and Reportnet has been modified to host special-cases so many times that the original design is beginning to be compromised and is reaching its capacity limits.

With the support of the European Commission, the project of Reportnet modernisation (namely Reportnet 3.0) has started in 2018 and aims, among others, to:

- Use a state of the art ICT technology for the next decade of e-reporting,

- Support the key functions of the whole data flow management lifecycle,

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[4] http://ec.europa.eu/environment/legal/reporting/fc_overview_en.htm ;

[5] https://www.eionet.europa.eu/reportnet

[6] https://www.eionet.europa.eu/

- Build upon interoperable generic modules and standards,

- Limit investment costs at national level by making use of existing IT infrastructure,

- Enhance Reportnet 2.0 functionalities,

- Reduce costs per individual data flow.

Action 4: Data harvesting tools at EU level

Data harvesting is proposed as a technological solution for the EU institutions to access data at national or local level without requesting Member States to actively report them. In principle, this would enable EU institutions to have better and more flexible access to data while minimising the administrative burden in Member States.

The European Commission, together with the EEA, have initiated projects[7] to explore the existing tools and ideas of data harvesting and to build the appropriate experiences on how this can be used more effectively in environment policy in the future.

Action 6: Promoting full implementation of the INSPIRE Directive, giving priority to datasets most relevant in environmental reporting

The development of the infrastructure for spatial information in Europe[8] (according to the INSPIRE Directive adopted in 2007) provides the possibility to directly access spatial datasets, according to 34 INSPIRE spatial data themes, via standard web services (INSPIRE network services). The spatial datasets covered by the themes in Annex I of the INSPIRE Directive (mostly reference data such as addresses, hydrography and transport network, but also protected sites) are required to be already provided through web services in a harmonised way (i.e. according to the Implementing Rules on interoperability of spatial data sets and services [6]). Spatial datasets from Annex II and III of the INSPIRE Directive shall be harmonised by 2020 and the complete INSPIRE infrastructure must be implemented by 2021 [7].

The definition of spatial datasets addressed by the INSPIRE Directive covers a wide spectrum of environmental (and other) data, from geographic reference points (e.g. location of monitoring station) to the environmental data being collected (e.g. concentration of a specific pollutant in the environment). At the same time, **most or all information reported under EU environmental legislation has a geospatial component, overlapping therefore with the INSPIRE scope.** If available through the INSPIRE infrastructure, the relevant geospatial datasets could eventually be harvested online by the corresponding reporting authorities whenever a new report is due, optimising the data flows from different organisations for EU level reporting purposes. There is therefore scope for streamlining the environmental reporting processes requiring the submission of geospatial information covered by INSPIRE, in order to avoid double reporting and address possible lack of coherence and consistency.

As a result of the mid-term evaluation of INSPIRE implementation[9] and the REFIT exercise published in 2016, the INSPIRE Maintenance and Implementation Group expert group (INSPIRE

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[7] http://www.eis-data.eu/

[8] INSPIRE web site: https://inspire.ec.europa.eu/

[9] https://www.eea.europa.eu/publications/midterm-evaluation-report-on-inspire-implementation

MIG)[10] agreed on a series of activities under their work programme 2017 – 2020 [8], which should help to simplify the implementation of INSPIRE and reinforce the INSPIRE use case in the context of environmental reporting.

One of these activities, "Priority list of datasets for e-Reporting" (2016.5), is actually included as the driver of the action 6 of the Action Plan to streamline monitoring and reporting. This action covers the identification and maintenance of a priority list of datasets[11] that are essential for monitoring and reporting of EU environment policy. The priority list of datasets for eReporting currently covers seven environmental domains (air, noise, nature, water, industrial accidents, industrial emissions, waste) and 22 EU environmental policies, and indicates the spatial data that are required under the relevant reporting obligations. The list serves as a guidance to Member States to make these datasets accessible through INSPIRE in a stepwise manner. Initially, the spatial datasets are to be provided "as is" (i.e. in their original structure and format) since most of these datasets fall under Annex III of the INSPIRE Directive and the deadline for their harmonisation according to the INSPIRE implementing rules on data and service interoperability is only in late 2020. The complete data harmonisation, including their connection with the reporting obligations, will then take place later in a stepwise approach, in line with the agreed reporting data models.

In the context of this activity, the INSPIRE Geoportal[12], established at Community level as the entry point to the Member States' (or other countries') INSPIRE infrastructures through network services, has also been revamped. Its current version presents simplified overviews of spatial datasets that are included in the priority list of datasets for e-Reporting (Priority Data Sets Viewer) or otherwise related to the INSPIRE spatial data themes (INSPIRE Thematic Viewer). These new functionalities provide simplified access to downloadable spatial datasets and their descriptions (metadata).

1.2   Scope of the feasibility study

The actions above aiming to streamline environmental reporting clearly indicate the new directions that need to be explored in order to achieve higher coherence and consistency in the geospatial information included in, or relevant to, environmental reporting obligations, avoiding double implementation and data provision and hence reducing costs for reporting.

The scope of this feasibility study is therefore to explore and assess up to which extent the national services available through the INSPIRE infrastructure can actually contribute to streamline the reporting processes, by automating as much as possible the collection of geospatial datasets pertaining to reporting obligations and which are available through INSPIRE services.

This feasibility study is supporting the Reportnet 3.0 scoping study, which will lay the foundations for the next generation of the reporting platform at the EEA.

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[10] https://webgate.ec.europa.eu/fpfis/wikis/pages/viewpage.action?pageId=268249090
[11]
https://webgate.ec.europa.eu/fpfis/wikis/display/InspireMIG/Action+2016.5%3A+Priority+list +of+datasets+for+e-Reporting
[12] http://inspire-geoportal.ec.europa.eu/

Objectives

The specific objectives of this feasibility study on INSPIRE data harvesting are the following:

- **To demonstrate the viability of the harvesting workflow of complete datasets, including the collection of national service end points, the connection to the services and their monitoring, and the download and analysis of the geospatial data required by reporting obligations, and**

- **To test the possibility to reference, find and download specific spatial objects required by environmental obligations through the INSPIRE infrastructure.**

In order to address each of these two specific objectives, two use cases have been defined, which are further described below and from chapter 2 onwards.

Thematic context

To address the objectives of the feasibility study it was decided to pilot the harvesting of INSPIRE datasets provided as part of an existing and operational reporting data flow. It was also considered very convenient that the datasets on focus fall under INSPIRE Annex I, since for all themes covered by this Annex, harmonised spatial datasets, metadata and services should be available in the INSPIRE infrastructure since November 2017. The selected dataset was the Natura 2000 sites.

The Natura 2000 network[13] was established under the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) [9]. The network includes also special protected areas designated under the Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. The spatial data representing the Natura 2000 sites are related to the INSPIRE Protected sites spatial data theme which is included in the INSPIRE Directive Annex I. These datasets are also included in the priority list of datasets for eReporting mentioned above.

Use cases

As indicated above, the feasibility study explores two use cases:

- **Use case 1 on "Data harvesting using INSPIRE network services" explores the access and download of the complete spatial datasets of Natura 2000 sites from the INSPIRE infrastructure (harvesting of complete spatial dataset), and**

- **Use case 2 on "Referencing spatial objects using INSPIRE network services" explores how to reference, select and download only selected Natura 2000 sites from the INSPIRE infrastructure (harvesting of selected spatial objects).**

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[13] http://ec.europa.eu/environment/nature/natura2000/index_en.htm

Out of scope

The feasibility study does not aim to fully validate the conformity of datasets and services neither with the INSPIRE Directive nor with the Natura 2000 reporting obligations.

1.3 Methodology

1.3.1 Common methodology

The feasibility study relies on re-using existing tools (e.g. INSPIRE Geoportal), data (e.g. Natura 2000 reported data and datasets available in the INSPIRE infrastructure), services (national services available in the INSPIRE infrastructure) and specifications (e.g. reporting guidelines and specifications of INSPIRE components).

A pool of available and accessible INSPIRE download services providing INSPIRE spatial datasets of Natura 2000 sites is established as a common basis for more detailed and specific use and evaluation in both use cases. This initial list of service access points is established by semi-automatic and manual search in the INSPIRE Geoportal, which is then completed by creating the specific service end point requests:

- Using the INSPIRE Geoportal Priority Data Set viewer, which already provides an advanced selection of downloadable spatial datasets related to Natura 2000; the Geoportal Thematic Viewer can be further used for some additional refinements in the search if needed (e.g. INSPIRE spatial data theme Protected sites),

- Manually searching for additional downloadable spatial datasets in INSPIRE Geoportal Resource Browser,

- Compiling the list of service access points,

- Creating the specific service end point requests.

1.3.2 Methodology in use case on data harvesting

In addition to the common methodology for the feasibility study, the following specific methodology is applied in the use case 1:

- Exploring the possibility of an automated process to identify Natura 2000 sites downloadable datasets through the INSPIRE Geoportal, which provides access to the national discovery services (CSW end points) ,

- Setting the service monitoring and testing environment to observe service performance based on the INSPIRE service quality criteria, and to design and apply a specific reliability test,

- Evaluating the downloaded spatial datasets provided in GML file format by reusing the existing INSPIRE validation tools and/or by developing specific tests for this purpose,

- Creating the vision of a potential reporting workflow, which includes data harvesting as data delivery mechanism.

The performance and capacity tests of services were developed and executed using Apache JMeter. A custom Python scheduled-monitoring tool was used for the availability and reliability tests.

The automatic scripts for identification of downloadable datasets were build using Python language.

The datasets and datasets metadata were validated against INSPIRE criteria using a locally deployed instance of INSPIRE Validator (ETF).

All the scripts are available on GitHub.

1.4   How to read the reports of the feasibility study

Reports

The feasibility study is described in two reports, one for each use case:

- Use case on data harvesting (Use case 1) is described in the report **"Report 1: Data harvesting using INSPIRE network services**
- **"**, and
- Use case on referencing spatial objects (Use case 2) is described in the report **"Referencing spatial objects using INSPIRE network services".**

Both use cases use the common terminology, thematic context, datasets and services, and complements each other. The reports also reference each other to indicate the common elements or other exchange of related information or findings.

Documenting requirements

Based on the findings in the feasibility study, a set of requirements have been developed to foster the inclusion of web services, in particular INSPIRE network services and data, in the modernisation and development of the future reporting platform Reportnet 3.0. The priority of the requirements is provided by using the MoSCoW method[14] (M – must, S – should, C – could, W – won't).

The requirements are provided in a common template that has the following structure: title, focus (stakeholder to whom the requirement is addressed) and description. They are included in the reports in the following form:

Requirement title
Requirement focus: <Stakeholder to whom the requirement is addressed>
Description: <Description>

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14 https://en.wikipedia.org/wiki/MoSCoW_method

This report "Data harvesting using INSPIRE network services" has the following structure:

Terms and definitions includes all terms and definitions used in the feasibility study (common to both use cases),

Chapter 1 Introduction provides background information, scope of the feasibility study and methodology,

Chapter 2 Identification of web services presents the process of finding and collecting download services and spatial datasets using the INSPIRE Geoportal,

Chapter 3 Service availability and performance describes criteria used as a reference benchmark to measure the quality of services and a summary of service monitoring results,

Chapter 4 Initial data quality control covers the tests applied to downloaded spatial data provided as GML and datasets metadata,

Chapter 5 Proposed workflow for data harvesting recommends improvements of the current workflow to include automatic harvesting using the INSPIRE infrastructure,

Conclusions presents the findings and the recommendations of this feasibility study,

Annex 1 List of service includes a detailed list of service end points and presents the results of Chapter 1,

Annex 2 Service monitoring results includes the detailed results of performance, capacity and reliability tests,

Annex 3 INSPIRE spatial data suitability provides the results of the tests performed on datasets and datasets metadata ensuring the dataset content corresponds with the requested information.

2 Identification of web services

This chapter presents the process of finding and accessing the INSPIRE services to be used in this feasibility study. Instead of using pure web scraping[15] techniques, the feasibility study relies on the available information from the national infrastructures for spatial information. This information is regularly harvested to be displayed through the INSPIRE Geoportal. The portal provides the means to discover datasets and services based on their metadata and access them through their view or download services. It is a direct source of information about the nationally available and downloadable INSPIRE spatial datasets. In addition, the countries continuously document the spatial datasets covered by the priority list of datasets for eReporting (priority datasets). As the INSPIRE Directive in its article 15 obliges all Member States to provide access to their services through the INSPIRE Geoportal, it is assumed that it can be used as the first and reliable entry point to discover the INSPIRE download services and spatial datasets of Natura 2000 sites.

The identification of the relevant web services using INSPIRE Geoportal functionalities was concluded in August 2018. The INSPIRE Geoportal has been updated later in 2018, therefore some images or procedures described in this report present the functionalities of a previous version of the currently available INSPIRE Geoportal.

The following subchapters describe several approaches to identify the relevant data services.

2.1 Options for collecting service access points

In the context of eReporting, there are several methods that could be used for collecting service access points, each with their own benefits and challenges:

- Use of INSPIRE Geoportal through the Thematic Viewer or the Priority Data Sets Viewer,

- Use of INSPIRE Resource Browser[16],

- Performing OGC CSW operations against the INSPIRE Geoportal end point[17],

- By direct request of service access points and end points to the countries as part of the reporting process.

The first three options rely on an intermediate application, the INSPIRE Geoportal, which makes the collection of access points quicker and easier, as it provides access to all national discovery services in a one-stop-shop. On the other hand, the INSPIRE Geoportal provides a snapshot of all what is available at the national discovery service during the last harvesting process[18], which not necessarily is the most up-to-date information at national level at the time of the search.

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[15] Web scraping, web harvesting, or web data extraction is data scraping used for extracting data from websites. https://en.wikipedia.org/wiki/Web_scraping

[16] http://inspire-geoportal.ec.europa.eu/proxybrowser

[17] http://inspire-geoportal.ec.europa.eu/GeoportalProxyWebServices/resources/OGCCSW202

[18] The frequency of the harvesting of national discovery services can be daily, weekly, biweekly or monthly.

INSPIRE Geoportal Viewers

Using the INSPIRE Geoportal through specific viewers provides the advantage of easy browsing through the datasets and services allowing basic filtering. The **Priority Data Sets Viewer** displays the availability and provides access to the selected datasets using filtering by environmental domain, environmental legislation and country [Figure 1].

Figure 1 Priority Datasets Viewer
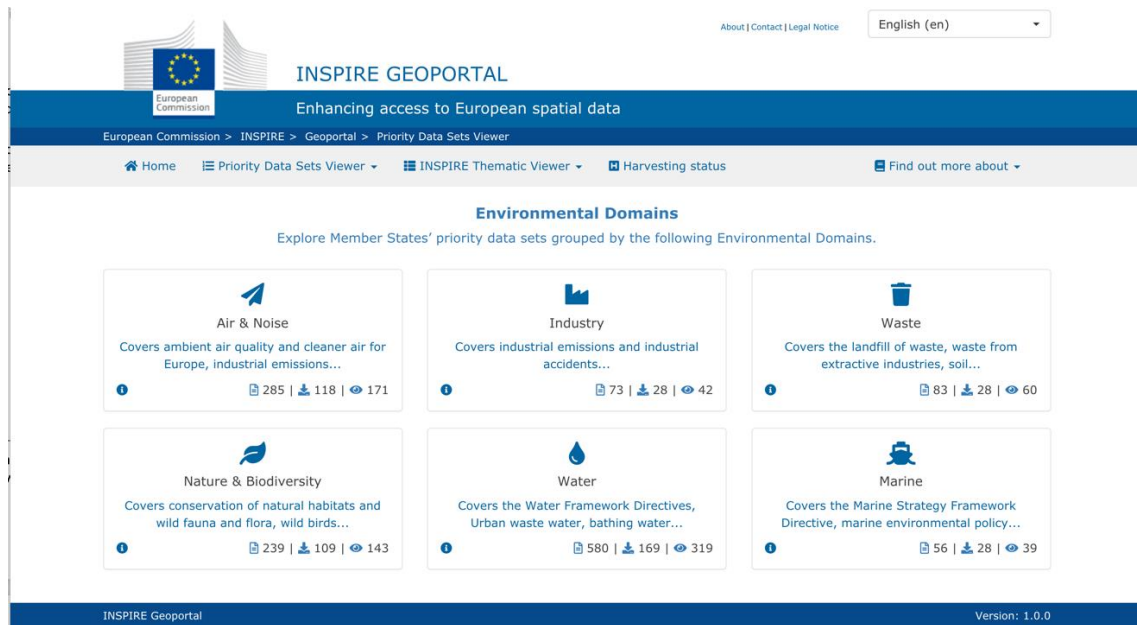
The other alternative is the **INSPIRE Thematic Viewer**, which displays the availability and provides access to all datasets falling under the scope of INSPIRE Directive filtered by INSPIRE data themes and countries (i.e. Annex I, II and III) [Figure 2].

Figure 2 INSPIRE Thematic Viewer
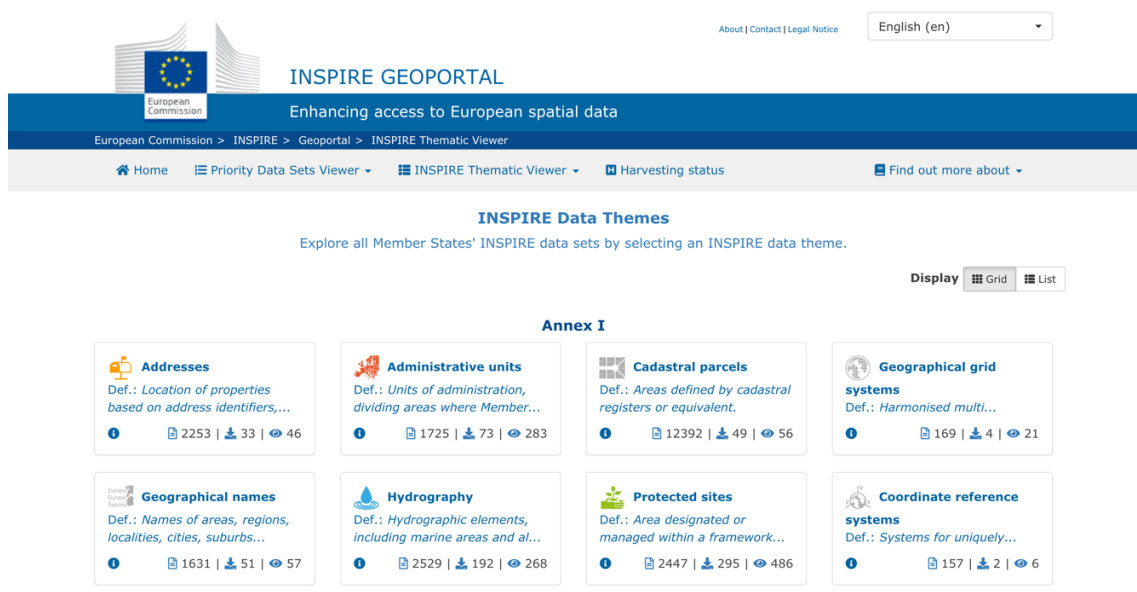
INSPIRE Resource Browser

The INSPIRE Resource Browser provides access to the complete metadata of spatial datasets, data series and services in the INSPIRE Geoportal and allows using complex selection criteria to manually select the service needed. In addition, it also provides the evaluation reports with respect to INSPIRE Metadata Implementing Rules, the Network Service Regulation and the Technical Guidance documents [
Figure 3].

Figure 3 INSPIRE Resource Browser

Automatic search on INSPIRE Geoportal CSW

It is possible to perform queries and operations to retrieve the services that are made accessible through the INSPIRE Geoportal by using its OGC CSW 2.0.2 interface. The CSW and query language should support specifying multiple criteria for searching, e.g. combining several conditions and using logical operators (and|or).

In this study it was only briefly tested how to query the CSW end point to find those services that provide data that correspond to a certain reporting obligation by using the POST method to send XML requests [Figure 4]. An additional programming logic was designed for analysing the results returned in order to identify a single specific service (e.g. Natura 2000 spatial dataset for Romania related to the INSPIRE Protected sites).

Figure 4 Using INSPIRE Geoportal CSW end point to search for Natura 2000 services


```xml
1  <?xml version="1.0" encoding="UTF-8"?>
2  <csw:GetRecords xmlns:csw="http://www.opengis.net/cat/csw/2.0.2" service="CSW" version="2.0.2">
3    <csw:Query typeNames="csw:Record">
4      <csw:Constraint version="1.1.0">
5        <Filter xmlns="http://www.opengis.net/ogc" xmlns:gml="http://www.opengis.net/gml">
6          <PropertyIsLike wildCard="%" singleChar="_" escape="\\">
7            <PropertyName>AnyText</PropertyName>
8            <Literal>%Natura 2000%</Literal>
9          </PropertyIsLike>
10         </Filter>
11       </csw:Constraint>
12     </csw:Query>
13   </csw:GetRecords>
```

The CSW end point returns the results in XML format that can be easily parsed and integrated in the reporting process [Figure 5].

Figure 5 INSPIRE Geoportal CSW end point results in XML format


```xml
1  <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
2  <csw:GetRecordsResponse
3    xmlns:ns6="http://www.opengis.net/ogc"
4    xmlns:ns5="http://purl.org/dc/terms/"
5    xmlns:ns8="http://www.opengis.net/ows"
6    xmlns:ns9="http://www.w3.org/2001/SMIL20/Language"
7    xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
8    xmlns:ns2="http://www.w3.org/1999/xlink"
9    xmlns:ns1="http://www.opengis.net/gml"
10   xmlns:ns4="http://purl.org/dc/elements/1.1/"
11   xmlns:ns3="http://www.w3.org/2001/SMIL20/">
12   <csw:SearchStatus timestamp="2018-11-15T20:56:18.992+01:00"/>
13   <csw:SearchResults numberOfRecordsMatched="2007" numberOfRecordsReturned="10" nextRecord="11">
14     <gmd:MD_Metadata
15       xmlns:gmd="http://www.isotc211.org/2005/gmd"
16       xmlns:gco="http://www.isotc211.org/2005/gco"
17       xmlns:gml="http://www.opengis.net/gml"
18       xmlns:geonet="http://www.fao.org/geonetwork"
19       xmlns:xlink="http://www.w3.org/1999/xlink"
20       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
21              xsi:schemaLocation="http://www.isotc211.org/2005/gmd
   http://www.isotc211.org/2005/gmd/gmd.xsd http://www.isotc211.org/2005/gmx
   http://www.isotc211.org/2005/gmx/gmx.xsd">
22     <gmd:fileIdentifier>
23       <gco:CharacterString
24         xmlns:xs="http://www.w3.org/2001/XMLSchema"
25         xmlns:fn="http://www.w3.org/2005/xpath-functions">/INSPIRE-6f0cd439-226d-11e6-9ff2-
   52540023a883_20181115-133308/services/1/PullResults/1-137/datasets/112_ID_c93002fa-8064-4b7c-866b-
   2648ca1c403e
26       </gco:CharacterString>
27     </gmd:fileIdentifier>
28     <gmd:language>
29       <gmd:LanguageCode codeList="http://www.loc.gov/standards/iso639-2/" codeListValue="slv"/>
30     </gmd:language>
31     <gmd:characterSet>
32       <gmd:MD_CharacterSetCode
   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/codelist/ML_gm
   xCodelists.xml#MD_CharacterSetCode"
33                    codeListValue="MD_CharacterSetCode_utf8"
34                    codeSpace="ISOTC211/19115"/>
35     </gmd:characterSet>
36     <gmd:hierarchyLevel>
```

Information about services is provided in addition

A last method could be simply to rely on asking the reporting authorities (EU Member States, other reporting countries) to provide the information of services as part of the reporting process. They can either supply one of the following information (which should be already provided in the INSPIRE Geoportal):

- Dataset metadata and a coupled download service metadata,

- Direct link to an Atom feed containing entries to datasets,

- Direct link to a WFS StoredQuery for retrieving the dataset.

This method has the advantage to eliminate the doubts upon the source of the dataset, being provided directly by the country. It is worth to mention that for each reporting cycle the Member State / country should check (and confirm) the validity of the download service URL as those services might change between reporting cycles.

2.2 Initial list of INSPIRE download services

During this first stage of identification of download services, the objective was not to provide a comprehensive list of all relevant datasets or services in the EU countries, but rather to establish an adequate variety of download service access points and end points suitable for both use cases of the feasibility study.

Process and findings

As the first step, the INSPIRE Geoportal Priority Data Set Viewer was used, with the selected environmental domain "Nature and Biodiversity" that was further refined with a few additional filters. As a result, 22 relevant download services from eight EU Member States were selected.

Since this first shortlist did not provide a sufficient variety of download services (mostly, file download links were provided), additional manual search was applied on INSPIRE Geoportal by using other functionalities. This included analysing the metadata of spatial datasets related to the INSPIRE Protected Sites spatial data theme (using INSPIRE Thematic Viewer) or searching for specific download service types like WFS or Atom in Resource Browser.

The final list includes altogether 52 download service access points from a total of 13 EU Member States [Figure 6].

Figure 6 Overview of initial list of INSPIRE download services
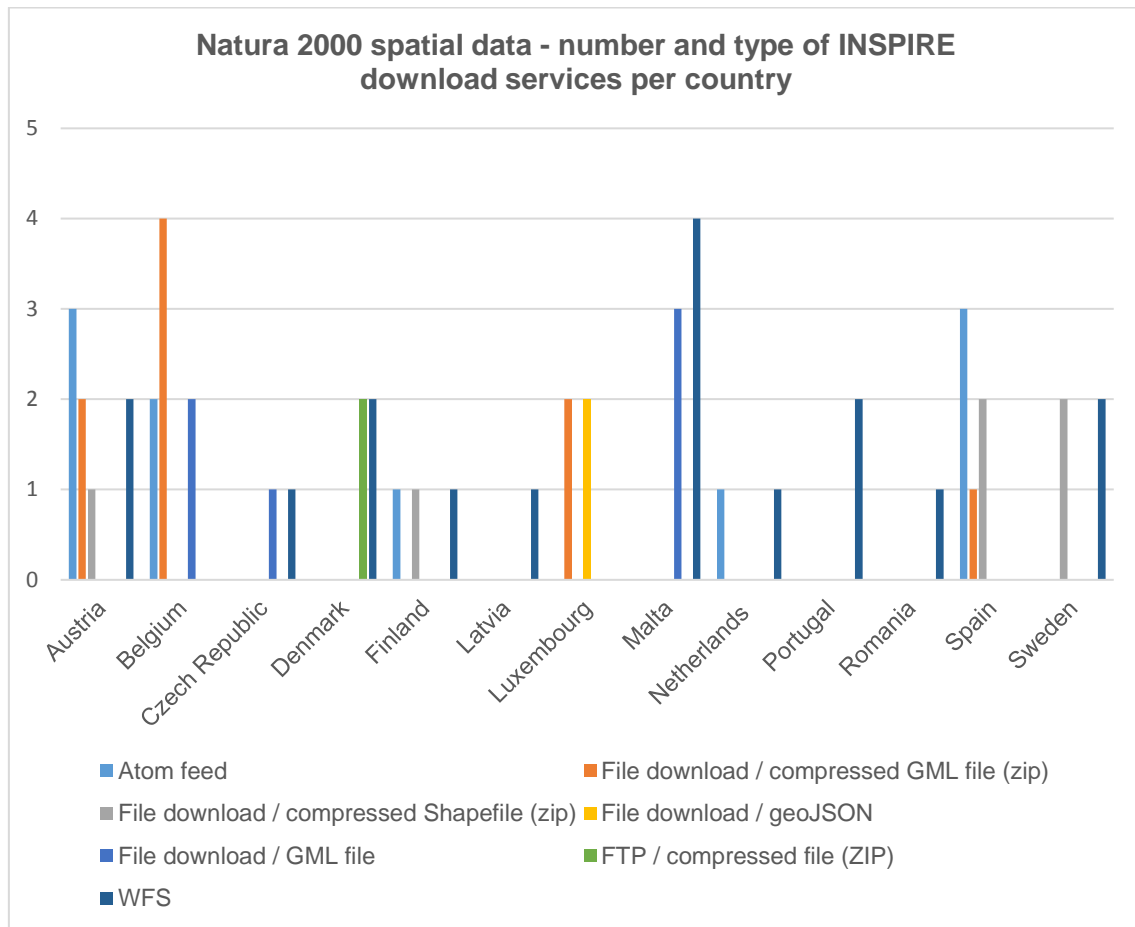
The INSPIRE download service types

The INSPIRE Technical Guidelines for download services [1] distinguish two types of download services:

- Pre-defined dataset download service(s) which provides the simple download of pre-defined datasets (or pre-defined parts of a dataset) with no ability to query datasets or select user-defined subsets of datasets, and

- Direct access download service(s) with the ability to query and download subsets of datasets.

The above mentioned Technical Guidelines recommends the use of Atom syndication format as a one way to implement pre-defined dataset download services, or alternatively WFS.

Direct access download services, which should be implemented where practicable, are recommended to be implemented using WFS.

The feasibility study use case 1 used different type of download services, while the use case 2 was focused only on direct access download services (WFS).

Creating service end points

The INSPIRE Technical Guidelines for metadata[19] provide detailed information how to document the download service and dataset metadata, including the link between them. The metadata should include the information about the download service access point (in the element "Resource Locator"); this is an Internet-resolvable address containing a detailed description of a service, including a list of end points to allow an automatic execution.

If the service end points (a URL used for directly calling an operation provided by the service) are not directly provided in the INSPIRE metadata for datasets or services they have to be created in addition. In the feasibility study, several INSPIRE service end points have been manually built on the basis of the download service access points.

In the case of WFS, two types of requests have been generated:

- For downloading all features in the dataset (used in use case 1), and

- For extracting selected feature(s) (used in use case 2).

2.3 Outcomes

In the context of eReporting, the countries should provide an official dataset source. The process of identification of INSPIRE download services for the Natura 2000 sites datasets that could be potentially used in the reporting data flow, brought out the following issues:

- Some countries provide more than one service,

- Different service types (WFS, Atom feed, direct file download link) are available, even for the same dataset,

- A full national dataset can be provided disaggregated by geospatial coverage or thematic topic through different services e.g. for Belgium, eight different datasets were identified (at federal and regional levels and by designation types),

- Some services can provide several diverse datasets, e.g. Atom feeds, making it necessary to apply additional manual investigation of Atom feeds to determine which dataset should be used,

- Some services are protected, e.g. with CAPTCHA or FTP protected access. The protected services have not been used in the feasibility study,

- There is no clear indication (e.g. a flag) marking the resource as "official". Spatial datasets tagged as priority datasets could be assumed to be part of the official reporting data flow, but searching for the priority dataset keywords still provides ambiguous results,

- Some of the datasets include content (data) without relevance for the specific reporting obligation). This is presumably because the datasets were organised

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[19] https://inspire.ec.europa.eu/id/document/tg/metadata-iso19139

following the logic of the INSPIRE spatial data themes or Annexes instead of reporting (e.g. a dataset provided by Romania included not only Natura 2000 information but also data from the Administrative units, Bio-geographical regions and Geographical names themes). Such mixed content is unusual in the current reporting data flow practices and would demand additional filtering or quality control procedures in the eReporting process.

- Automatic identification of the services could be a good step forward but, as it currently stands, it still provides ambiguous results,

- Identification of INSPIRE download services in INSPIRE Geoportal (regardless of a search method used) highly depends on the quality of metadata for spatial datasets and services.

Annex 1 List of service end points contains the final list of INSPIRE service end points collected using the INSPIRE Geoportal which provide the relevant datasets. They are the starting point for testing the services, for accessing data and their quality, and ultimately for automating the reporting data flow.

In view of the future eReporting process and the modernisation of the reporting platform Reportnet 3.0 that will include data harvesting, the following requirement is provided in relation to datasets and service identification:

Inspire spatial dataset and download service identification

Requirement focus: Requirement related to the Reportnet

Description:

Reportnet must include the means to provide / identify the Inspire dataset(s)/services that contain the correct data related to the reporting obligation in non-ambiguous way. It shall be mandatory for Member States / countries to provide this information. With the metadata currently available in the Inspire Geoportal, it is often difficult to identify automatically the correct datasets and / or services. The Member States / countries are responsible to communicate and maintain the correct and complete list of relevant data sources (e.g. direct download, Atom data feeds, WFS Stored Queries, applicable query parameters and values). The complete data for reporting must include all relevant data that cover the national level, for example: complete national Natura 2000 coverage (SPA/SCI/SAC).

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3 Service availability and performance

The purpose of this chapter is to define and explain the tests performed for determining the quality of the download services described in the Chapter 2 Identification of web services and listed in the Annex 1 List of service end points.

The INSPIRE quality of service criteria, as defined in Annex I of [2], are used only as a reference benchmark in the evaluation of the quality of services for a specific reporting obligation and not for validation in the INSPIRE context. For example, in the context of the Natura 2000 reporting obligation, a service not fulfilling the INSPIRE criteria and validation tests could still be used for data harvesting.

The quality of the identified INSPIRE download services for Natura 2000 sites datasets was tested in the period of August – October 2018.

3.1 Service quality criteria

The implementing rules for INSPIRE network services – download service [2] specify three criteria for quality of service: performance, capacity and availability. For the purpose of this feasibility study the same INSPIRE service quality criteria were used, but only a few parameters were monitored in a period of a few weeks. An additional fourth criterion "reliability" was defined in order to cater for the specific Natura 2000 requirements.

3.1.1 Performance

Performance represents the minimal level by which an objective is considered to be attained representing the fact how fast a request can be completed within an INSPIRE network service. As defined in [2], the response time for accessing a download service has to be within 10 seconds for metadata and within 30 seconds for spatial datasets or spatial objects. Further details of this particular criterion are given in Annex 2.

3.1.2 Capacity

Capacity is defined as the limit of the number of simultaneous service requests provided with guaranteed performance. Minimum number of simultaneous requests shall be 10 for a download service.

3.1.3 Availability

Availability measures the probability that the INSPIRE network service is available. This availability is the probability that the system is up. The availability shall be 99%.

3.1.4 Reliability

Reliability is the overall measure of a web service to maintain its service quality. The data provided by the web service should be real, updated and relevant.

3.2   Service monitoring and results

A first, pragmatic solution to monitor the INSPIRE download services against the above-mentioned criteria of performance, capacity and availability was to use the automatic service reports provided by the INSPIRE Geoportal Resource Browser[20]. These evaluation reports included performance metrics for some but not for all download service resources. The lack of detailed documentation of conditions and methodology under which these indicators were collected (e.g. time of the latest end point harvest) was another obstacle that prevented using this information directly. The feasibility study was also focused on the service availability and performance in a shorter period than what is specified in the relevant Implementing Rules[21]. Monitoring services under different load was an important part of the feasibility study to gain a more complete understanding of service performance.

Therefore, for the purpose of this study, a tailor-made tool for measuring the quality of service was developed. Although the limited testing interval available did not provide data with a perfect statistical relevance, the results are considered to be adequate for this study.

3.2.1 Performance and Capacity

Performance and capacity were measured using the same test scenario, applied to the INSPIRE service end points listed in Annex 1 List of service end points. The test was developed and executed using Apache JMeter, a Java application designed to measure performance, with custom test execution and results collation scripts available in the project's non-functional testing tools repository on GitHub[22].

The same test scenario was executed for all services, and consisted in fetching the service response with the following load profile:

- 1-minute ramp-up from 1 to 10 users,

- 4 minutes of sustained load at 10 concurrent users.

Following each test run, the results were generated in both raw JMeter and HTML formats. A summary of all tests, highlighting results outside the performance criteria for the respective service types, is available in the Table 3 Performance testing results in Annex 2.

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[20] http://inspire-geoportal.ec.europa.eu/proxybrowser

[21] INSPIRE Technical Guidelines for the implementation of INSPIRE Download Services requires the availability shall be based on a time frame of one year.
https://inspire.ec.europa.eu/documents/technical-guidance-implementation-inspire-download-services

[22] https://github.com/eea/inspire.harvest.feasibility.tools/tree/master/performance

Monitoring service Get Spatial Data Set requests

The feasibility study evaluated 40 service end points, monitoring the behaviour of services requesting spatial data (Get Spatial Data Set request). The number of service requests varied between 19 (minimum) and 8498 (maximum) requests per service, presented on the next figure.

Figure 7 Service monitoring – number of service requests per service
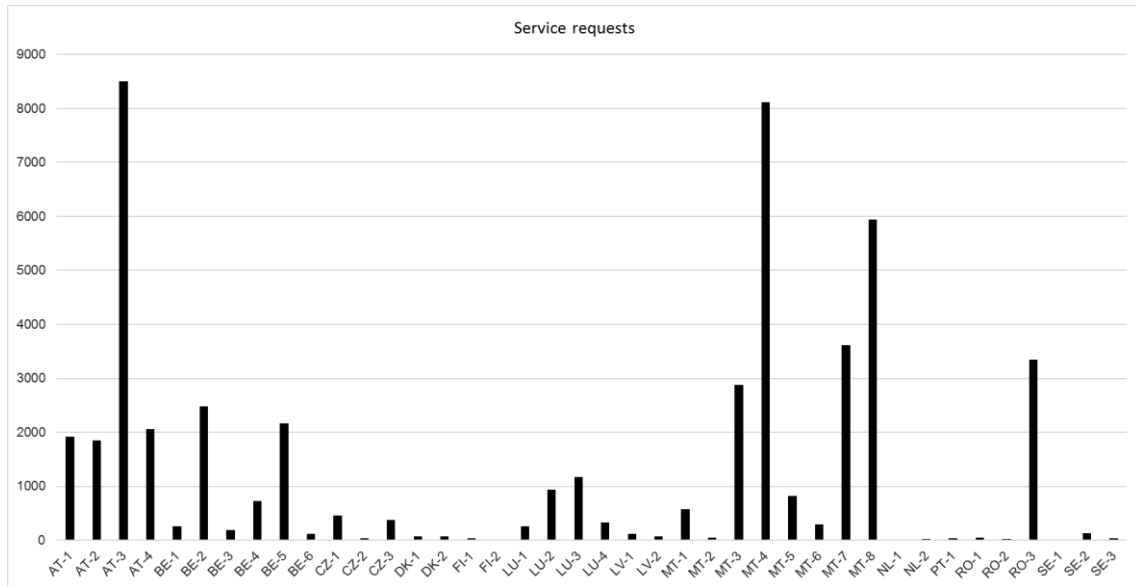
A mean latency [s] of service responses was measured, showing a low latency for most of the services (33 services below 1 sec and 7 services in range between 1 and 10 sec), while seven WFS services showed latency higher than 10 sec, presented on Figure 8.

Figure 8 Service monitoring – mean latency [s]
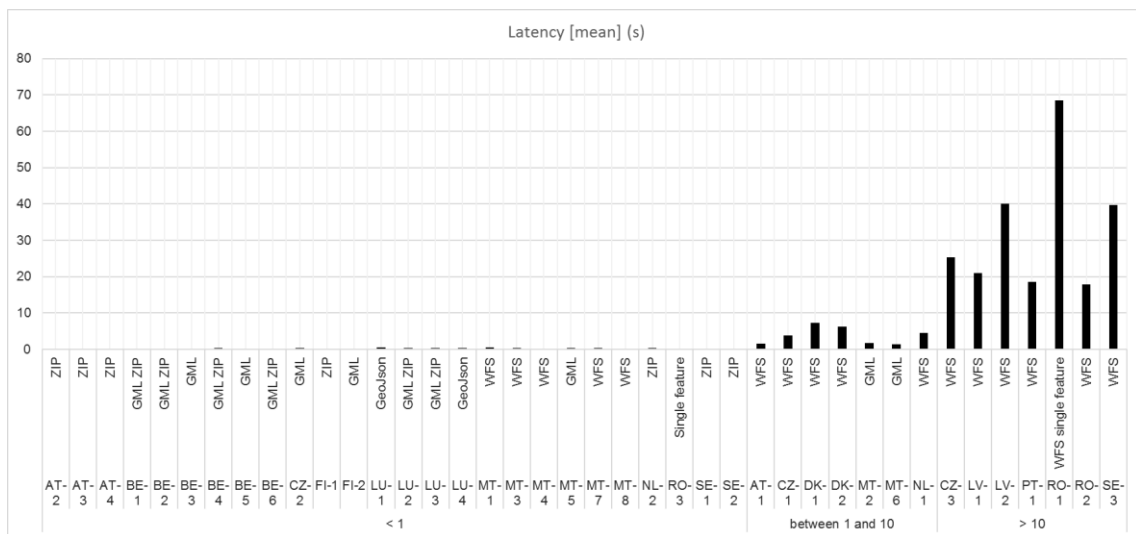
Another measurement monitored potential service errors. It revealed that 30 service end-points were active without errors, four services with minor errors (less than 3%) and six services with errors greater than 10%, among them one service was not usable, presented on Figure 9.

Figure 9 Service monitoring – errors
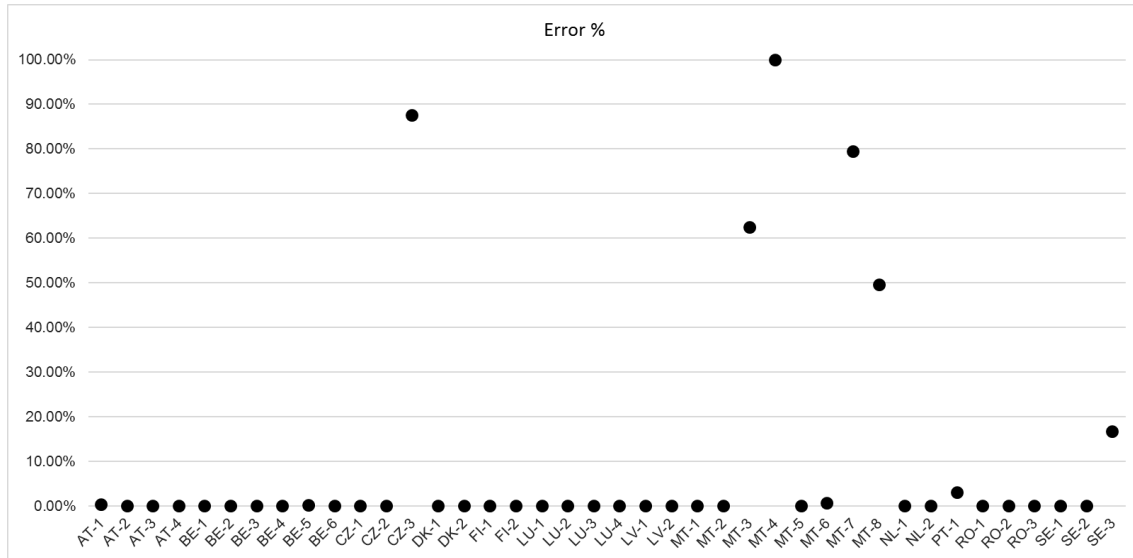
Overall, with a few exceptions, the performance and capacity of identified service end points demonstrated the services are responsive and provide spatial datasets.

3.2.2 Availability

Availability was measured through a monitoring exercise targeting all INSPIRE service end points listed in Annex 2 (Availability tests and results). A custom Python scheduled-monitoring tool was used for this purpose, available in the project's non-functional testing tools repository on GitHub[23].

Each service was checked for availability over a duration of one week, by fetching the end point's response headers every 5 minutes.

Altogether, the availability of 65 services was monitored, including direct file URLs, top level Atom feeds and the individual entries in the Atom feeds, and also WFS GetCapabilities and GetFeature requests.

Most of the services (57 services) were available during the monitoring period with more than 99% probability and only a few services were not available occasionally. The following figure presents the results of service availability test.

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[23] https://github.com/eea/inspire.harvest.feasibility.tools/tree/master/monitoring

Figure 10 Service monitoring – availability
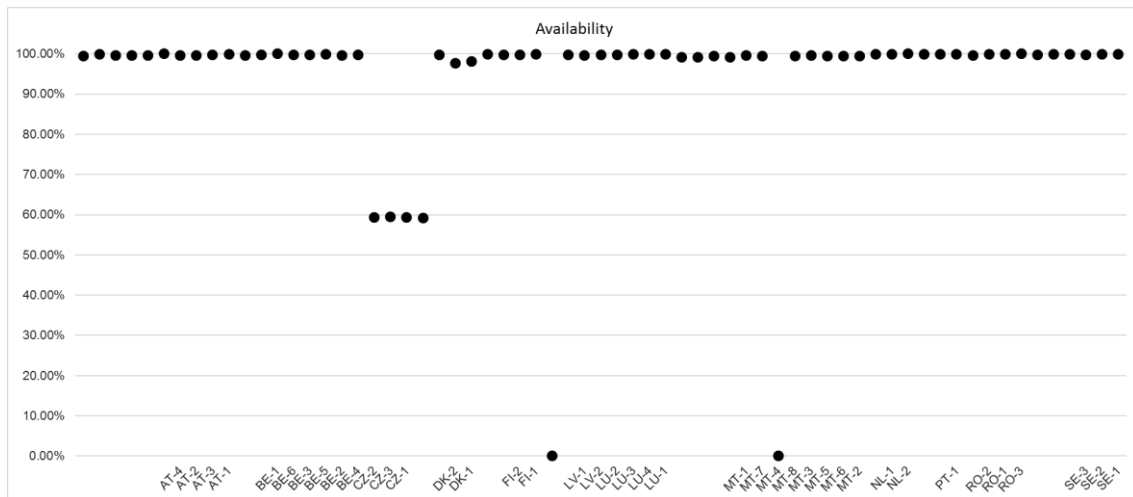
The detailed availability summary report is included in the Table 4 Availability monitoring results in Annex 2.

The monitoring of service availability could be applied in different environments, e.g. on service provider site, by INSPIRE Geoportal or by other service providers or users. During the feasibility study, the EEA used the opportunity to retrieve some test service information from Spatineo Monitor[24] - a tool that measures the quality of download services over one year according to INSPIRE, but also in shorter periods. With courtesy from the Spatineo, we received a sample of information of service availability over one month for seven WFS services originating from five countries. A brief comparison with the results from the feasibility study shows very similar results, except for a service provided by Denmark, where the feasibility study tests show better result. The results are provided in the next table.

Table 1 A sample comparison of service availability

Country	Number of WFS services	Feasibility study tests	Spatineo September 2018
Netherlands	1	99.8316%	99.68%
Malta	3 / services provide different Natura2000 designations	99.3824%	99.87% - 99.9%
Finland	1	99.8316%	96.26%
Portugal	1 / covering Azores	99.9439%	98.83%
Denmark	1	97.6979%	87.65%

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[24] https://directory.spatineo.com

3.2.3 Reliability

INSPIRE download service end points returning GML responses were targeted in the reliability monitoring exercise, that fetched the complete response of each service for one week, at 12 hours intervals and looked for an identical response. To compare the responses, a solution of computing checksums[25] of each response has been used.

The monitoring was performed using a custom tool, available in the project's non-functional testing tools repository in GitHub[26].

The following procedure was applied when checking service response reliability:

- A checksum was computed for each service's response, and compared to the checksum of the previous response,

- When a checksum change occurred, a diff (line-oriented difference summary) of the actual responses was calculated and preserved,

- For ZIP-files responses, comparisons were performed on the archived file, where a single file was in the archive. Multi-file archives were not inspected beyond the checksum comparison,

- Changed responses were saved for future comparisons, and identical responses were discarded.

In the feasibility study, 36 services providing spatial datasets were tested. Comparing the datasets, in 16 cases no dataset changes were detected. This is particularly true for pre-defined datasets (GML, ZIP).

The individual files in the compressed ZIP archives were not checked, but the checksum on the complete archive did not show any changes.

However, when analysing the responses from the WFS, the following differences were detected:

- Geometry:

  o order and/or content in surface/polygon tags,

  o id attribute in <gml:LineString> changes every request (but inner <gml:posList> remains the same),

- Characters: random encoding issues for diacritic characters (e.g. ā, ķ, ī),

- Time: timeStamp attribute in <wfs:FeatureCollection>.

The summary of reliability test results is presented on Figure 11.

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[25] https://en.wikipedia.org/wiki/Checksum
[26] https://github.com/eea/inspire.harvest.feasibility.tools/tree/master/monitoring

Figure 11 Reliability test – detected changes in datasets / service results
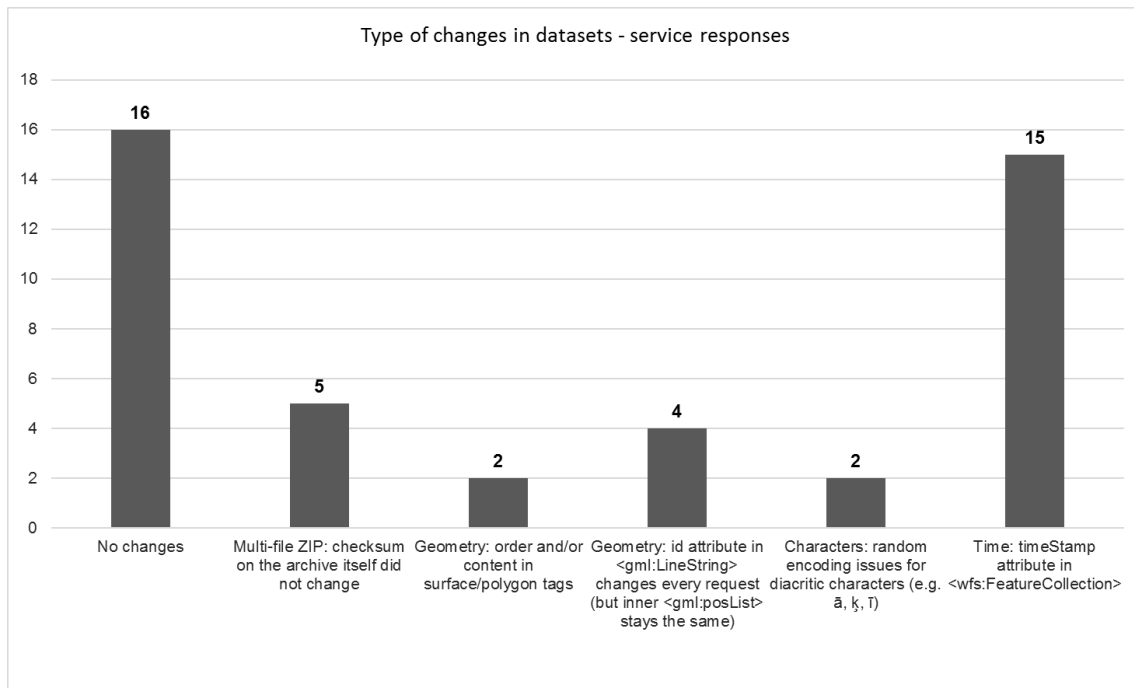
The report available in Table 5 Reliability monitoring results in Annex 2 provides the details of the reliability test and lists the presence and nature of the changes found. Those cases where the changes affected to more than the timestamp would require additional review by an expert in the subject. The results also indicate the detected changes do not mean necessarily changes in the thematic content, therefore additional methods would be needed to evaluate if the service provides the same or updated thematic content.

3.2.4 Outcomes

Although not all services met the reference INSPIRE criteria, we managed to harvest the data (with a few exceptions, e.g. the Spanish services were protected by reCaptcha so they were not used in the feasibility study). With regard to the potential use of Member State's INSPIRE download services and data for the Natura 2000 reporting obligation, our test results show the identified services are stable enough to harvest data, even though in some cases the workflow might need adjustments, such as launching the harvesting process several times, or in different days.

Based on the experiences from the service testing and monitoring environment, we found also additional requirements and recommendations for data and service management that would improve the use of services, as described below.

In addition, the use case 2 in this feasibility study provides additional requirements for improving the use of WFS for requesting individual spatial objects that are described in the report Referencing spatial objects using INSPIRE network services.

INSPIRE download service - Atom feeds

Requirement focus: Requirement related to Reportnet and service providers (MS)

Description:

Supplied Atom feeds should be datasets feeds (not top feeds). Reportnet should include quality procedures to test the service and to provide the notification on findings. Reviewing Atom feeds in scope of this study has revealed that top feeds will also contain entries to non-Natura 2000 data feeds.

INSPIRE download service - Atom feeds coverage

Requirement focus: Requirement related to the Reportnet and service providers (MS)

Description:

Atom dataset feeds supplied for harvesting could contain only the entries for the datasets under the specific reporting obligation. The Reportnet should include quality procedures to test the service and to provide the notification on findings. Although Reportnet quality assurance (QA) checks will verify that only required datasets are reported, supplying only relevant information will reduce the load on both national services and Reportnet infrastructure.

INSPIRE download service - WFS - should provide ListStoredQueries feature for reporting datasets

Requirement focus: Requirement related to Reportnet and service providers (MS)

Description:

The spatial datasets can be easily harvested using a pre-defined StoredQuery. Before using them, Reportnet must be able to check if they exist, therefore the ListStoredQueries feature is mandatory. WFS Download Service must provide the ListStoredQueries feature for further interrogations.

INSPIRE download service - Unique filenames in archives

Requirement related to Reportnet and service providers (MS).

Description: Reportnet should include quality procedures to test the service and to provide the notification on findings. Non-flat (with folders) zip archived contents are supported but upon download the files will be extracted in a flat structure therefore unique names are required to avoid overwriting files.

4 Initial data quality control

The purpose of the quality assessments performed in this feasibility study on INSPIRE spatial datasets is to ensure the data harvested from the INSPIRE services is valid for the reporting data flow. The quality control has to include topic specific criteria based on the requirements in the reporting guidelines for each reporting obligation and could reuse suitable criteria defined in INSPIRE (INSPIRE Implementing Rules and Technical Guidelines) where feasible.

The reporting obligation may not actually need to require a full compliance with all INSPIRE requirements (defined already within the INSPIRE Directive, Implementing Rules and Technical Guidelines), but could benefit from it. A compliant dataset would provide a certainty in its harmonisation (e.g. data structure, vocabulary, constraints) that could further serve as a basis for automatic procedures, i.e. quality controls and content extraction.

One of the suitable tools for validation of INSPIRE spatial datasets is the INSPIRE Reference Validator (ETF)[27]. Its purpose is to help data providers, solution providers, national coordinators or other users to check whether data sets, network services and metadata meet the requirements defined in the INSPIRE Technical Guidelines. It is based on the Abstract and Executable Test Suites agreed between the Member States and the Commission in the INSPIRE Maintenance and Implementation Group. The Executable Test Suits are still under development and some limitations or errors might be encountered during the test execution.

This section covers some of the quality controls applicable to the downloaded spatial data provided as GML. The case study is focused on the Natura 2000 reporting obligation, and the possibility to apply automatic quality checks.

The feasibility study tested only a few criteria, using INSPIRE Validator ETF and custom developed tests.

4.1 Data quality criteria

INSPIRE Implementing Rules and Technical Guidelines already define requirements and criteria the INSPIRE spatial datasets shall meet.

Specific criteria and quality assessments of reported data are developed within the scope of each reporting obligation and implemented inside the Reportnet infrastructure.

Some criteria might cover requirements from both INSPIRE and reporting obligations, for example, those related to location, as following:

- **Geographic extent** – The reporting obligations require providing data covering the complete spatial extent of the country. At the same time, a minimal containing geographic bounding box of a dataset or series (geographic extent) shall be described in INSPIRE metadata[28].

- **Edge matching on country boundaries** – Often, in the reporting obligations, the datasets are validated against reference data (e.g. topographic data) to check the geometrical, topological and semantic cross-boundary consistency. Similarly, the

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[27] http://inspire-sandbox.jrc.ec.europa.eu/validator/
[28] Technical Guidance for the implementation of INSPIRE dataset and service metadata based on ISO/TS 19139:2007; https://inspire.ec.europa.eu/id/document/tg/metadata-iso19139

INSPIRE Directive Article 10 (2) provides the basis to ensure coherence in the spatial data spanning the frontier between two or more Member States.

A set of common (general) criteria could be developed for validation of dataset against requirements common to diverse reporting data flows, such as data format or coordinate reference system.

Data format validation

The validation typically consists of a series of tests regarding data structure, encoding (e.g. INSPIRE metadata records shall be encoded in XML format, every encoding rule in INSPIRE for spatial datasets and series shall conform to ISO 19118[29]), identifiers and metadata.

Coordinate reference system

The coordinate reference system is already indicated in the INSPIRE metadata of spatial datasets or series. This information is encoded also in a dataset.

Reporting obligation criteria

Specific criteria will need to be developed for each reporting data flow to validate the compliance of a dataset with specific reporting obligation requirements. In practice, several levels of quality control have already been applied in current data flows provided in Reportnet 2.0.

Specific criteria are derived from the reporting obligation requirements, which may clearly indicate also the relationship to INSPIRE spatial data themes and application schemas used to provide spatial datasets. Considering both origins of requirements, at least the following criteria shall be used:

- Using and referencing the INSPIRE schema,

- Presence of the INSPIRE identifier, unique in the dataset, and

- Presence and values of specific attributes related to the reporting obligation.

The next chapters describe the findings of the initial quality assessment of INSPIRE datasets regarding Natura 2000 sites.

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[29] https://inspire.ec.europa.eu/documents/guidelines-encoding-spatial-data; ISO 19118 Geographic information – Encoding

4.2   Data quality control – suitable data

4.2.1   Is dataset compliant to the INSPIRE Protected sites?

The INSPIRE Validator (ETF) [Figure 12] provides test cases covering general INSPIRE criteria and INSPIRE theme-specific checks. ETF provides a web application that allows both manual testing through a browsed-based interface, and automatic testing using a REST API.

The feasibility study re-used INSPIRE tests for datasets. For testing of Natura 2000 sites datasets, the corresponding INSPIRE theme is Protected sites[30] and the INSPIRE Protected Sites Simple application schema[31].

Figure 12 ETF Web application
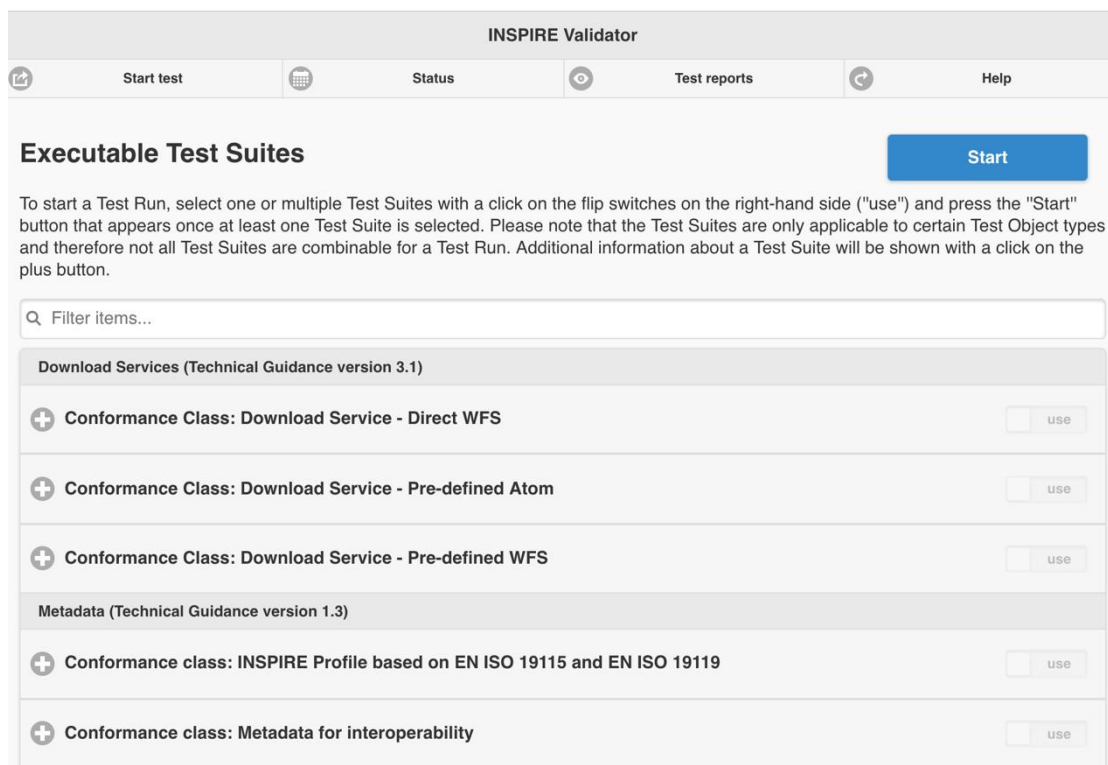
The INSPIRE Validator includes several test suits to validate datasets against general and theme-application schema specific requirements, as follows:

- INSPIRE GML application schema and INSPIRE GML encoding,

- Data consistency,

- Information accessibility, and

- Reference systems.

To determine if a dataset is compliant to the INSPIRE Protect sites theme and application schema, the test suite *Conformance Class 'GML application schema, Protected Sites'* from the

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[30] https://inspire.ec.europa.eu/Themes/117/2892
[31] http://inspire.ec.europa.eu/applicationschema/ps

INSPIRE ETF Validator was used. This test examines the GML encoding of spatial objects specified in the INSPIRE GML application schema 'Protected Sites Simple'. In order for the validation to be successful, the dataset must pass also the following generic tests suites, which examines GML documents against basic requirements for the GML encoding for spatial datasets in INSPIRE (it covers application-schema-independent, generic requirements):

- Conformance Class 'INSPIRE GML application schemas' and

- Conformance Class 'INSPIRE GML encoding'.

Results

The feasibility study tested 31 datasets (in GML format) from 12 countries, out of which 14 passed all the tests, therefore could be considered compliant with the INSPIRE Protected Sites schema (Protected Sites Simple).
The INSPIRE Validator ETF could not finish the tests for seven datasets for unknown reasons.

Reflection on INSPIRE ETF performance

The opportunity to use the INSPIRE ETF on the usually big datasets of Natura 2000 sites, revealed also the following performance issues in the ETF that could be provided as feedback to improve the functionalities and performance of the tool:

- Connection to the remote file doesn't always work because the tool checks for the XML or GML content types, and some services use different content types (when providing a GML file),

- Some of the tests return a lot of results (like gmlas.d.10: Validate geometries (1)) and the ETF times out when trying to list the results in JSON format for big files; we skipped the test to work around this,

- Some files take a lot of testing time and it's not clear if the test actually finished; it was necessary to implement a timeout for the tests to skip this issue,

- Tests that take a lot of time cannot be cancelled; there is a delete operation for tests, but it fails with an error making the tool unusable until the ETF is restarted.

4.2.2   Custom-developed tests for Natura 2000 site information

The INSPIRE metadata provides a first information about the dataset content, for example by referencing INSPIRE spatial data themes[32], INSPIRE priority data sets or other topics. However, the metadata information or tests performed by the INSPIRE Validator ETF might not be enough to establish the content of the dataset. Therefore, some custom-developed tests are necessary to be performed on the dataset itself.
The INSPIRE Protected sites Simple application schema was used in this study as a reference benchmark and the following custom tests for checking Natura 2000 specific elements in the downloaded (GML) datasets were developed:

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[32] https://inspire.ec.europa.eu/Themes/Data%20Specifications/2892

- Natura 2000 sites are included,

- Specific Natura 2000 site types are used,

- The localId is unique across the file or files.

Does it include Natura 2000 sites?

The INSPIRE metadata information was used in the first place to identify the Natura 2000 relevant and downloadable INSPIRE datasets [Chapter 2], where the following INSPIRE priority data sets keywords were used for a precise identification:

- Natura 2000 sites (Birds Directive)[33], and / or

- Natura 2000 sites (Habitats Directive)[34].

As indicated above, relying only on the metadata description is not enough so it was necessary to check the actual datasets to look for Natura 2000 content. Based on the INSPIRE Protected sites application schema, this information should be encoded in the designationScheme attribute. This was tested by the following custom-developed test:

- The designationScheme is Natura 2000 (*<ps:designationScheme xlink:href="http://inspire.ec.europa.eu/codelist/DesignationSchemeValue/natura2000" xlink:title="natura2000"/>*).

What types (designations) of Natura 2000 are included?

The Natura 2000 reporting guidelines[35] specify the data delivery must comprise an exhaustive set of Natura 2000 site types[36]:

- Special Protection Areas (SPA),

- proposed Sites of Community Importance (pSCI),

- Sites of Community Importance (SCI),

- Special Areas of Conservation (SAC).

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[33]http://inspire.ec.europa.eu/metadata-codelist/PriorityDataset/Natura2000Sites-dir-2009-147

[34] http://inspire.ec.europa.eu/metadata-codelist/PriorityDataset/Natura2000Sites-dir-1992-43

[35] Reference Portal for Natura 2000, https://bd.eionet.europa.eu/activities/Natura_2000/reference_portal

[36] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011D0484&from=EN

The Natura 2000 site types ("designations") are specified in the INSPIRE code list register[37], and the relevant datasets must include a reference to one or more of those entries. The custom-developed tests calculated the number of designated sites SPA/SAC/SCI/pSCI in a dataset.

Unique identifiers?

Each Natura 2000 site has a unique code within the European scope. Following this requirement, a spatial object in a dataset should have a unique identifier. The custom-developed test checked the attribute localId (part of the INSPIRE Identifier data type) is not duplicated in a dataset. The test checked uniqueness of identifiers, not how the INSPIRE identifiers are related to the Natura 2000 site codes.

Does it provide national coverage?

The Natura 2000 reporting guidelines specify that the data delivery must be a national one. The INSPIRE Geoportal filter uses the metadata records (bounding boxes) that could be compared spatially with a reference country geographic extent (also in a form of bounding boxes); however, this comparison provides only indicative information. Actually, the study showed that the Natura 2000 content could be provided through several INSPIRE datasets and services within the same country, e.g. organised by geographical areas (sub-national administrative divisions) and / or categories of content. Therefore, to obtain a national coverage it would be necessary to access and evaluate all relevant datasets and services.

This requirement would therefore have demanded a more thorough analysis, including the comparison with already reported data from the previous reporting cycles, so it was finally decided not to test it in the feasibility study.

A new INSPIRE code list providing values for the spatial scope of datasets, introduced with the upcoming revised Decision on INSPIRE Monitoring and Reporting, is currently under preparation and would help assess whether a dataset intends to cover the national territory or only parts of it (sub-national level).

Results

The test results showed the following findings:

- 5 datasets failed the Natura 2000 designation scheme test,

- 9 datasets failed the XML validation because the namespace for ProtectedSite was declared as an attribute on each element[38],

- In 6 datasets, the Natura 2000 designation types according to the INSPIRE code list, were not found,

- All datasets passed the localId uniqueness test.

Failed tests indicate the existence of heterogeneity in the datasets and the need for additional investigation of structure and content before those datasets can be used, e.g. for creating a

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[37] http://inspire.ec.europa.eu/codelist/Natura2000DesignationValue

[38] <ps:ProtectedSite xmlns:ps="http://inspire.ec.europa.eu/schemas/ps/4.0" gml:id="MT.ERA.MT0000108">

Europe-wide geospatial datasets. This also increases work in developing automatic quality control procedures, as each of those specific cases would need a customised investigation and adjustment of exceptions.

The spatial data quality control results are available in Table 6 Spatial data test results in Annex 3.

4.3 Outcomes

As the main outcomes of the tests performed in this study related to data quality validation, two different types of issues have been detected, the first is related to the validation tool and dataset size while the other relates to the significant number of inconsistencies in the provided data.

The results of the study shows that the INSPIRE datasets from the countries may have a mixed content:

- Besides the INSPIRE Protected sites, a dataset may include also other INSPIRE spatial data themes,

- If the dataset includes only INSPIRE Protected sites related content, it still may include data of diverse designated schemas and not only Natura 2000, e.g. Ramsar protected sites or sites under UNESCO protection, or

- A dataset may also include extended content (beyond required or common schema).

If a dataset includes data not related to the reporting obligation, this content could be excluded with a proper service request configuration, if a service supports such filtering. However, in all cases, it would be necessary to apply specific content related quality control on downloaded datasets, similar to the practice that has been already widely implemented for the reporting data flows in the current Reportnet 2.0 infrastructure.

The spatial datasets might be provided according to different schemas or encoding rules than those defined in INSPIRE and requires additional, case by case investigation.

We acknowledge the INSPIRE Validator ETF is still in development and future versions may correct identified errors in order to support a full validation of datasets of different sizes.

5 Proposed workflow for data harvesting

The reporting of environmental data and information, agreed between the EU and the Member States, has a history of more than 40 years. In order to assist Member States in their data reporting tasks, the EEA developed an infrastructure for supporting and improving the environmental data and information flows. This reporting platform is referred to as Reportnet, and is used for reporting environmental data to the EEA in a transparent way.

Presented in the Chapter 1, the Reportnet infrastructure is currently under evaluation with the aim to establish a modern, flexible and scalable infrastructure (Reportnet 3.0) that might require also changes in the reporting workflows, in particular if new data collection methods, like data harvesting, are included in the reporting data flow. This chapter describes the main details of the current reporting workflow in Reportnet 2.0 and presents some ideas of a new workflow based on data harvesting underpinned by the findings of this feasibility study.

5.1 General characteristics of current workflow

5.1.1 General reporting workflow

The current Reportnet 2.0 infrastructure is composed of several modules that support the reporting data flows as shown on Figure 13.

Figure 13 Reportnet 2.0 modular structure

[01] Reporting Obligations Database	[02] Data Dictionary	[03] Conversion Service & [04] QA Service	[05] Web Forms
[06] Central Data Repositories (CDR, MDR, BDR)	[07] Eionet Network Directory	[08] Unified Notification System	[09] Content Registry

[10] Support modules
(ACL Library, ACLAdmin, HelpAdmin, DocModule, Central Authentication Service)
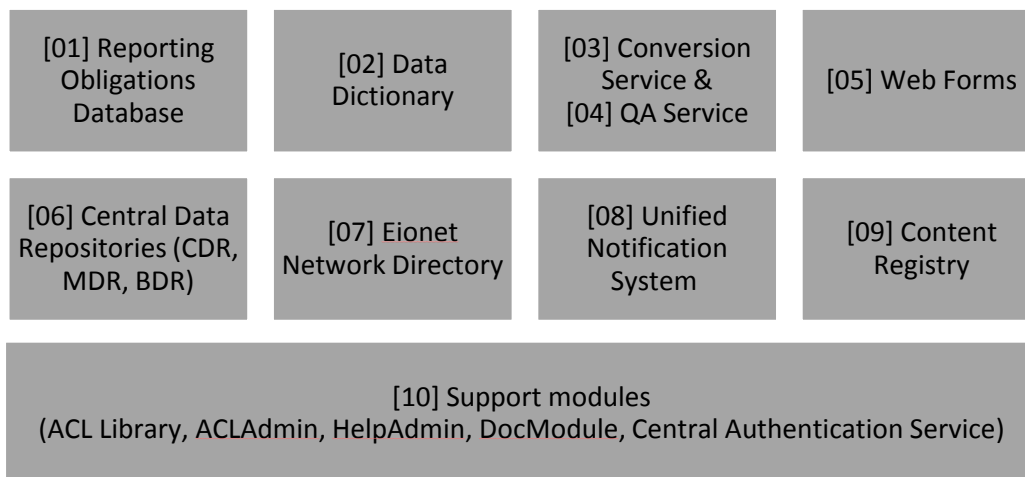
The Central Data Repository[39] (CDR) is the main component the country interacts with during their reporting process. It provides a web interface for guiding the reporter through the reporting workflow, with key steps such as uploading files and presenting quality control feedback. Due to different characteristics of different reporting obligations, a tailored workflow can be configured for each of them. These workflow configurations often refer to how and when quality control and formal acceptance is done.

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[39] http://cdr.eionet.europa.eu

Since many reporting obligations require providing more than one file, each delivery is organised into a folder ("envelope"). These folders are further organised in parent folders ("collections"), that builds up a structure from the delivery to the reporting obligation, and at the top to the country. Files can be uploaded to the envelope, which can then be finally released to the public. CDR has the option of restricting access to confidential data.

Reporters must carry out the following steps within the reporting interval specified in the Reporting Obligations Database[40] (ROD), which holds information on legal reporting obligations that countries have agreed to in the framework of EU legislation:

1. A country reporter must be appointed in charge of the delivery in CDR. The reporter will receive an account with upload rights in a specific directory for this obligation previously created by the EEA reporting obligation project manager.

2. The country reporter uploads the files whenever updated information is available, or the reporting obligation deadline approaches.

3. Once the files are uploaded in CDR, a series of automated quality control (QC) consistency tests are made against them, such as reporting schema validation, and spatial data validation (different from the INSPIRE data validation).

4. If the delivery fails the automated QC tests, then the country reporter is informed about the outcome. They will be required to correct the problems in the data delivery and upload it again. If the data delivery passes the tests, an automatic acknowledgment of the delivery is generated by CDR.

5. The reporting process continues outside CDR, involving more analysis on the reported data. In case of nature related reporting obligations, by ETC/BD and the European Commission.

5.1.2 Natura 2000 reporting workflow example

As stated in the Natura 2000 reporting guidelines [10], Member States are requested to upload the following data delivery, composed of three parts, in the CDR:

- A dataset containing the Natura 2000 information for all sites according to the Natura 2000 Standard Data Form[41] (SDF) in data formats as MDB or XML format,

- A spatial component containing the sites boundaries (shapefile[42] format),

- An explanatory note with all the changes.

The Natura 2000 data reporting workflow follows the general workflow described in the previous section. The Natura 2000 main workflow steps are presented on Figure 14.

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[40] https://rod.eionet.europa.eu
[41] Commission Implementing Decision of 11 July 2011 concerning a site information format for Natura 2000 sites, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32011D0484
[42] https://doc.arcgis.com/en/arcgis-online/reference/shapefiles.htm

Figure 14 Current Natura 2000 data reporting workflow
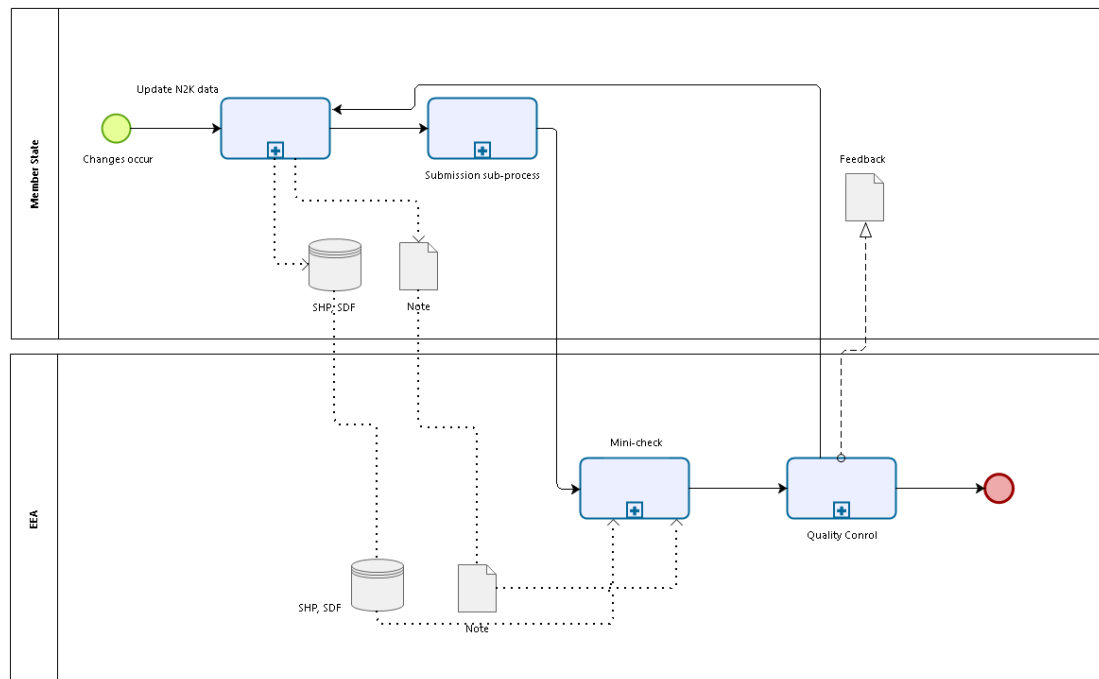
The appointed country reporter can upload Natura 2000 files whenever updated information is available. Mandatory delivery is expected once a year, on the 1st October.

Once data is uploaded in the CDR, the file with SDF data undergoes validation. The spatial data validation is performed including coordinate reference system checks, edge matching on country boundaries and geographic extent.

Upon successful validation, an automatic acknowledgement of the delivery is generated in the CDR. This receipt must be used by the Member State as an annex to the formal notification of delivery sent to DG Environment by the Permanent Representative, a requirement for considering electronic data as official.

The EEA/Eionet European Topic Centre on Biological Diversity (ETC/BD) analyses the national dataset and verifies if changes, e.g. deletions or reductions of sites, habitats or species, have been justified in the accompanying explanatory note. The resulting report outlines the remaining issues affecting the database and discrepancies between the spatial and the descriptive database. Member States are expected to use this report as a basis for improving the quality of their national datasets.

5.2 General characteristics of workflow with data harvesting

5.2.1 General reporting workflow with data harvesting

A first outcome of the feasibility study points out that a potential data harvesting workflow would still need to preserve many of the features of the existing reporting workflow, in particular the guidance and involvement of national reporters.

In the feasibility study several methods were used to find the relevant INSPIRE download services for Natura 2000 sites datasets in scope of e-Reporting: results provided by the INSPIRE Geoportal Thematic Viewer, manual search through the INSPIRE Resource Browser and performing queries directly against the INSPIRE Geoportal CSW end point and searching in metadata information.

Currently, all the solutions tested above provide results that still need additional check and verification since, among other issues found, the datasets may not cover in several cases the entire country, or more than one dataset or service were identified for the same reporting obligation, or no spatial dataset for specific reporting data flow was identified automatically.

It must also be noted that the current technical guidelines and recommendations of INSPIRE metadata do not either provide any particular specification on how to signal officially reported datasets. To solve these issues, the reporter would be eventually required to confirm, select or provide if necessary, the link to the correct (official) service(s) to be harvested. The harvesting might be triggered either by the reporter or by the (future) Reportnet infrastructure.

Including INSPIRE infrastructure in the data harvesting process would also most likely require additional coordination among the INSPIRE coordination structure in the Member State / country, relevant data and service providers, and organisations responsible for the environmental reporting data flows.

Taking all the above into account, a proposed reporting workflow with data harvesting could include the following steps within the reporting interval specified in the Reporting Obligations Database[43] (ROD):

1. A Member State / country reporter must be appointed in charge of the delivery. The reporter would receive an account with appropriate delivery rights. The EEA reporting obligation project manager would support the delivery process.

2. The service end points would have to be known and confirmed. The list of service end points could be based on search results in the INSPIRE Geoportal that the reporter would need to confirm, or on the information provided by the reporter in the first place. The reporter would still have an option to upload manually the files, e.g. when the reporting obligation deadline is approaching.

3. The harvesting process would download datasets from the service end points. Data quality control would be performed to validate datasets against (specific) INSPIRE criteria and perform other thematic specific consistency tests according to the reporting obligation (different from the INSPIRE data validation).

4. The outcomes of automated tests would be provided to the country reporters, especially information about failed tests. The reporters would be required to correct the problems in the datasets and publish them. The Members States / countries would be the solely responsible to correct, update and republish the datasets or services, while the Reportnet infrastructure should provide functionality to harvest the datasets once more. When data delivery passes the tests, an automatic acknowledgment of the delivery should be generated. This would also indicate the data acquisition[44] step of the

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[43] https://rod.eionet.europa.eu
[44] DG Environment 10-step guidance to reporting workflow, 2018

reporting workflow is completed.

5. The reporting process would continue outside of the Reportnet delivery module, with data processing[45] and data dissemination[46] steps by involving more analysis on the reported data, by ETC/BD and the European Commission.

5.2.2 *Natura 2000 reporting workflow using data harvesting*

In the particular case of Natura 2000 reporting obligation, after the country reporter indicates or confirms the INSPIRE download services of the datasets, the harvesting process could start, triggered by the reporter or automatically by an application. The downloaded datasets would be stored in the Reportnet infrastructure, providing a local snapshot of reported data. Defined quality control would apply to downloaded datasets with a notification to the reporter if the datasets need additional correction. A re-harvesting process would be triggered again to access the corrected datasets, presumably using already confirmed services.

This procedure would however only provide the Natura 2000 relevant (INSPIRE) spatial data. Therefore, the country reporter would need to provide also other data that constitute the complete reporting obligation (Natura 2000 SDF information and explanatory note), e.g. by manually uploading the files.

The following figure presents the main steps in the potential Natura 2000 reporting workflow with data harvesting.

Figure 15 Natura 2000 data reporting workflow with data harvesting

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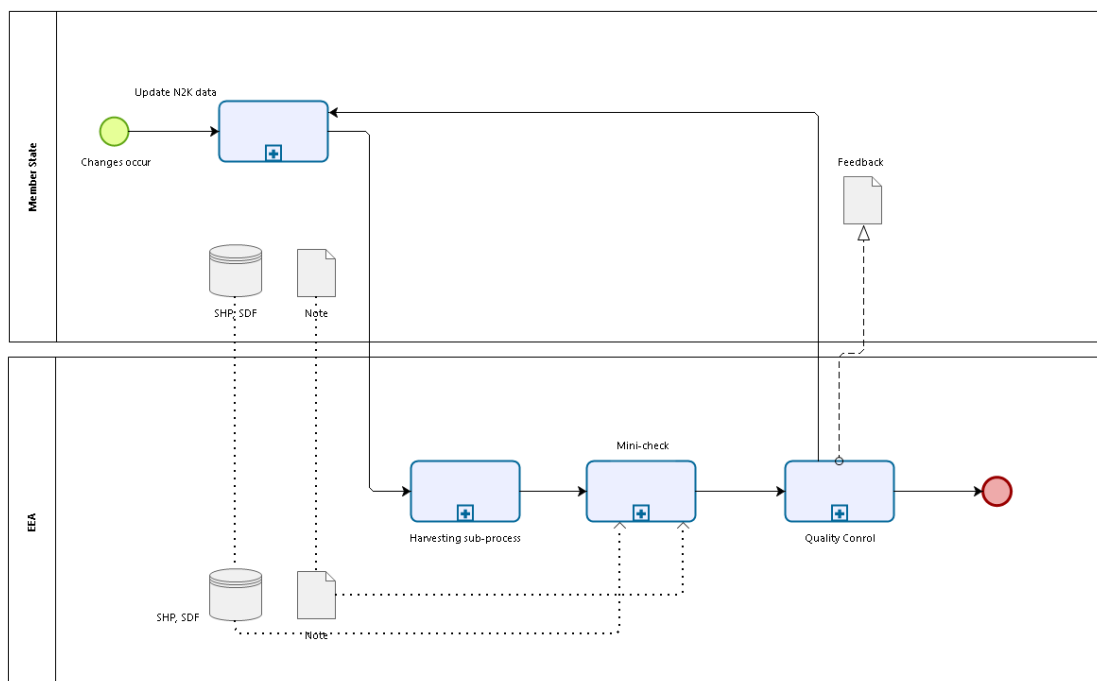
[45] DG Environment 10-step guidance to reporting workflow, 2018
[46] DG Environment 10-step guidance to reporting workflow, 2018

5.3   Lessons learned – benefits and open issues

A reporting workflow shall support the collection of all data and information required by the reporting obligation. This includes spatial data, documents or other structured or non-structured data.

While fostering the coherence and reusability of Member States' geospatial datasets, the data harvesting process of INSPIRE data within reporting would only provide part of required reporting data. Other methods and means may be required to collect the non-geospatial reporting data, possibly including manual upload of non-spatial data to Reportnet.

While the identification of datasets and services in the INSPIRE infrastructure could be automatised (e.g. either through the INSPIRE Geoportal interface (API) or using its OGC CSW interface), the verification of services and data would still need human interaction to solve ambiguous results and to confirm that the correct (official) datasets are collected in the harvesting process.

In addition, Member States / countries should always have the possibility to manually upload the files in case the INSPIRE download services are not available, which may be critical especially close to the reporting obligation deadline.

Support for manual reporting fall-back

Requirement focus: Requirement related to the Reportnet.

Description: Reportnet workflows should continue to accommodate manual uploading of datasets where services are not available. Member States should be able to provide data under the reporting obligation within the reporting window where national INSPIRE services are not available.

Conclusions

The scope of this study was to evaluate the possibility of data harvesting in the scope of eReporting by using the INSPIRE spatial data infrastructure with the aim of automating the collection of spatial data sets falling under the reporting obligations.

The feasibility study used and evaluated the existing INSPIRE metadata, datasets and download services related to Natura 2000 sites provided by data providers in Member States / countries.

The findings are relevant to:

- Understand the availability and usability of Natura 2000 datasets and services within INSPIRE for data harvesting in eReporting, and

- To extrapolate the specific findings into requirements for future Reportnet modernisation that will include data harvesting as one of data input sources in the reporting data flows.

The INSPIRE Geoportal provides an entry point to the INSPIRE downloadable datasets in the Members States / countries and it can be used as a starting point to identify downloadable datasets in data harvesting process. Different methods can be used to find datasets for environmental reporting obligations - from using INSPIRE Geoportal application to a more programmable search on the INSPIRE Geoportal catalogue service.

However, the search results may sometimes provide ambiguous or incomplete results (e.g. several services, also of different types, for the same dataset, disaggregated national datasets, datasets with mixed and non-related content to reporting obligation) that may require additional search refinements, and ultimately the confirmation of service end points by the national reporter before starting harvesting process. Protected services present yet another obstacle in the automatizing of the process by requiring appropriate authentication, authorization or human detection before they can be accessed.

The Natura 2000 relevant services analysed in this study are stable enough to be harvested. The harvesting ran successfully for almost all identified INSPIRE download services, with the exception of protected services that were not investigated in the feasibility study. The majority of the identified download services also met the reference INSPIRE service quality criteria related to availability, performance and capacity. Some deviations were noticed though, such as higher latency in WFS responses, lower availability of service or other service errors.

Environmental reporting has been recognized as a specific use case that can rely on, and benefit from, harvesting national INSPIRE infrastructures. The feasibility study shows this could be better supported in the future with guidelines on how to organize datasets and services in an improved way to support a more efficient and reliable harvesting for reporting purposes (e.g. content, country-wide coverage, Atom feed or WFS).

An important step in any reporting data flow is data quality control and validation. In a future reporting relying on INSPIRE harvesting, these quality control processes will also need to include additional INSPIRE-related validation tests. While re-using existing validation tools for INSPIRE components (e.g. INSPIRE Validator ETF for metadata, data and services) can save resources, more specific quality control related to the reporting data flow requirements would still need to be developed.

The current reporting obligation / reporting data flow workflow could, in principle, be successfully extended to support data harvesting using INSPIRE services. However, the feasibility study has also flagged outstanding issues that currently prevents a fully automated solution. One of these issues concerns the need for an official confirmation by the national reporter of the reporting sources to be harvested. Data harvesting will provide a local snapshot of dataset that will undergo validation and quality control (e.g. data consistency and format). The workflow will still include notifications to country reporters, including results of failed tests that will require additional provision of data or re-harvesting.

As a general conclusion, the study demonstrates a positive outcome in harvesting the Natura 2000 sites datasets in INSPIRE infrastructure, but it also shows the need for a high quality implementation of the INSPIRE requirements as regards metadata, services and harmonised datasets. A loose implementation of INSPIRE would make more difficult to discover and utilise the harvested data across countries. Collected requirements in this study indicate a few directions for further improvement and provide information on data harvesting for Reportnet development.

List of abbreviations

Abbreviation	Name	Reference
API	Application programming interface	
CDR	Central Data Repository	
CSW	Catalogue Service for the Web	http://www.opengeospatial.org/standards/cat
EEA	European Environment Agency	https://www.eea.europa.eu/
EIONET	European Environment Information and Observation Network	https://www.eionet.europa.eu
ETC/BD	European Topic Center on Biological Diversity	
EU	European Union	
FTP	File Transfer Protocol	
ICT	Information and communication technology	
INSPIRE	Infrastructure for Spatial Information in the European Community	https://inspire.ec.europa.eu/
INSPIRE MIG	INSPIRE Maintenance and Implementation Group	https://inspire.ec.europa.eu/inspire-maintenance-and-implementation/46
IR	Implementing Rules	
ISO	International Organization for Standardization	https://www.iso.org/home.html
IT	Information technology	
MAWP	Multi-annual work programme	
OGC	Open Geospatial Consortium	http://www.opengeospatial.org/
pSCI	proposed Sites of Community Importance	
QC	Quality control	
REFIT	Regulatory fitness and performance	
Reportnet	Eionet's infrastructure for supporting and improving data and information flows	https://www.eionet.europa.eu/reportnet
ROD	Reporting Obligations Database	
SAC	Special Areas of Conservation	
SCI	Sites of Community Importance	
SDF	Standard Data Form	
SPA	Special Protection Areas	

TG	Technical Guidelines	
WFS	Web Feature Service	

References

[1] "Technical Guidance for the implementation of INSPIRE Download Services," August 2013. [Online]. Available: https://inspire.ec.europa.eu/file/1705/download?token=iSTwpRWd.

[2] "COMMISSION REGULATION (EC) No 976/2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services," October 2009. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02009R0976-20101228&from=EN.

[3] "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)," 2007. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32007L0002.

[4] "Technical Guidance for the implementation of INSPIRE dataset and service metadata based on ISO/TS 19139:2007," March 2017. [Online]. Available: https://inspire.ec.europa.eu/file/1705/download?token=iSTwpRWd.

[5] "REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on the implementation of Directive 2007/2/EC of March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) pursuant to article 23," August 2016. [Online]. Available: https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-478-EN-F1-1.PDF.

[6] "Commission Regulation (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services," November 2010. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02010R1089-20131230&qid=1400675738563.

[7] "INSPIRE Roadmap," [Online]. Available: https://inspire.ec.europa.eu/inspire-roadmap/61.

[8] "Maintenance and Implementation Work Programme for the INSPIRE Directive for the period from 2017-2020 (MIWP 2017)," 2016. [Online]. Available: https://webgate.ec.europa.eu/fpfis/wikis/display/InspireMIG/MIWP+2016-2020?preview=/272860396/300878064/miwp-2017-3.0.pdf.

[9] "Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora," 1992. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31992L0043.

[10] "User Manual for the delivery of a new national Natura 2000 database to the Commission," March 2012. [Online]. Available: https://bd.eionet.europa.eu/activities/Natura_2000/Folder_Reference_Portal/Reporting%20guidelines%20update%201.3-March%202012.pdf.

Annex 1 List of service end points

Table 2 List of service end points

Austria
Get Download Service Metadata
http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a_atom.xml
https://gis.tirol.gv.at/inspire/downloadservice/DownloadServiceFeed.xml
https://stp.wien.gv.at/agsinspire/rest/services/inspireh/MapServer/exts/InspireFeatureDownload/service?VERSION=2.0.0&SERVICE=WFS&REQUEST=GetCapabilities
Describe Spatial Data Set
http://gis.tirol.gv.at/inspire/downloadservice/DatasetFeed_Natura2000_FFH_Richtlinie.xml
http://gis.tirol.gv.at/inspire/downloadservice/DatasetFeed_Natura2000_Vogelschutzrichtlinie.xml
http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a_atom_dataset.xml
Get Spatial Data Set
http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_FFH_Richtlinie_ETRS89UTM32N.zip
http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_Vogelschutzrichtlinie_ETRS89UTM32N.zip
http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a.zip
https://stp.wien.gv.at/agsinspire/rest/services/inspireh/MapServer/exts/InspireFeatureDownload/service?VERSION=2.0.0&SERVICE=WFS&Count=10&srsName=urn:ogc:def:crs:EPSG::3035&REQUEST=GetFeature&typeNames=ps:ProtectedSite
Belgium
Get Download Service Metadata
http://geoservices.wallonie.be/inspire/atom/PS_Service.xml
Describe Spatial Data Set
http://geoservices.wallonie.be/inspire/atom/PS_Dataset_ProtectedSitesNatura2000.xml
Get Spatial Data Set
http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_habitat.gml
http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_station.gml
http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSite.gml.zip
http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSitesNatura2000.gml.zip
https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Birds.gml.zip
https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Habitat.gml.zip
Czech Republic
Get Download Service Metadata
http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&verion=2.0.0&request=getCapabilities
Get Spatial Data Set
http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&count=200&startIndex=0&Typenames=Natura2000:Evropsky_v%fdznamn%e1_lokalita__EVL_
http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&Typenames=Natura2000:Forma_ochrany_EVL_-_stav_k_NV_207_2016__1._7._2016_

http://gis.nature.cz/inspire/gml/CZ-AOPK-PS_Natura2000.gml

Denmark

Get Download Service Metadata

http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetCapabilities

Get Spatial Data Set

http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::3035

http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258

Finland

Get Download Service Metadata

http://geoserver.ymparisto.fi/geoserver/wfs?service=wfs&version=2.0.0&request=GetCapabilities

Describe Spatial Data Set

http://wwwd3.ymparisto.fi/d3/INSPIREAtom/PS_natura2000.xml

Get Spatial Data Set

http://geoserver.ymparisto.fi/geoserver/wfs?service=WFS&version=2.0.0&request=getfeature&storedqueryid=http://inspire.ec.europa.eu/operation/download/getspatialdataset/&DataSetIdCode=http://paikkatiedot.fi/so/1%20002201/ps/ProtectedSite/&CRS=http://www.opengis.net/def/crs/EPSG/0/3035

http://wwwd3.ymparisto.fi/d3/gis_data/gml/PS_Natura2000_3035.gml

http://wwwd3.ymparisto.fi/d3/gis_data/spesific/natura.zip

Lithuania

Get Spatial Data Set

https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zac-special-areas-of-conservation-habitats-directive-1/20180223-091925/PS.ProtectedSitesNatureConservation-Habitats.gml.zip

https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zpa-special-protection-areas-for-birds-birds-directive-2/20180223-091930/PS.ProtectedSitesNatureConservation-Birds.gml.zip

https://download.data.public.lu/resources/natura-2000-zac-special-areas-of-conservation-habitats-directive/20170718-224546/mddi_natura2000_oiseaux.geojson

https://download.data.public.lu/resources/natura-2000-zpa-special-protection-areas-for-birds-birds-directive/20170718-224609/mddi_natura2000_habitats.geojson

Latvia

Get Download Service Metadata

http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=getcapabilities

Get Spatial Data Set

http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&count=5000&request=getFeature&typeNames=protSite:psSiteS&srsName=urn:ogc:def:crs:EPSG::3035

http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=getFeature&typeNames=protSite:psSiteS

Malta

Get Download Service Metadata

https://msdi.data.gov.mt/deegree/services/hb_HabitatNatura2000Biotope?service=WFS&version=2.0.0&request=GetCapabilities

https://msdi.data.gov.mt/deegree/services/ps_Natura2000SCI?service=WFS&version=2.0.0&request=GetCapabilities

https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?service=WFS&version=2.0.0&request=GetCapabilities
https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetCapabilities
Get Spatial Data Set
https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SCI.gml
https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPA.gml
https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPASCI.gml
https://msdi.data.gov.mt/deegree/services/hb_HabitatNatura2000Biotope?service=WFS&version=2.0.0&request=GetFeature&Typenames=hb:Habitat
https://msdi.data.gov.mt/deegree/services/ps_Natura2000SCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite
https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?request=GetFeature&Language=eng&CRS=http://www.opengis.net/def/crs/EPSG/0/3045&DataSetIdNamespace=https://era.org.mt/&service=WFS&count=10&STOREDQUERY_ID=http://inspire.ec.europa.eu/operation/down
https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?service=WFS&version=2.0.0&request=getFeature&typeNames=ps:ProtectedSite
https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite
Netherlands
Get Download Service Metadata
https://geodata.nationaalgeoregister.nl/natura2000/wfs?service=wfs&version=2.0.0&request=GetCapabilities
Describe Spatial Data Set
https://geodata.nationaalgeoregister.nl/natura2000/atom/natura2000.xml
Get Spatial Data Set
http://geodata.nationaalgeoregister.nl/natura2000/extract/natura2000.zip
https://geodata.nationaalgeoregister.nl/natura2000/wfs?request=getfeature&typenames=natura2000:natura2000&srsName=urn:ogc:def:crs:EPSG::3035
Portugal
Get Download Service Metadata
http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetCapabilities
Get Spatial Data Set
http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258
Romania
Get Download Service Metadata
http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetCapabilities&service=WFS&version=2.0.0
Get Spatial Data Set
http://gmlid.eu/RO/ENV/PADS/PS/ROSCI0135
http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&storedqueryID=urn:ogc:def:query:OGC-WFS::GetFeatureById&ID=RO.ENV.PADS.PS.ROSCI0135
http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&typenames=ps:ProtectedSite&count=1000&startindex=966
Spain
Get Download Service Metadata
https://www.mapama.gob.es/ide/inspire/atom/CategBiodiversidad/downloadservice.xml
Describe Spatial Data Set
http://wwwd3.ymparisto.fi/d3/INSPIREAtom/PS_natura2000.xml

Sweden

Get Download Service Metadata

https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=GetCapabilities

Get Spatial Data Set

http://gpt.vic-metria.nu/data/land/SCI_Rikstackande.zip

http://gpt.vic-metria.nu/data/land/SPA_Rikstackande.zip

https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&srsName=urn:ogc:def:crs:EPSG::3035&request=GetFeature&TypeNames=ps-f:ProtectedSite

Annex 2 Service monitoring results

Performance and capacity tests and results

The following criteria apply to the performance of a service in the context of INSPIRE:

- Response time for *Get Download Service Metadata* shall be < 10 seconds.

- Response time for a *Get Spatial Dataset* and the *Get Spatial Object* < 30 seconds and get a sustained response of 0.5Mb/s or 500 objects/s.

- Response time for a *Describe Spatial Data set* and the *Describe Spatial Object Type* < 10 seconds and get a sustained response of 0.5Mb/s or 500 objects/s.

The performance metrics described above must be achieved using the capacity criteria. For example, response time for "Get Download Service Metadata" shall be < 10 seconds for 10 simultaneous requests.

For Atom feeds the INSPIRE abstract Download Service operations are mapped as follows:

INSPIRE operations	Atom
Get Download Service Metadata	Top level Atom feed
Get Spatial Data Set	Feed entry with link to dataset
Describe Spatial Data Set	Feed entry with link to dataset feed

For WFS links the INSPIRE abstract Download Service operations are mapped as follows:

INSPIRE operations	WFS
Get Download Service Metadata	GetCapabilities
Get Spatial Data Set	GetFeatures or GML/ZIP resources

Table 3 Performance testing results

Austria

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://stp.wien.gv.at/agsinspire/rest/services/inspireh/MapServer/exts/InspireFeatureDownload/service?VERSION=2.0.0&SERVICE=WFS&REQUEST=GetCapabilities	1841	1.68	0.00%	6.1	127.4
http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a_atom.xml	43763	0.07	0.00%	146.0	591.7

	26567	0.09	0.00%	88.6	4513.9
https://gis.tirol.gv.at/inspire/download service/DownloadServiceFeed.xml	26567	0.09	0.00%	88.6	4513.9

Describe Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uu id_d18f358a-26fe-4144-8feb-7f805485f90a_atom_dataset.xml	43622	0.07	0.00%	145.4	545.3
http://gis.tirol.gv.at/inspire/downloads ervice/DatasetFeed_Natura2000_Vogel schutzrichtlinie.xml	25199	0.05	0.00%	84.0	268.0
http://gis.tirol.gv.at/inspire/downloads ervice/DatasetFeed_Natura2000_FFH_ Richtlinie.xml	24197	0.05	0.00%	80.7	251.6

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://stp.wien.gv.at/agsinspire/rest/s ervices/inspireh/MapServer/exts/Inspir eFeatureDownload/service?VERSION=2 .0.0&SERVICE=WFS&Count=10&srsNa me=urn:ogc:def:crs:EPSG::3035&REQU EST=GetFeature&typeNames=ps:Prote ctedSite	1922	1.61	0.36%	6.4	5.0
http://gis.tirol.gv.at/inspire/downloads ervice/Natura2000_FFH_Richtlinie_ETR S89UTM32N.zip	1852	0.08	0.00%	6.1	5555.6
http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uu id_d18f358a-26fe-4144-8feb-7f805485f90a.zip	8498	0.07	0.00%	28.3	5811.7
http://gis.tirol.gv.at/inspire/downloads ervice/Natura2000_Vogelschutzrichtlin ie_ETRS89UTM32N.zip	2063	0.08	0.00%	6.9	5370.3

Belgium

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://geoservices.wallonie.be/inspire/ atom/PS_Service.xml	36260	0.06	0.00%	120.9	4084.0

Describe Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s

http://geoservices.wallonie.be/inspire/atom/PS_Dataset_ProtectedSitesNatura2000.xml	40173	0.06	0.00%	134.0	1420.2

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSitesNatura2000.gml.zip	261	0.18	0.00%	0.8	9523.9
https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Birds.gml.zip	2478	0.16	0.00%	8.2	2726.8
http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_habitat.gml	185	0.15	0.00%	0.6	4280.2
https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Habitat.gml.zip	727	0.26	0.00%	2.4	2686.9
http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_station.gml	2168	0.1	0.09%	3.7	1963.0
http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSite.gml.zip	122	0.18	0.00%	0.4	8472.0

Czechia

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&verion=2.0.0&request=getCapabilities	26615	0.13	46.41%	88.1	667.9

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&Typenames=Natura2000:Forma_ochrany_EVL_-_stav_k_NV_207_2016__1._7._2016_	461	3.79	0.00%	1.5	3073.7
http://gis.nature.cz/inspire/gml/CZ-AOPK-PS_Natura2000.gml	34	0.42	0.00%	0.1	5109.3
http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&count=200&startIndex=0&Typenames=Natura2000:Evropsky_v%fdznamn%e1_lokalita__EVL_	378	25.32	87.57%	1.0	1646.4

Denmark

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetCapabilities	44150	0.06	0.00%	147.4	2769.9

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::3035	71	7.27	0.00%	0.2	7770.1
http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258	75	6.23	0.00%	0.2	8388.0

Spain

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://www.mapama.gob.es/ide/inspire/atom/CategBiodiversidad/downloadservice.xml	22249	0.07	0.00%	74.1	4487.8

Describe Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://www.mapama.gob.es/ide/inspire/atom/CategBiodiversidad/RedNatura2000RN2000.xml	32847	0.04	0.00%	109.5	431.5

Finland

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://geoserver.ymparisto.fi/geoserver/wfs?service=wfs&version=2.0.0&request=GetCapabilities	15958	0.15	0.00%	53.2	5125.6

Describe Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s

http://wwwd3.ymparisto.fi/d3/INSPIRE Atom/PS_natura2000.xml	33147	0.09	0.00%	110.5	261.8

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://wwwd3.ymparisto.fi/d3/gis_dat a/spesific/natura.zip	39	0.17	0.00%	0.1	3669.4
http://wwwd3.ymparisto.fi/d3/gis_dat a/gml/PS_Natura2000_3035.gml	19	0.19	0.00%	0.0	3149.2

Luxembourg

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://download.data.public.lu/resour ces/natura-2000-zac-special-areas-of-conservation-habitats-directive/20170718-224546/mddi_natura2000_oiseaux.geo json	256	0.45	0.00%	0.8	9689.2
https://download.data.public.lu/resour ces/inspire-annex-i-theme-protected-sites-natura-2000-zpa-special-protection-areas-for-birds-birds-directive-2/20180223-091930/PS.ProtectedSitesNatureConse rvation-Birds.gml.zip	941	0.37	0.00%	3.1	9820.6
https://download.data.public.lu/resour ces/inspire-annex-i-theme-protected-sites-natura-2000-zac-special-areas-of-conservation-habitats-directive-1/20180223-091925/PS.ProtectedSitesNatureConse rvation-Habitats.gml.zip	1169	0.31	0.00%	3.9	9393.6
https://download.data.public.lu/resour ces/natura-2000-zpa-special-protection-areas-for-birds-birds-directive/20170718-224609/mddi_natura2000_habitats.ge ojson	325	0.39	0.00%	1.0	9473.9

Latvia

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://proxygds.viss.gov.lv/arcgis/rest/ services/Predefined/ProtectedSitesInsp ireFeatDownServiceSiteProtClassLayers /MapServer/exts/InspireFeatureDownl oad/service?service=wfs&version=2.0. 0&request=getcapabilities	2467	0.35	0.08%	8.2	624.2

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s

http://proxygds.viss.gov.lv/arcgis/rest/ services/Predefined/ProtectedSitesInsp ireFeatDownServiceSiteProtClassLayers /MapServer/exts/InspireFeatureDownl oad/service?service=wfs&version=2.0. 0&request=getFeature&typeNames=pr otSite:psSiteS	123	20.95	0.00%	0.4	2178.8
http://proxygds.viss.gov.lv/arcgis/rest/ services/Predefined/ProtectedSitesInsp ireFeatDownServiceSiteProtClassLayers /MapServer/exts/InspireFeatureDownl oad/service?service=wfs&version=2.0. 0&count=5000&request=getFeature&t ypeNames=protSite:psSiteS&srsName= urn:ogc:def:crs:EPSG::3035	70	40.04	0.00%	0.2	2325.3

Malta

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://msdi.data.gov.mt/deegree/serv ices/ps_Natura2000SPA?service=WFS& version=2.0.0&request=GetCapabilities	8747	0.06	32.03%	26.8	484.4
https://msdi.data.gov.mt/deegree/serv ices/ps_Natura2000SPASCI?service=W FS&version=2.0.0&request=GetCapabili ties	5940	0.08	49.49%	19.6	276.6
https://msdi.data.gov.mt/deegree/serv ices/ps_Natura2000SCI?service=WFS& version=2.0.0&request=GetCapabilities	6037	0.03	50.31%	20.1	278.5
https://msdi.data.gov.mt/deegree/serv ices/hb_HabitatNatura2000Biotope?se rvice=WFS&version=2.0.0&request=Ge tCapabilities	5670	0.39	46.91%	18.1	266.4

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://msdi.data.gov.mt/deegree/serv ices/hb_HabitatNatura2000Biotope?se rvice=WFS&version=2.0.0&request=Ge tFeature&Typenames=hb:Habitat	576	0.5	0.00%	1.9	6574.7
https://msdi.data.gov.mt/data/PS.Prot ectedSitesNatura2000.SCI.gml	48	1.81	0.00%	0.1	213.2
https://msdi.data.gov.mt/deegree/serv ices/ps_Natura2000SCI?service=WFS& version=2.0.0&request=GetFeature&Ty peNames=ps:ProtectedSite	2882	0.32	62.35%	9.5	3285.9
https://msdi.data.gov.mt/deegree/serv ices/ps_Natura2000SPA?service=WFS& version=2.0.0&request=getFeature&ty peNames=ps:ProtectedSite	8116	0.07	100.00%	26.5	35.3
https://msdi.data.gov.mt/data/PS.Prot ectedSitesNatura2000.SPA.gml	819	0.4	0.00%	2.4	2649.5
https://msdi.data.gov.mt/data/PS.Prot ectedSitesNatura2000.SPASCI.gml	289	1.31	0.69%	0.9	210.2

https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?request=GetFeature&Language=eng&CRS=http://www.opengis.net/def/crs/EPSG/0/3045&DataSetIdNamespace=https://era.org.mt/&service=WFS&count=10&STOREDQUERY_ID=http://inspire.ec.europa.eu/operation/download/GetSpatialDataSet&version=2.0.0&DataSetIdCode=N200_MT_SPAs	3618	0.3	79.35%	12.0	1449.5
https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	5941	0.1	49.50%	19.3	1607.9

Netherlands

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://geodata.nationaalgeoregister.nl/natura2000/wfs?service=wfs&version=2.0.0&request=GetCapabilities	1176	1.01	0.00%	3.9	325.7

Describe Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://geodata.nationaalgeoregister.nl/natura2000/atom/natura2000.xml	7226	0.4	0.07%	23.9	53.1

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://geodata.nationaalgeoregister.nl/natura2000/wfs?request=getfeature&typenames=natura2000:natura2000&srsName=urn:ogc:def:crs:EPSG::3035	19	4.43	0.00%	0.0	612.3
http://geodata.nationaalgeoregister.nl/natura2000/extract/natura2000.zip	26	0.34	0.00%	0.1	571.9

Portugal

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetCapabilities	2150	0.51	0.00%	7.1	978.2

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetFeature&typeNames=ps:Prot	34	18.59	2.94%	0.1	1248.3

ectedSite&srsName=urn:ogc:def:crs:EP
SG::4258

Romania

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetCapabilities&service=WFS&version=2.0.0	13698	0.06	0.00%	45.7	4068.4

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&storedqueryID=urn:ogc:def:query:OGC-WFS::GetFeatureById&ID=RO.ENV.PADS.PS.ROSCI0135	44	68.45	0.00%	0.1	45.0
http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&typenames=ps:ProtectedSite&count=1000&startindex=966	25	17.85	0.00%	0.1	5187.9
http://gmlid.eu/RO/ENV/PADS/PS/ROSCI0135	3342	0.18	0.00%	11.1	3940.1

Sweden

Get Download Service Metadata

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=GetCapabilities	19344	0.14	0.00%	64.4	1681.8

Get Spatial Data Set

Service URL	Requests	Latency [mean] (s)	Error %	Throughput	Received KB/s
http://gpt.vic-metria.nu/data/land/SCI_Rikstackande.zip	19	0.17	0.00%	0.0	2847.3
http://gpt.vic-metria.nu/data/land/SPA_Rikstackande.zip	131	0.21	0.00%	0.4	1799.9
https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&srsName=urn:ogc:def:crs:EPSG::3035&request=GetFeature&TypeNames=ps-f:ProtectedSite	42	39.63	16.67%	0.1	1203.2

Availability tests and results

Table 4 Availability monitoring results

Country	Service URL	Availability
Austria	https://gis.tirol.gv.at/inspire/downloadservice/DownloadServiceFeed.xml	99.4947%
Austria	http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a_atom.xml	99.8316%
Austria	https://stp.wien.gv.at/agsinspire/rest/services/inspireh/MapServer/exts/InspireFeatureDownload/service?VERSION=2.0.0&SERVICE=WFS&REQUEST=GetCapabilities	99.6631%
Austria	http://gis.tirol.gv.at/inspire/downloadservice/DatasetFeed_Natura2000_Vogelschutzrichtlinie.xml	99.6070%
Austria	http://gis.tirol.gv.at/inspire/downloadservice/DatasetFeed_Natura2000_FFH_Richtlinie.xml	99.5508%
Austria	http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a_atom_dataset.xml	100.0000%
Austria	http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_Vogelschutzrichtlinie_ETRS89UTM32N.zip	99.5508%
Austria	http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_FFH_Richtlinie_ETRS89UTM32N.zip	99.6070%
Austria	http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a.zip	99.7193%
Austria	https://stp.wien.gv.at/agsinspire/rest/services/inspireh/MapServer/exts/InspireFeatureDownload/service?VERSION=2.0.0&SERVICE=WFS&Count=10&srsName=urn:ogc:def:crs:EPSG::3035&REQUEST=GetFeature&typeNames=ps:ProtectedSite	99.8316%
Belgium	http://geoservices.wallonie.be/inspire/atom/PS_Service.xml	99.5508%
Belgium	http://geoservices.wallonie.be/inspire/atom/PS_Dataset_ProtectedSitesNatura2000.xml	99.7193%
Belgium	http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSitesNatura2000.gml.zip	100.0000%
Belgium	http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSite.gml.zip	99.7754%
Belgium	http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_habitat.gml	99.7754%
Belgium	http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_station.gml	99.9439%
Belgium	https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Birds.gml.zip	99.6631%
Belgium	https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Habitat.gml.zip	99.7754%
Czechia	http://gis.nature.cz/inspire/gml/CZ-AOPK-PS_Natura2000.gml	59.4048%
Czechia	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&count=200&startIndex=0&Typenames=Natura2000:Evropsky_v%fdznamn%e1_lokalita__EVL_	59.4610%
Czechia	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&Typenames=Natura2000:Forma_ochrany_EVL_-_stav_k_NV_207_2016__1._7._2016_	59.3487%
Czechia	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&verion=2.0.0&request=getCapabilities	59.2364%

Country	Service URL	Availability
Denmark	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetCapabilities	99.7754%
Denmark	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258	97.6979%
Denmark	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::3035	98.1471%
Finland	http://geoserver.ymparisto.fi/geoserver/wfs?service=wfs&version=2.0.0&request=GetCapabilities	99.8316%
Finland	http://wwwd3.ymparisto.fi/d3/INSPIREAtom/PS_natura2000.xml	99.7193%
Finland	http://wwwd3.ymparisto.fi/d3/gis_data/gml/PS_Natura2000_3035.gml	99.7754%
Finland	http://wwwd3.ymparisto.fi/d3/gis_data/spesific/natura.zip	99.9439%
Finland	http://geoserver.ymparisto.fi/geoserver/wfs?service=WFS&version=2.0.0&request=getfeature&storedqueryid=http://inspire.ec.europa.eu/operation/download/getspatialdataset/&DataSetIdCode=http://paikkatiedot.fi/so/1%20002201/ps/ProtectedSite/&CRS=http://www.opengis.net/def/crs/EPSG/0/3035	0.0000%
Latvia	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=getcapabilities	99.7193%
Latvia	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=getFeature&typeNames=protSite:psSiteS	99.6631%
Latvia	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&count=5000&request=getFeature&typeNames=protSite:psSiteS&srsName=urn:ogc:def:crs:EPSG::3035	99.7754%
Luxembourg	https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zpa-special-protection-areas-for-birds-birds-directive-2/20180223-091930/PS.ProtectedSitesNatureConservation-Birds.gml.zip	99.7754%
Luxembourg	https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zac-special-areas-of-conservation-habitats-directive-1/20180223-091925/PS.ProtectedSitesNatureConservation-Habitats.gml.zip	99.8877%
Luxembourg	https://download.data.public.lu/resources/natura-2000-zpa-special-protection-areas-for-birds-birds-directive/20170718-224609/mddi_natura2000_habitats.geojson	99.8316%
Luxembourg	https://download.data.public.lu/resources/natura-2000-zac-special-areas-of-conservation-habitats-directive/20170718-224546/mddi_natura2000_oiseaux.geojson	99.9439%
Malta	https://msdi.data.gov.mt/deegree/services/hb_HabitatNatura2000Biotope?service=WFS&version=2.0.0&request=GetCapabilities	99.1016%
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?service=WFS&version=2.0.0&request=GetCapabilities	99.2139%
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetCapabilities	99.3824%
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SCI?service=WFS&version=2.0.0&request=GetCapabilities	99.2139%
Malta	https://msdi.data.gov.mt/deegree/services/hb_HabitatNatura2000Biotope?service=WFS&version=2.0.0&request=GetFeature&Typenames=hb:Habitat	99.5508%
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?request=GetFeature&Language=eng&CRS=http://www.opengis.net/def/crs/EPSG/0/3045&DataSetIdNamespace=https://era.org.mt/&service=WFS&count=10&STOREDQUER	99.4947%

Country	Service URL	Availability
	Y_ID=http://inspire.ec.europa.eu/operation/download/GetSpatialDataSet&version=2.0.0&DataSetIdCode=N2000_MT_SPAs	
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?service=WFS&version=2.0.0&request=getFeature&typeNames=ps:ProtectedSite	0.0000%
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	99.4385%
Malta	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	99.5508%
Malta	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPA.gml	99.4385%
Malta	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPASCI.gml	99.3824%
Malta	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SCI.gml	99.3824%
Netherlands	https://geodata.nationaalgeoregister.nl/natura2000/wfs?service=wfs&version=2.0.0&request=GetCapabilities	99.8877%
Netherlands	https://geodata.nationaalgeoregister.nl/natura2000/wfs?request=getfeature&typenames=natura2000:natura2000&srsName=urn:ogc:def:crs:EPSG::3035	99.8316%
Netherlands	http://geodata.nationaalgeoregister.nl/natura2000/extract/natura2000.zip	100.0000%
Netherlands	https://geodata.nationaalgeoregister.nl/natura2000/atom/natura2000.xml	99.8877%
Portugal	http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetCapabilities	99.9439%
Portugal	http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258	99.8316%
Romania	http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetCapabilities&service=WFS&version=2.0.0	99.6631%
Romania	http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&typenames=ps:ProtectedSite&count=1000&startindex=966	99.8877%
Romania	http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&storedqueryID=urn:ogc:def:query:OGC-WFS::GetFeatureById&ID=RO.ENV.PADS.PS.ROSCI0135	99.9439%
Romania	http://gmlid.eu/RO/ENV/PADS/PS/ROSCI0135	100.0000%
Spain	https://www.mapama.gob.es/ide/inspire/atom/CategBiodiversidad/downloadservice.xml	99.7193%
Spain	http://www.mapama.gob.es/ide/inspire/atom/CategBiodiversidad/RedNatura2000RN2000.xml	99.8877%
Sweden	https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=GetCapabilities	99.8877%
Sweden	https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&srsName=urn:ogc:def:crs:EPSG::3035&request=GetFeature&TypeNames=ps-f:ProtectedSite	99.7754%
Sweden	http://gpt.vic-metria.nu/data/land/SPA_Rikstackande.zip	99.8316%
Sweden	http://gpt.vic-metria.nu/data/land/SCI_Rikstackande.zip	99.8877%

Reliability tests and results

Table 5 Reliability monitoring results

Country	URL	Changes	Notes
Austria	http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_Vogelschutzrichtlinie_ETRS89UTM32N.zip	-	Diff performed on "SPA_Tirol.gml" file extracted from archive.
	http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_FFH_Richtlinie_ETRS89UTM32N.zip	-	Diff performed on file "PSC_Tirol.gml" extracted from archive.
	http://vogis.cnv.at/inspire-download/natura_2000_epsg_3035_uuid_d18f358a-26fe-4144-8feb-7f805485f90a.zip	-	Could not perform diff: response is multi-file ZIP archive. However, the checksum on the archive itself did not change.
Belgium	http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSitesNatura2000.gml.zip	-	Diff performed on "PS.ProtectedSitesNatura2000.gml" file extracted from archive.
	http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSite.gml.zip	-	Diff performed on "Protectedsites.n2k_station.gml" file extracted from archive.
	http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_habitat.gml	-	
	http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_station.gml	-	
	https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Birds.gml.zip	-	Diff performed on "PS.ProtectedSitesNatureConservation-Natura2000_Birds.gml" file extracted from archive.
	https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Habitat.gml.zip	-	Diff performed on "PS.ProtectedSitesNatureConservation-Natura2000_Habitat.gml" file extracted from archive.
Czech Republic	http://gis.nature.cz/inspire/gml/CZ-AOPK-PS_Natura2000.gml	-	
	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&count=200&startIndex=0&Typenames=Natura2000:Evropsky_v%fdznamn%e1_lokalita__EVL_	- timeStamp attribute in <wfs:FeatureCollection>	

Country	URL	Changes	Notes
	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&Typenames=Natura2000:Forma_ochrany_EVL_-_stav_k_NV_207_2016__1._7._2016_	- timeStamp attribute in <wfs:FeatureCollection>	
Denmark	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258	timeStamp attribute in <wfs:FeatureCollection> - order and/or content in surface/polygon tags - requires SME review	
	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::3035	timeStamp attribute in <wfs:FeatureCollection> - order and/or content in surface/polygon tags - requires SME review	
Finland	http://wwwd3.ymparisto.fi/d3/gis_data/gml/PS_Natura2000_3035.gml	-	
	http://wwwd3.ymparisto.fi/d3/gis_data/spesific/natura.zip	-	Could not perform diff: response is multi-file ZIP archive. However, the checksum on the archive itself did not change.
Latvia	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=getFeature&typeNames=protSite:psSiteS	timeStamp attribute in <wfs:FeatureCollection> random encoding issues for diacritic characters (e.g. ā, ķ, ī)	
	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&count=5000&request=getFeature&typeNames=protSite:psSiteS&srsName=urn:ogc:def:crs:EPSG::3035	timeStamp attribute in <wfs:FeatureCollection> random encoding issues for diacritic characters (e.g. ā, ķ, ī)	
Lithuania	https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zpa-special-protection-areas-for-birds-birds-directive-2/20180223-091930/PS.ProtectedSitesNatureConservation-Birds.gml.zip	-	

Country	URL	Changes	Notes
	https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zac-special-areas-of-conservation-habitats-directive-1/20180223-091925/PS.ProtectedSitesNatureConservation-Habitats.gml.zip	-	
Malta	https://msdi.data.gov.mt/deegree/services/hb_HabitatNatura2000Biotope?service=WFS&version=2.0.0&request=GetFeature&Typenames=hb:Habitat	timeStamp attribute in <wfs:FeatureCollection> id attribute in <gml:LineString> changes every request (but inner <gml:posList> stays the same)	
	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?request=GetFeature&Language=eng&CRS=http://www.opengis.net/def/crs/EPSG/0/3045&DataSetIdNamespace=https://era.org.mt/&service=WFS&count=10&STOREDQUERY_ID=http://inspire.ec.europa.eu/operation/download/GetSpatialDataSet&version=2.0.0&DataSetIdCode=N2000_MT_SPAs	-	
	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?service=WFS&version=2.0.0&request=getFeature&typeNames=ps:ProtectedSite	timeStamp attribute in <wfs:FeatureCollection> id attribute in <gml:LineString> changes every request (but inner <gml:posList> stays the same)	
	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	timeStamp attribute in <wfs:FeatureCollection> id attribute in <gml:LineString> changes every request (but inner <gml:posList> stays the same)	

Country	URL	Changes	Notes
	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	timeStamp attribute in <wfs:FeatureCollection> id attribute in <gml:LineString> changes every request (but inner <gml:posList> stays the same)	
	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPA.gml	-	
	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPASCI.gml	-	
	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SCI.gml	-	
Netherlands	https://geodata.nationaalgeoregister.nl/natura2000/wfs?request=getfeature&typenames=natura2000:natura2000&srsName=urn:ogc:def:crs:EPSG::3035	- timeStamp attribute in <wfs:FeatureCollection>	
	http://geodata.nationaalgeoregister.nl/natura2000/extract/natura2000.zip	-	Could not perform diff: response is multi-file ZIP archive. However, the checksum on the archive itself did not change.
Portugal	http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258	- timeStamp attribute in <wfs:FeatureCollection>	Occasional fake "bad gateway" response as HTML page with 200 status code
Romania	http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&typenames=ps:ProtectedSite&count=1000&startindex=966	- timeStamp attribute in <wfs:FeatureCollection>	
	http://gmlid.eu/RO/ENV/PADS/PS/ROSCI0135	- timeStamp attribute in <wfs:FeatureCollection>	
Sweden	https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&srsName=urn:ogc:def:crs:EPSG::3035&request=GetFeature&TypeNames=ps-f:ProtectedSite	- timeStamp attribute in <wfs:FeatureCollection>	
	http://gpt.vic-metria.nu/data/land/SPA_Rikstackande.zip	-	Could not perform diff: response is multi-file ZIP archive. However, the checksum on the archive itself did not change.

Country	URL	Changes	Notes
	http://gpt.vic-metria.nu/data/land/SCI_Rikstackande.zip	-	Could not perform diff: response is multi-file ZIP archive. However, the checksum on the archive itself did not change.

Annex 3 INSPIRE spatial data suitability

On 31 datasets in GML format, from 12 countries, we run 5 custom Natura2000 tests and 27 INSPIRE tests using the ETF Validator:

Natura 2000 schema checks
Verify for each XML document that:

- xml schema is correct. The error response is *XML parse*

- there are ps:ProtectedSite entries (error response: *no_protected_sites*)

- all ps:ProtectedSite entries have a local ID (ps:inspireID/base:Identifier/base:localId)

- the local IDs are unique (error response: *duplicate_local_ids*)

- the protected sites have a designation scheme in ps:siteDesignation / ps:DesignationType / ps:designationScheme. (error response: *non_n2k_designation_scheme*)

- the designation scheme is http://inspire.ec.europa.eu/codelist/DesignationSchemeValue/natura2000 (error response: *non_n2k_designation_scheme*)

- the designation is in the accepted list (error response: *non_n2k_designation*):

    - http://inspire.ec.europa.eu/codelist/Natura2000DesignationValue/proposedSiteOfCommunityImportance

    - http://inspire.ec.europa.eu/codelist/Natura2000DesignationValue/proposedSpecialProtectionArea

    - http://inspire.ec.europa.eu/codelist/Natura2000DesignationValue/siteOfCommunityImportance

    - http://inspire.ec.europa.eu/codelist/Natura2000DesignationValue/specialAreaOfConservation

    - http://inspire.ec.europa.eu/codelist/Natura2000DesignationValue/specialProtectionArea

- there is at least one SCI or SPA designation (error: *spa_not_found* / *sci_not_found*)

SPAs found
Count the number of Special Protected Areas in each document.

SACs found
Count the number of Special Areas of Conservation in each document.

SCIs found
Count the number of Sites of Community Importance in each document.

pSCIs found

Count the number of Proposed Sites of Community Importance in each document.

gml.a.1: Errors loading the XML documents

Report errors that occurred during loading the documents in the test object.

gml.a.2: Document root element

Check for each XML document that the root element is a GML feature or a GML feature collection. For feature collections the following root elements are recognised:

- wfs:FeatureCollection (WFS 2.0)

- gml:FeatureCollection (GML 3.2)

- base:SpatialDataSet (INSPIRE Base 3.2 or 3.3)

gml.a.3: Character encoding

Inspect each XML document. If an XML declaration exists, verify that the encoding attribute has the value "UTF-8" or that the attribute is missing.

gmlas.a.1: Mapping of source data to INSPIRE

Verify whether each relevant element of the source data set under inspection has been properly mapped to the INSPIRE application schemas.

gmlas.a.2: Modelling of additional spatial object types

Inspect the XML Schema namespace of each feature element. If a namespace URI does not start with "http://inspire.ec.europa.eu/schemas/" or "urn:x-inspire:specification:gmlas:" it is not one of the approved INSPIRE application schema namespaces.

gmlas.b.1: xsi:schemaLocation attribute

Verify for each XML document that the xsi:schemaLocation attribute is provided in the root element.

gmlas.b.2: validate XML documents

Validate each document against the schema(s) specified in the xsi:schemaLocation attribute using strict XML schema validation.

gmlas.c.1: Consistency with the GML model

Inspect each property element and verify that it either carries a URI reference to an object (@xlink:href), contains one or more object elements as child elements or contains a non-empty text node (whitespace is trimmed before checking for empty text). Strictly, empty string values are valid according to the GML model, but they are not an appropriate value for any of the string-valued attributes in INSPIRE.

gmlas.c.2: nilReason attributes require xsi:nil=true

Inspect each XML element that represents a feature property and that has a nilReason XML attribute. Verify that xsi:nil='true' is present in the property element, i.e. a reason is only

provided in properties that are void / nil.

gmlas.c.3: nilReason values

Inspect all nilReason values and verify that either the values from the INSPIRE registry or the pre-defined values from the GML standard are used. Otherwise report incorrectReason. Valid values are:

- http://inspire.ec.europa.eu/codelist/VoidReasonValue/Unknown

- http://inspire.ec.europa.eu/codelist/VoidReasonValue/Unpopulated

- http://inspire.ec.europa.eu/codelist/VoidReasonValue/Withheld

- unknown

- other:unpopulated

- withheld

gmlas.d.1: No spatial topology objects

Verify that no spatial topology types are used, i.e. check that none of the GML object elements for spatial topology are used as child elements of a feature from the application schema.

gmlas.d.2: No non-linear interpolation

Verify that only linear interpolation is used, i.e. check that none of the nonlinear GML curve segment object elements are used as child elements of a feature from the application schema.

gmlas.d.3: Surface geometry elements

Verify that only gml:Polygon or gml:Surface are used, i.e. check that none of the disallowed GML surface object elements are used as child elements of a feature from the application schema.

gmlas.d.4: No non-planar interpolation

Verify that only planar interpolation is used, i.e. check that only PolygonPatch is used as a GML surface patch object elements in features from the application schema.

gmlas.d.5: Geometry elements

Verify that only valid GML geometry elements are used, i.e. check that none of the disallowed GML geometry object elements are used as child elements of a feature from the application schema.

gmlas.d.6: Point coordinates in gml:pos

Verify that in points only gml:pos is used for coordinates.

gmlas.d.7: Curve/Surface coordinates in gml:posList

Verify that in curves and surfaces only gml:posList is used for coordinates.

gmlas.d.8: No array property elements

Verify that geometry aggregates do not use the GML array property elements, i.e. check that the only the regular property elements are used, but not the array property elements. For example, for a gml:MultiPoint, only gml:pointMember may be used, not gml:pointMembers.

gmlas.d.9: 1, 2 or 3 coordinate dimensions

Coordinate reference systems may have 1, 2 or 3 dimensions, i.e. check all occurances of srsDimension and for values greater than '3'.

gmlas.d.10: Validate geometries (1)

Verify that in curves and surfaces only gml:posList is used for coordinates, i.e. validate all geometry elements of a feature from the application schema using a geometry library.

gmlas.d.11: Validate geometries (2)

Report any errors found while parsing GML geometries.

gmlas.e.1: GrammaticalNumber attributes

When an attribute has a code list as its type, verify that the values comply with the definitions and include the values set out in Annex II of the regulation. For this attribute, the allowed values are specified in code list http://inspire.ec.europa.eu/codelist/GrammaticalNumberValue.

gmlas.e.2: GrammaticalGender attributes

When an attribute has a code list as its type, verify that the values comply with the definitions and include the values set out in Annex II of the regulation. For this attribute, the allowed values are specified in code list http://inspire.ec.europa.eu/codelist/GrammaticalGenderValue.

gmlas.e.3: NameStatus attributes

When an attribute has a code list as its type, verify that the values comply with the definitions and include the values set out in Annex II of the regulation. For this attribute, the allowed values are specified in code list http://inspire.ec.europa.eu/codelist/NameStatusValue.

gmlas.e.4: Nativeness attributes

When an attribute has a code list as its type, verify that the values comply with the definitions and include the values set out in Annex II of the regulation. For this attribute, the allowed values are specified in code list http://inspire.ec.europa.eu/codelist/NativenessValue.

gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void

OCL: "inv: self.pronunciationIPA -> notEmpty() or self.pronunciationSoundLink -> notEmpty()"

Verify that for all features either or both pronunciationSoundLink or pronunciationIPA is not void.

ps-gml.a.1: Protected site feature in dataset

Check that the set of features in the spatial data set is not empty.

Table 6 Spatial data test results

Table 6 Spatial data test results

Country	Austria	
Filename	http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_Vogelschutzrichtlinie_ETRS89UTM32N.zip	http://gis.tirol.gv.at/inspire/downloadservice/Natura2000_FFH_Richtlinie_ETRS89UTM32N.zip
schema checks	spa_not_found	sci_not_found
SPAs found	0	7
SACs found	12	0
SCIs found	3	0
pSCIs found	0	0
gml.a.1: Errors loading the XML documents	PASSED	PASSED
gml.a.2: Document root element	PASSED	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED	PASSED
gmlas.b.2: validate XML documents	PASSED	PASSED
gmlas.c.1: Consistency with the GML model	PASSED	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED	PASSED
gmlas.c.3: nilReason values	PASSED	PASSED
gmlas.d.1: No spatial topology objects	PASSED	PASSED
gmlas.d.2: No non-linear interpolation	PASSED	PASSED
gmlas.d.3: Surface geometry elements	PASSED	PASSED
gmlas.d.4: No non-planar interpolation	PASSED	PASSED
gmlas.d.5: Geometry elements	PASSED	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED	PASSED
gmlas.d.8: No array property elements	PASSED	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED	PASSED
gmlas.e.3: NameStatus attributes	PASSED	PASSED
gmlas.e.4: Nativeness attributes	PASSED	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED	PASSED

ps-gml.a.1: Protected site feature in dataset				PASSED	PASSED	

Country	**Belgium**					
Filename	http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSitesNatura2000.gml.zip	http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_station.gml	http://geoportal.ibgebim.be/pdf/gml/Protectedsites.n2k_habitat.gml	http://geoservices.wallonie.be/geotraitement/spwdatadownload/inspire/PS.ProtectedSite.gml.zip	https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Birds.gml.zip	https://www.mercator.vlaanderen.be/zoekdienstenmercatorinspire/srv/api/records/e406ea0b-c4e5-4d02-a129-29dbb7c242b1/attachments/PS.ProtectedSitesNatureConservation-Natura2000_Habitat.gml.zip
schema checks	spa_not_found	spa_not_found	spa_not_found	non_n2k_designation_scheme	sci_not_found	sci_not_found
SPAs found	0	0	0	0	24	38
SACs found	239	48	1012	239	0	0
SCIs found	0	0	0	0	0	0
pSCIs found	0	0	0	0	0	0
gml.a.1: Errors loading the XML documents	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gml.a.2: Document root element	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL
gmlas.b.1: xsi:schema Location attribute	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.b.2: validate XML documents	PASSED	PASSED	PASSED	PASSED	FAILED	FAILED
gmlas.c.1: Consistency with the GML model	PASSED	PASSED	PASSED	FAILED	FAILED	FAILED

gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.c.3: nilReason values	PASSED	PASSED	PASSED	FAILED	PASSED	PASSED
gmlas.d.1: No spatial topology objects	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.2: No non-linear interpolation	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.3: Surface geometry elements	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.4: No non-planar interpolation	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.5: Geometry elements	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.8: No array property elements	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.e.2: Grammatic	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED

alGender attributes						
gmlas.e.3: NameStatus attributes	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.e.4: Nativeness attributes	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
ps-gml.a.1: Protected site feature in dataset	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED

Country	Czech		
Filename	http://gis.nature.cz/inspire/gml/CZ-AOPK-PS_Natura2000.gml	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&count=200&startIndex=0&Typenames=Natura2000:Evropsky_v%fdznamn%e1_lokalita_EVL_	http://gis.nature.cz/arcgis/services/UzemniOchrana/Natura2000/MapServer/WFSServer?service=wfs&version=2.0.0&request=GetFeature&Typenames=Natura2000:Forma_ochrany_EVL_-_stav_k_NV_207_2016__1._7._2016_
schema checks		Undefined namespace prefix	Undefined namespace prefix
SPAs found	41	0	0
SACs found	749	0	0
SCIs found	363	0	0
pSCIs found	0	0	0
gml.a.1: Errors loading the XML documents	PASSED	PASSED	PASSED
gml.a.2: Document root element	PASSED	PASSED	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED	PASSED	PASSED

gmlas.b.2: validate XML documents	PASSED	PASSED	PASSED
gmlas.c.1: Consistency with the GML model	PASSED	FAILED	FAILED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED	PASSED	PASSED
gmlas.c.3: nilReason values	PASSED	PASSED	PASSED
gmlas.d.1: No spatial topology objects	PASSED	PASSED	PASSED
gmlas.d.2: No non-linear interpolation	PASSED	PASSED	PASSED
gmlas.d.3: Surface geometry elements	PASSED	PASSED	PASSED
gmlas.d.4: No non-planar interpolation	PASSED	PASSED	PASSED
gmlas.d.5: Geometry elements	PASSED	PASSED	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED	PASSED	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED	PASSED	PASSED
gmlas.d.8: No array property elements	PASSED	PASSED	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED	PASSED	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED	PASSED	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED	PASSED	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED	PASSED	PASSED
gmlas.e.3: NameStatus attributes	PASSED	PASSED	PASSED
gmlas.e.4: Nativeness attributes	PASSED	PASSED	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSou	PASSED	PASSED	PASSED

ndLink and pronunciationIPA shall not be void			
ps-gml.a.1: Protected site feature in dataset	PASSED	FAILED	FAILED

Country	Denmark	
Filename	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258	http://services.kortforsyningen.dk/service?servicename=ps_inspire_gml321&version=2.0.0&SERVICE=WFS&REQUEST=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::3035
schema checks	non_n2k_designation_scheme	non_n2k_designation_scheme
SPAs found	122	122
SACs found	319	319
SCIs found	0	0
pSCIs found	0	0
gml.a.1: Errors loading the XML documents	PASSED	PASSED
gml.a.2: Document root element	PASSED	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED	PASSED
gmlas.b.2: validate XML documents	PASSED	PASSED
gmlas.c.1: Consistency with the GML model	PASSED	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED	PASSED
gmlas.c.3: nilReason values	PASSED	PASSED
gmlas.d.1: No spatial topology objects	PASSED	PASSED
gmlas.d.2: No non-linear interpolation	PASSED	PASSED
gmlas.d.3: Surface geometry elements	PASSED	PASSED
gmlas.d.4: No non-planar interpolation	PASSED	PASSED
gmlas.d.5: Geometry elements	PASSED	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED	PASSED

gmlas.d.8: No array property elements	PASSED	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED	PASSED
gmlas.e.3: NameStatus attributes	PASSED	PASSED
gmlas.e.4: Nativeness attributes	PASSED	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED	PASSED
ps-gml.a.1: Protected site feature in dataset	PASSED	PASSED

Country	**Finland**
Filename	http://wwwd3.ymparisto.fi/d3/gis_data/gml/PS_Natura2000_3035.gml
schema checks	sci_not_found
SPAs found	460
SACs found	1640
SCIs found	0
pSCIs found	4
gml.a.1: Errors loading the XML documents	PASSED
gml.a.2: Document root element	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED
gmlas.b.2: validate XML documents	PASSED
gmlas.c.1: Consistency with the GML model	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED
gmlas.c.3: nilReason values	PASSED
gmlas.d.1: No spatial topology objects	PASSED
gmlas.d.2: No non-linear interpolation	PASSED
gmlas.d.3: Surface geometry elements	PASSED
gmlas.d.4: No non-planar interpolation	PASSED
gmlas.d.5: Geometry elements	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED

gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED
gmlas.d.8: No array property elements	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED
gmlas.e.3: NameStatus attributes	PASSED
gmlas.e.4: Nativeness attributes	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED
ps-gml.a.1: Protected site feature in dataset	PASSED

Country	Luxemburg	
Filename	https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zpa-special-protection-areas-for-birds-birds-directive-2/20180223-091930/PS.ProtectedSitesNatureConservation-Birds.gml.zip	https://download.data.public.lu/resources/inspire-annex-i-theme-protected-sites-natura-2000-zac-special-areas-of-conservation-habitats-directive-1/20180223-091925/PS.ProtectedSitesNatureConservation-Habitats.gml.zip
schema checks	spa_not_found	spa_not_found
SPAs found	0	0
SACs found	0	0
SCIs found	48	18
pSCIs found	0	0
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED	PASSED
gmlas.b.2: validate XML documents	PASSED	PASSED
gmlas.c.1: Consistency with the GML model	PASSED	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED	PASSED
gmlas.c.3: nilReason values	PASSED	PASSED
gmlas.d.1: No spatial topology objects	PASSED	PASSED
gmlas.d.2: No non-linear interpolation	PASSED	PASSED
gmlas.d.3: Surface geometry elements	PASSED	PASSED

gmlas.d.4: No non-planar interpolation	PASSED	PASSED
gmlas.d.5: Geometry elements	PASSED	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED	PASSED
gmlas.d.8: No array property elements	PASSED	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED	PASSED
gmlas.e.3: NameStatus attributes	PASSED	PASSED
gmlas.e.4: Nativeness attributes	PASSED	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED	PASSED
ps-gml.a.1: Protected site feature in dataset	PASSED	PASSED

Country		Latvia
Filename	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&request=getFeature&typeNames=protSite:psSiteS	http://proxygds.viss.gov.lv/arcgis/rest/services/Predefined/ProtectedSitesInspireFeatDownServiceSiteProtClassLayers/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&count=5000&request=getFeature&typeNames=protSite:psSiteS&srsName=urn:ogc:def:crs:EPSG::3035
schema checks	Undefined namespace prefix	Undefined namespace prefix
SPAs found	-	-
SACs found	-	-
SCIs found	-	-
pSCIs found	-	-

gml.a.1: Errors loading the XML documents	Timeout on test	Timeout on test
gml.a.2: Document root element		
gml.a.3: Character encoding		
gmlas.a.1: Mapping of source data to INSPIRE		
gmlas.a.2: Modelling of additional spatial object types		
gmlas.b.1: xsi:schemaLocation attribute		
gmlas.b.2: validate XML documents		
gmlas.c.1: Consistency with the GML model		
gmlas.c.2: nilReason attributes require xsi:nil=true		
gmlas.c.3: nilReason values		
gmlas.d.1: No spatial topology objects		
gmlas.d.2: No non-linear interpolation		
gmlas.d.3: Surface geometry elements		
gmlas.d.4: No non-planar interpolation		
gmlas.d.5: Geometry elements		
gmlas.d.6: Point coordinates in gml:pos		
gmlas.d.7: Curve/Surface coordinates in gml:posList		
gmlas.d.8: No array property elements		
gmlas.d.9: 1, 2 or 3 coordinate dimensions		

| gmlas.d.10: Validate geometries (1) |
| gmlas.d.11: Validate geometries (2) |
| gmlas.e.1: GrammaticalNumber attributes |
| gmlas.e.2: GrammaticalGender attributes |
| gmlas.e.3: NameStatus attributes |
| gmlas.e.4: Nativeness attributes |
| gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void |
| ps-gml.a.1: Protected site feature in dataset |

Country	MT							
Filename	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPASCI.gml	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SPA.gml	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?request=GetFeature&Language=eng&CRS=http://www.opengis.net/def/crs/EPSG/0/3045&DataSetIdNamespace=https://era.org.mt/&service=WFS&count=10&STOREDQUERY_ID=http://inspire.ec.europa.eu/operation/download/GetSpatialDataSet&version=2.0.0&DataSetIdCode=N2000_MT_SPAs	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPASCI?service=WFS&version=2.0.0&request=GetFeature&TypeNames=ps:ProtectedSite	https://msdi.data.gov.mt/deegree/services/ps_Natura2000SPA?service=WFS&version=2.0.0&request=getFeature&typeNames=ps:ProtectedSite	https://msdi.data.gov.mt/deegree/services/hb_HabitatNatura2000Biotope?service=WFS&version=2.0.0&request=GetFeature&Typenames=hb:Habitat	https://msdi.data.gov.mt/data/PS.ProtectedSitesNatura2000.SCI.gml
schema checks		sci_not_found	Undefined namespace prefix	Undefined namespace prefix	Undefined namespace prefix		Undefined namespace prefix	spa_not_found
SPAs found	7	13	-	-	-	0	-	-
SACs found	0	0	-	-	-	0	-	-
SCIs found	1	0	-	-	-	27	0	0

pSCIs found	0	0	-	-	-	0	-	-
gml.a.1: Errors loading the XML documents	PASSED	PASSED	Timeout on test	Timeout on test	Timeout on test	Error on upload	Timeout on test	PASSED
gml.a.2: Document root element	PASSED	PASSED						PASSED
gml.a.3: Character encoding	NOT_APPLICABLE	NOT_APPLICABLE						NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL						PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL						PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED	PASSED						PASSED
gmlas.b.2: validate XML documents	FAILED	FAILED						FAILED
gmlas.c.1: Consistency with the GML model	PASSED	PASSED						PASSED
gmlas.c.2: nilReas	PASSED	PASSED						PASSED

on attributes require xsi:nil= true				
gmlas.c .3: nilReas on values	PASS ED	PAS SED		PAS SED
gmlas. d.1: No spatial topolo gy objects	PASS ED	PAS SED		PAS SED
gmlas. d.2: No non-linear interpo lation	PASS ED	PAS SED		PAS SED
gmlas. d.3: Surface geome try elemen ts	PASS ED	PAS SED		PAS SED
gmlas. d.4: No non-planar interpo lation	PASS ED	PAS SED		PAS SED
gmlas. d.5: Geome try elemen ts	PASS ED	PAS SED		PAS SED
gmlas. d.6: Point coordi nates in gml:po s	PASS ED	PAS SED		PAS SED
gmlas. d.7: Curve/ Surface coordi nates in gml:po sList	PASS ED	PAS SED		PAS SED
gmlas. d.8: No array proper	PASS ED	PAS SED		PAS SED

ty elemen ts			
gmlas. d.9: 1, 2 or 3 coordi nate dimens ions	PASS ED	PAS SED	PAS SED
gmlas. d.10: Validat e geome tries (1)	NOT _AP PLIC ABLE	NOT _AP PLIC ABL E	NOT _AP PLIC ABL E
gmlas. d.11: Validat e geome tries (2)	PASS ED	PAS SED	PAS SED
gmlas. e.1: Gramm aticalN umber attribu tes	PASS ED	PAS SED	PAS SED
gmlas. e.2: Gramm aticalG ender attribu tes	PASS ED	PAS SED	PAS SED
gmlas. e.3: NameS tatus attribu tes	PASS ED	PAS SED	PAS SED
gmlas. e.4: Native ness attribu tes	PASS ED	PAS SED	PAS SED
gmlas.f .1: At least one of the two attribu tes pronun ciation SoundL ink and pronun	PASS ED	PAS SED	PAS SED

ciationl PA shall not be void				
ps-gml.a.1 : Protect ed site feature in dataset	PASS ED	PAS SED		PAS SED

Country	Nederland
Filename	https://geodata.nationaalgeoregister.nl/natura2000/wfs?request=getfeature&typenames=natura2000:natura2000&srsName=urn:ogc:def:crs:EPSG::3035
schema checks	Undefined namespace prefix
SPAs found	-
SACs found	-
SCIs found	-
pSCIs found	-
gml.a.1: Errors loading the XML documents	PASSED
gml.a.2: Document root element	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED
gmlas.b.2: validate XML documents	PASSED
gmlas.c.1: Consistency with the GML model	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED
gmlas.c.3: nilReason values	PASSED
gmlas.d.1: No spatial topology objects	PASSED
gmlas.d.2: No non-linear interpolation	PASSED
gmlas.d.3: Surface geometry elements	PASSED
gmlas.d.4: No non-planar interpolation	PASSED
gmlas.d.5: Geometry elements	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED
gmlas.d.8: No array property elements	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED

gmlas.e.3: NameStatus attributes	PASSED
gmlas.e.4: Nativeness attributes	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED
ps-gml.a.1: Protected site feature in dataset	FAILED

Country	Portugal
Filename	http://wssig3.azores.gov.pt/geoserver/ps/wfs?service=wfs&version=2.0.0&request=GetFeature&typeNames=ps:ProtectedSite&srsName=urn:ogc:def:crs:EPSG::4258
schema checks	non_n2k_designation_scheme
SPAs found	-
SACs found	-
SCIs found	-
pSCIs found	-
gml.a.1: Errors loading the XML documents	PASSED
gml.a.2: Document root element	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED
gmlas.b.2: validate XML documents	FAILED
gmlas.c.1: Consistency with the GML model	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED
gmlas.c.3: nilReason values	PASSED
gmlas.d.1: No spatial topology objects	PASSED
gmlas.d.2: No non-linear interpolation	PASSED
gmlas.d.3: Surface geometry elements	PASSED
gmlas.d.4: No non-planar interpolation	PASSED
gmlas.d.5: Geometry elements	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED
gmlas.d.8: No array property elements	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED
gmlas.e.3: NameStatus attributes	PASSED
gmlas.e.4: Nativeness attributes	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED

ps-gml.a.1: Protected site feature in dataset	PASSED	

Country	Romania	
Filename	http://gmlid.eu/RO/ENV/PADS/WFS/wfs?request=GetFeature&service=WFS&version=2.0.0&typenames=ps:ProtectedSite&count=1000&startindex=966	http://gmlid.eu/RO/ENV/PADS/PS/ROSCI0135
schema checks	non_n2k_designation_scheme	spa_not_found
SPAs found	171	0
SACs found	0	0
SCIs found	435	1
pSCIs found	0	0
gml.a.1: Errors loading the XML documents	PASSED	PASSED
gml.a.2: Document root element	PASSED	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED	PASSED
gmlas.b.2: validate XML documents	PASSED	PASSED
gmlas.c.1: Consistency with the GML model	PASSED	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED	PASSED
gmlas.c.3: nilReason values	PASSED	PASSED
gmlas.d.1: No spatial topology objects	PASSED	PASSED
gmlas.d.2: No non-linear interpolation	PASSED	PASSED
gmlas.d.3: Surface geometry elements	PASSED	PASSED
gmlas.d.4: No non-planar interpolation	PASSED	PASSED
gmlas.d.5: Geometry elements	PASSED	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED	PASSED
gmlas.d.8: No array property elements	PASSED	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED	PASSED
gmlas.e.1: GrammaticalNumber attributes	PASSED	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED	PASSED
gmlas.e.3: NameStatus attributes	PASSED	PASSED
gmlas.e.4: Nativeness attributes	PASSED	PASSED

gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED	PASSED
ps-gml.a.1: Protected site feature in dataset	PASSED	PASSED

Country	**Sweden**
Filename	https://gis-services.metria.se/arcgis/rest/services/nv/InspireNV_WFS_N2K/MapServer/exts/InspireFeatureDownload/service?service=wfs&version=2.0.0&srsName=urn:ogc:def:crs:EPSG::3035&request=GetFeature&TypeNames=ps-f:ProtectedSite
schema checks	no_protected_sites
SPAs found	0
SACs found	0
SCIs found	0
pSCIs found	0
gml.a.1: Errors loading the XML documents	PASSED
gml.a.2: Document root element	PASSED
gml.a.3: Character encoding	NOT_APPLICABLE
gmlas.a.1: Mapping of source data to INSPIRE	PASSED_MANUAL
gmlas.a.2: Modelling of additional spatial object types	PASSED_MANUAL
gmlas.b.1: xsi:schemaLocation attribute	PASSED
gmlas.b.2: validate XML documents	PASSED
gmlas.c.1: Consistency with the GML model	PASSED
gmlas.c.2: nilReason attributes require xsi:nil=true	PASSED
gmlas.c.3: nilReason values	PASSED
gmlas.d.1: No spatial topology objects	PASSED
gmlas.d.2: No non-linear interpolation	PASSED
gmlas.d.3: Surface geometry elements	PASSED
gmlas.d.4: No non-planar interpolation	PASSED
gmlas.d.5: Geometry elements	PASSED
gmlas.d.6: Point coordinates in gml:pos	PASSED
gmlas.d.7: Curve/Surface coordinates in gml:posList	PASSED
gmlas.d.8: No array property elements	PASSED
gmlas.d.9: 1, 2 or 3 coordinate dimensions	PASSED
gmlas.d.10: Validate geometries (1)	NOT_APPLICABLE
gmlas.d.11: Validate geometries (2)	PASSED

gmlas.e.1: GrammaticalNumber attributes	PASSED
gmlas.e.2: GrammaticalGender attributes	PASSED
gmlas.e.3: NameStatus attributes	PASSED
gmlas.e.4: Nativeness attributes	PASSED
gmlas.f.1: At least one of the two attributes pronunciationSoundLink and pronunciationIPA shall not be void	PASSED
ps-gml.a.1: Protected site feature in dataset	PASSED