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Technical Guidelines on IACS Spatial Data Sharing
Part 2 – LPIS and GSA interoperability

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Joint Research Centre

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Contents

Abstract

The Land Parcel Identification System (LPIS) and Geospatial Application (GSA) harmonised data models described in this report represent a concrete proposal to solve the lack of harmonisation of LPIS and the GSA datasets across Europe. Currently, this is the main obstacle to interoperability of the spatial datasets of the Integrated Administration and Control Systems (IACS), which is the main information system on the national or regional implementations of the Common Agricultural Policy (CAP).

In addition to the common data models for LPIS and GSA this report provides a full data specification according to INSPIRE. Despite preserving the IACS semantics, the proposed solution facilitates the creation of INSPIRE conformant datasets from the LPIS and GSA implementations of the Member States.

Within the IACS context, this report "Technical Guidelines on IACS Spatial Data Sharing – Part 2 – Data interoperability" follows the report "Technical Guidelines on IACS Spatial Data Sharing – Part 1 – Data discovery", published in 2020.

Acknowledgements

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The first version of this ethnical guideline was discussed at the IACS –INSPIRE data sharing workshop, held at the end of February 2023. The input of Wideke BOERSMA, Bernadett CSONKA, Ciara DELANEY, Daniela DI MEDICI, Rositsa IVANOVA-STOYANOVA, Jurate KUCIENE, Pierluigi LONDERO, Anne MARECHAL, Jorge MATA, Pavel MILENOV Simone SCARPA and Lars STORGAARD at this workshop is much appreciated.

The work of the INSPIRE data specification drafting team as well as the experts of JRC T.1 Digital Economy unit are also acknowledged, who prepared and maintained the data specification template that is used in this document.

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We also thank all contributors who commented the initial discussion paper on interoperability in 2020 and participated in the review of the current documents.

Last, but not least, we also value the contributions of Jordi Escriu, who performed the JRC internal review of this report.

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Executive summary

Policy context

Data sharing is a process consisting of two main stages: enabling data discovery, by means of metadata published in data catalogues, and enabling data interoperability by means of common data models, semantics and publication protocols for data harmonisation. This report "Technical Guidelines on IACS Spatial Data Sharing – Part 2 – Data interoperability" follows the report "Technical Guidelines on IACS Spatial Data Sharing – Part 1 – Data discovery[1]", published in 2020, providing a full technical guidance in the subject.

IACS is composed of databases (subsystems) managing several datasets, among them the Identification System of Agricultural Parcels (a.k.a LPIS - Land Parcel Identification System) and the GSA (Geo Spatial Application, i.e. area based declaration from the beneficiaries of CAP). This report provides interoperability target specification for the LPIS and GSA datasets, strictly adhering to the principles of the INSPIRE Directive[2] (European Parliament and the Council of the European Union 2007), which, widely adopted in all Member States, provided a fertile ground for spatial data interoperability.

Monitoring and evaluation of the new performance based CAP explicitly requires higher level of data interoperability both on the level of the Member States (MS) to integrate various thematic datasets, and among the implementations between the MS. Moreover, reusing spatial data of IACS is very important in the context of the European Green Deal. A number of policies, such as LULUCF (Land Use, Land Use Change and Forestry)[3], Biodiversity strategy[4], Nature Restoration Law[5], Zero pollution[6], etc. are likely to benefit from increased interoperability.

Key conclusions and main findings

This report contains a proposal to solve the lack of harmonisation of the LPIS and GSA datasets across Europe, which is currently a big obstacle to IACS data sharing and interoperability.

A full documentation of the LPIS and GSA datasets have been defined according to the structure of INSPIRE data specifications, together with default gml encoding for the application schemas.

The proposed solution is not an extension of the current INSPIRE data models documented in Unified Modelling Language (UML). It is a simplified version of the IACS domain model (Tóth and Kučas 2016), which by preserving the IACS semantics facilitates the creation of INSPIRE conformant datasets from the national or regional implementations of the LPIS and the GSA datasets.

Interoperability of the spatial datasets is related to the standardisation of the land cover and land use (LCLU) concepts. Apart of INSPIRE, work of ISO TC211 and the Copernicus EIONET Action Group on Land Monitoring in Europe (EAGLE)[7] are also relevant. EAGLE is supporting the European Environment Agency (EEA) to develop a new paradigm of LCLU information managing. The developments of EAGLE may contribute to the future revisions of this TG. ISO 19144-2[8] and -3[9] standards to deal with LCLU. The current updates of these standards have taken into account the specific requirements of the Common Agricultural policy (CAP).

Related and future JRC work

The Technical Guidelines (TG) contained in this report will be shared with DG AGRI and the MS that can comment it and test by means of voluntary pilots. The collected feedback will lead to a revision of the TG and the publication of the final version. In parallel, the endorsement procedure will be discussed and agreed with JRC, DG AGRI and the INSPIRE MIG (Maintenance and Implementation Group).

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1 https://publications.jrc.ec.europa.eu/repository/handle/JRC121450

2 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 (https://eur-lex.europa.eu/eli/dir/2007/2/2019-06-26)

3 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG

4 https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en

5 https://environment.ec.europa.eu/publications/nature-restoration-law_en

6 https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A400%3AFIN

7 https://land.copernicus.eu/eagle

8 https://www.iso.org/standard/44342.html

9 https://committee.iso.org/sites/tc211/home/projects/projects---complete-list/iso-19144-3.html

This TG on interoperability has an impact on Part 1 – Data discovery. Even though this impact is not substantial, the necessary changes will be made as soon as the final version of this TG is approved after the stakeholders' review.

Quick guide

After an introductory section (sections 1 and 2), section 3 provides the LPIS and GSA data models, while sections 4-9 document other data specification elements according to the INSPIRE template. Conclusions are provided in section 10.

A preliminary test of this TG has been successfully executed, producing a harmonised LPIS dataset, as described in Annex 1.

A conceptual mapping from the LPIS data model to two INSPIRE data themes (LU/LC) and from the GSA data model to the INSPIRE theme LU have been developed and provided in Annexes 4, 5 and 6.

1 Introduction

The sound and transparent management of the CAP is ensured through an integrated system, a.k.a IACS[10], the Integrated Administration and Control System, which is set up and run by the Member States (MS). This system is composed by different databases (datasets), among them the LPIS (Land Parcel Identification System) and the GSA (Geo Spatial Application, formerly called as GSAA - Geo Spatial Aid Application, i.e. information from the beneficiaries of CAP). The evolution of the CAP, notably the necessity to assess the environmental and climate performance, requires more collaboration with different communities (e.g. statistics, forestry, agriculture, climate, environment.). Data sharing, including interoperability between the systems and access to the data are the key enablers of this process. With views of building a European data economy as part of the Digital Single Market strategy, the European Commission solicits to share the spatial information residing in the IACS.

The Internal Audit Service of the Commission concluded that the geospatial information included in the IACS of the MS has to be shared according to INSPIRE. The knowledge and the physical infrastructure resulting from the implementation of the INSPIRE Directive give an opportunity for the IACS community, including the Paying Agencies (PA) and the farmers, to get involved in the Common European Data Space - a seamless digital area, which enables the development of new products and services based on data.

The FAIR data principles[11], also supported by the EU, mark an important refinement of the concepts needed to give data greater value and enhance their propensity for reuse, by humans and by machines. For this to be the case, data should be Findable, Accessible, Interoperable and Reusable to the greatest extent possible. (European Commission DG RTD 2018). The activities connected to the IACS spatial data sharing perfectly complies with the FAIR principles.

In 2020 the JRC Technical Report "Technical Guidelines on IACS Spatial Data Sharing. Part 1 – Data discovery" (Tóth and Milenov 2020) moved the first important steps toward findability and accessibility, setting the rules for data discovery. These rules build on the opportunity to re-use the INSPIRE principles to create metadata for LPIS and GSA datasets and publish them in national/regional geospatial data catalogues which are harvested by the INSPIRE Geoportal. Key requirements to be fulfilled by data providers when creating their metadata consist in the use of mandatory keywords, which facilitate LPIS and GSA data discovery from a semantic point of view, apart from adopting the INSPIRE Metadata Technical Guidelines.

Regarding metadata publication, it is important to highlight the big organisational effort spent by data providers, who had to opt for the set-up of their own discovery service or for the hosting of their metadata within national/regional geospatial data catalogues which are, directly or indirectly, harvested by the INSPIRE Geoportal[12]. For both options they had to establish contacts with national INSPIRE contact points, who ultimately enabled the discoverability of LPIS and GSA datasets in the INSPIRE Geoportal, by means of standardised and harmonised datasets of metadata, conformant to INSPIRE metadata TG requirements. The main outcome of this first step is the possibility to use the search tool of the INSPIRE Geoportal to discover LPIS and GSA datasets, using one of the keywords referred to above.

The lack of harmonisation of LPIS and GSA datasets across Europe is still a big obstacle to IACS data sharing and interoperability. Removing this obstacle would be beneficial for several actors engaged in the different phases of the CAP life-cycle, including DG AGRI and other EU institutions, national/regional Paying Agencies, farmers associations, supporting industry and single farmers.

Harmonised and interoperable LPIS and GSA datasets would facilitate the application of standardised procedures (e.g. to generate statistics, perform data analytics and modelling future scenarios for supporting decision makers), generating, in turn, remarkable efficiency and effectiveness gains for every actor along the agricultural value chain.

Despite this achievement represents an important milestone in the IACS data sharing roadmap, the second strategic step consists in the provision of a common data model for IACS data, enabling the use of common semantics and harmonised spatial representations across the EU. This work, however, can capitalise on the collaboration established in phase of agreeing on the rules of data discovery.

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10 The term integrated administration and control system is referred to as "integrated system" in Regulation (EU) 2021/2116. \For a simple an unambiguous referencing, as well as for continuity of terminology we retain the IACS abbreviation.

11 https://en.wikipedia.org/wiki/FAIR_data

12 https://inspire-geoportal.ec.europa.eu/

Actually, in terms of data harmonisation, and re-using the INSPIRE roadmap jargon, the IACS data currently discoverable are "as-is" datasets, i.e. they do not share a common data model and are not yet fully semantically interoperable.

Indeed the current requirements contained in the "Technical Guidelines on IACS Spatial Data Sharing. Part 1 – Data discovery", namely TG Requirement 9 and TG Requirement 10, demand that "LPIS and GSAA data published under INSPIRE shall be assigned to the Land Cover (LC) and Land Use (LU) INSPIRE data themes respectively, but without specific instructions about how to harmonise them.

Within this context, this report provides a common data model for LPIS datasets and a common data model for GSA datasets and contains a full data specification on LPIS and full data specification on GSA, provided as data specifications on an INSPIRE theme, adhering to the INSPIRE "Methodology for the development of data specifications"[13] (INSPIRE Data Specifications Drafting Team 2008).

The starting point of this work is represented by two major inputs. On one hand, the JRC has developed the IACS domain model documented in Unified Modelling Language (UML) and taking into consideration the INSPIRE data specifications and its conceptual basis (Generic Conceptual Model (INSPIRE Data Specification Drafting Team 2014) and the use of ISO TC 211 standards). This model has been significantly simplified, leaving out all information that is related to the internal management of IACS, such as links to payment schemes, beneficiaries, controls, etc. On the other hand, already in frame of IACS-INSPIRE data sharing initiative, the stakeholders, comprising the Paying Agencies and other bodies of national public administration (e.g. ministries, cadastral agencies), as well as the national INSPIRE contact points, participated in exchange of views triggered by a discussion paper and followed by a survey. This latter provided an important input on the degree of data harmonisation accepted by the stakeholders, as well on preferred solutions (e.g. choice of code lists, choice of INSPIRE data themes).

The original idea presented in the discussion paper was to split the LPIS dataset based on its feature types and harmonise every feature type according to the concepts of that INSPIRE data theme, wich was found to be the most similar in the content. The three related INSPIRE data themes were:

- Land Cover (LC) (INSPIRE Thematic Working Group on Land Cover 2013),
- Land Use (LU) (INSPIRE Thematic Working Group on Land Use 2013) and
- Area management / restriction / regulation zones & reporting units (AM)[14].

This could have been implemented by extending these INSPIRE themes. However, this approach has been disregarded, because it would force the stakeholders to use the INSPIRE semantics of the three candidate themes, which means giving up the opportunity to preserve the naming conventions of IACS. Since the LPIS and the GSA are among the best harmonised datasets at the EU level (they respond to the same functional requirements stipulated by EU law,) this step would not add value, rather would introduce ambiguity. Therefore, the above mentioned LPIS and GSA UML models, together with the corresponding physical models are proposed in the form of a new application schemas, which help to achieve LPIS and GSA data interoperability across Europe, based on the principles of INSPIRE, expressed in the INSPIRE Generic Conceptual Model (GCM) (INSPIRE Data Specification Drafting Team 2014) and Methodology for Developing Data Specifications (INSPIRE Data Specifications Drafting Team 2008).

Indeed, in a wider perspective, the adoption of the common LPIS and GSA data model facilitates the creation of conformant LU/LC INSPIRE datasets, using the transformations described in Annex 4-6 to this report. This two-step approach supports whatever political decision is taken in the context of INSPIRE (mandatory harmonisation towards existing INSPIRE themes vs. presenting LPIS and GSA data harmonised according to the new data models described in this report). It should be noted that in the context of the High Value Datasets[15] or the upcoming Agricultural data spaces, the original IACS semantics is used.

The harmonised LPIS and GSA datasets with INSPIRE is expected to facilitate the reuse of environmental information included in INSPIRE, which could be beneficial for the Competent Authorities and for the Paying Agencies too.

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13 https://inspire.ec.europa.eu/documents/methodology-development-data-specifications-baseline-version-d-26-version-30
14 https://inspire.ec.europa.eu/Themes/139/2892
15 https://eur-lex.europa.eu/eli/reg_impl/2023/138/oj

Regarding the LPIS data model described in this report, it is a simplified version of the "Land Parcel Identification System" and "Applications and Payment Claims" data models contained in the overall IACS domain model (Tóth and Kučas 2016). This simplified version has been obtained keeping four spatial objects of LPIS represented by the following feature types: AgriculturalArea, ReferenceParcel, LandscapeFeature, and EcologicalFocusArea, and removing all the objects containing information of administrative nature. In order to comply with Title III of Regulation (EU) 2021/2115, the model was completed by NonAgriculturalEligibleArea feature type.

Regarding the GSA data model described in this report, it is a simplified version of the "Aid applications and payment claims" data model contained in the overall IACS data model. This simplified version has been obtained keeping the only spatial object represented by the AgriculturalParcel feature type and removing all the other objects containing information of administrative nature.

It should be noted that the work on IACS-INSPIRE interoperability started in the period when IACS was governed by Regulations 1305/2013, 1306/2013 and 1307/2013, to be continued under the new CAP Regulations; notably when 2021/2115 and 2021/2116 entered in force. In terms of spatial information the only changes are related to the phasing out the concept of the ecological focus area and introducing the non-agricultural eligible area. In addition, in the context of Performance Monitoring and Evaluation Framework (PMEF), the environmental and climate aspects gain more importance. This may require extending the spatial information content of IACS, keeping in mind the principle of no double counting. Inserting or extending landscape features (LF) in existing spatial datasets is one of the direction that MS might take in the future. Therefore, LF have been included in this TG as an anticipatory measure. A quick overview of the changes is given in **Table 1**.

Table 1. Comparison of terminology applied to the feature types of the "old" and "new" CAP

Old Terms		**Active Terms (Terms to be used)**			
		Historical Data purpose		**Current**	
EFA	Ecological Focus Area	EFA	Ecological Focus Area		
GSAA	Geospatial aid application			GSA	Geospatial application
IACS	Integrated Administration and Control System			IACS	Integrated Administration and Control System
LPIS	Land Parcel Identification System			LPIS	Land Parcel Identification System
RP	Reference Parcel			RP	Reference Parcel
				NAEA	Non-agricultural eligible area
				LF	Landscape feature

It should be also noted that the name of Geospatial Aid Application (GSAA) has changed to Geospatial Application (GSA) as stipulated by Article 65(4)(a) and Article 66(1)(b) of Regulation 2021/2116, Article 2(3) of Delegated act 2022/1172 and Articles 3(1), 8 and 13 of Implementing act 2022/1173. Since GSAA is a relatively newer term (introduced in 2013), which, unlike to LPIS, is less known in the user communities, it is reasonable to change the terminology now, before it gets a wider spread.

Regarding the roadmap to endorse the LPIS and GSA data specifications, the Technical Guidelines (TG) contained in this report will be shared with DG AGRI and the Paying Agencies (PA) and tested by means of voluntary pilots. The feedback collected will lead to a revision of the TG and the publication of the final version. In parallel, the endorsement procedure will be discussed and agreed with JRC, DG AGRI and the INSPIRE MIG (Maintenance and Implementation Group). This step will include the transformation of this IACS data Technical Guidelines to markdown format, in order to facilitate its dissemination and future update in a GitHub environment[16].

A preliminary test of this TG, described in Annex 1, has been executed, producing an harmonised LPIS dataset from two "as-is" LPIS datasets.

[16] https://github.com/INSPIRE-MIF/technical-guidelines/tree/main/data

As a final introductory remark, the structure of this report adheres to the structure of an INSPIRE data specification on a data theme, adopting for requirements and recommendations the styles shown below:

TG Requirement X. Notation and role

This style is used for requirements that shall be fulfilled by data providers to share spatial information according to these Technical Guidelines.

TG Recommendation Y. Notation and role

This style is used for recommendations that may help data providers to share spatial information according to these Technical Guidelines.

2 Overview

2.1 Name

Data specification for LPIS and GSA datasets.

2.2 Informal description

Definition:

Land Parcel Identification System, a subsystem of Integrated Administration and Control System (IACS) as defined by Art. 68 of Regulation 1306/2013 (European Parliament and the Council of the European Union 2013) or Art. 68 of Regulation 2021/2116 (European Parliament and the Council 2021) referred to as "Identification system for agricultural parcels".

Geo-Spatial Application, as part of the Aid applications subsystem of IACS, defined by Art. 68 of Regulation 1306/2013 or Art. 65 of Regulation 2021/2116 referred to as "geo-spatial application".

Description:

Spatial dataset containing the delineations of reference parcels, agricultural and non-agricultural eligible area types and stable ecological focus areas, landscape features.

Delineation of agricultural parcels with cultivated crop or crop groups as submitted by the farmer in a given year.

Similarities with INSPIRE spatial data themes

There is a similarity in scope between certain LPIS and GSA feature types and the feature types of the following INSPIRE spatial data themes:

- Annex I: Cadastral Parcels (CP): similarity (in specific cases coincidence) between the reference parcel (ReferenceParcel) LPIS cadastral parcel (CadastralParcel - CP) INSPIRE feature types.
- Annex II: Land Cover (LC): similarity between the landscape feature (LandscapeFeature) LPIS and the land cover unit (LandCoverUnit - LC) INSPIRE feature types.
- Annex III: Land Use (LU): similarity between the agricultural area (AgriculturalArea) LPIS and existing land use object (ExistingLandUseObject - LU) INSPIRE feature types..
- Annex III: Land Use (LU): similarity between agricultural parcel (AgriculturalParcel) GSA feature type and existing land use object (ExistingLandUseObject - LU) INSPIRE feature types.

These similarities allow new INSPIRE-compliant LC/LU datasets to be derived from LPIS/GSA datasets and existing INSPIRE-compliant CP datasets to be reused to generate LPIS datasets.

The related data transformations are described in Annex 4-6.

2.3 Normative References

Regulation (EU) 1306/2013, Regulation (EU) 2021/2115 and Regulation (EU) 2021/2116.

2.4 Terms and definitions

General terms and definitions helpful for understanding the INSPIRE data specification documents are defined in the INSPIRE Glossary[17].

The following LPIS specific terms are defined:

- **Agricultural area**: any area taken up by arable land, permanent grassland, or agroforestry. Art. 4(1)(e) of R (EU) 1307/2013 or Art. 4(3) of R (EU) 2021/2115.

[17] https://inspire.ec.europa.eu/glossary

— **NonAgriculturalEligibleArea**: Land containing non-agricultural areas considered eligible by the Member States for receiving payment under Title III, Chapter 4 of R (EU) 2021/2115.

— **Ecological Focus Area**: Ecological focus areas as referred to in Article 46 of R (EU) 1307/2013 and its Delegated Regulation (EU) 639/2014 (European Commission 2014) (areas contributing to practices beneficial for the climate and the environment as referred to in Art. 43(2)(c) of R (EU) 1307/2013).

— **Landscape feature**: Elements of the agricultural area that are traditionally part of good agriculture cropping or utilization practices [R (EU) 640/2014 Art. 9(1)] and defined in accordance with Article 13 of Regulation (EU) 2021/2115.

— **Reference parcel**: a geographically delimited area retaining a unique identification as registered in the LPIS. a.k.a. identification system for agricultural parcels referred to in Art. 70 of R (EU) 1306/2013 or Art. 2(2) of R 2022/1172.

Definition of additional terms are provided in section 3.3.2 (LPIS Feature catalogue).

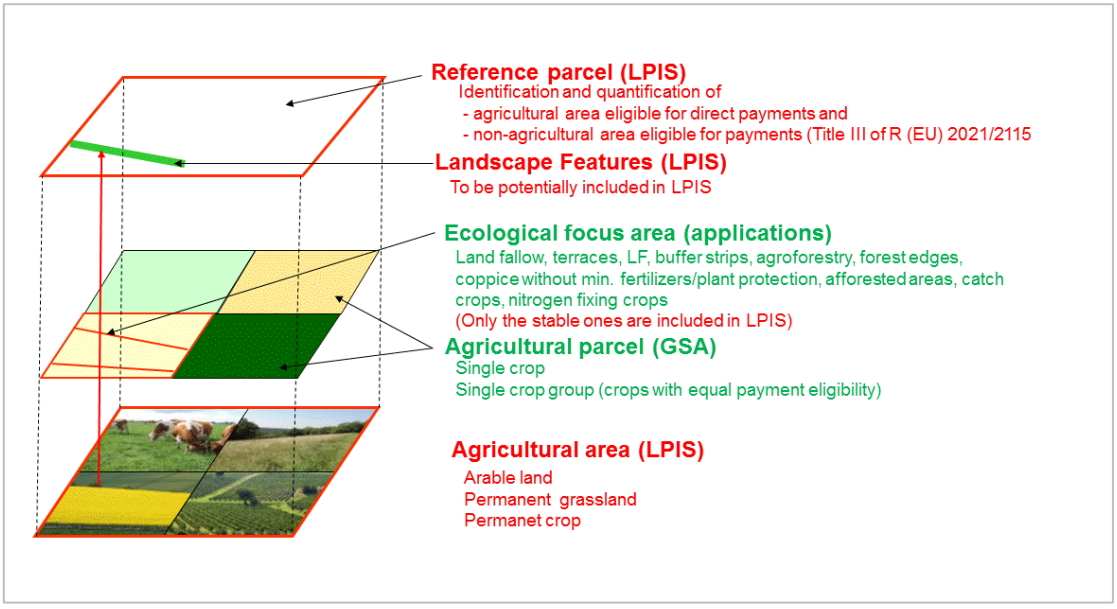
The following GSA specific terms are defined:

— **Agricultural parcel:** means a unit of agricultural area, defined by Member States, as determined in accordance with Article 4(3) of R (EU) 2021/2115.

Definition of additional terms are provided in section 3.4.2 (GSA Feature catalogue).

The above definitions describe the feature types (in INSPIRE spatial object types) of IACS, which are subject of this technical guidelines. Their relation to the real world and the spatial datasets of IACS are shown in **Figure 1**.

Figure 1.Spatial object (feature) types of IACS as abstracted from the real world



Note: Elements of the LPIS datasets are sown in red, while that of GSA in green.

3 Data content and structure

3.1 Application schemas – Overview

The types to be used for the exchange and classification of spatial objects from data sets related to the spatial data themes LPIS and GSA are defined in the following application schemas:

— LPIS application schema, which contains the concepts of agricultural area, non-agricultural eligible area, reference parcel, EFA and LF

— GSA application schema, which contains the concept of agricultural parcel.

The application schemas specify requirements on the properties of each spatial object including its multiplicity, domain of valid values, constraints, etc.

TG Requirement 1 **Types for the Exchange and Classification of Spatial Objects**
For the exchange and classification of spatial objects from data sets meeting the conditions laid down in Article 67 (3) and (4) of Regulation (EU) 2021/2116 , Member States shall use the spatial object types and associated data types, enumerations and code lists that are defined in this section.

As compared to the full information content of LPIS and GSA datasets the application schemas defined in this section are restricted to the spatial object types and data types that are required to their spatial management. When publishing these datasets according to INSPIRE, additional feature and data types may be present, respecting the requirements of R (EU) 2016/679[18].

TG Requirement 2 **Multiplicity**
Spatial object types and data types shall comply with the multiplicities defined for the attributes and association roles in this section.

3.2 Basic notions

3.2.1 Notation

The application schema included in this section is specified in Unified Modelling Language (UML), version 2.1. The spatial object types, their properties and associated types are shown in UML class diagrams[19].

The use of a common conceptual schema language (i.e. UML) allows for an automated processing of application schemas and the encoding, querying and updating of data based on the application schema – across the different themes and different levels of detail.

3.2.2 Voidable characteristics

Voidable stereotype is not used in this data specification.

3.2.3 Enumerations

No enumerations are used in this data specification.

3.2.4 Code lists

The purpose of a code list is to present an agreed set of codes with multilingual names, definitions and descriptions to be used as values of properties and which might be shared and reused by a wide audience. Code lists serve as controlled vocabularies for the values of object properties.

The benefits are:

— interoperability is improved through greater consistency and precision of data,

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18 [GDPR] http://data.europa.eu/eli/reg/2016/679/oj

19 For an overview of the UML notation, see Annex D in [ISO 19103].

— data consumers (client applications) know and understand the values used by data providers,

— reuse of code values is promoted via adoption and integration by developers and users,

— searching and recovery of data items becomes more reliable,

— there is less variation in coding, minimising the duplication of datasets.[20]

Code lists are modelled as classes in the application schema. Their values, however, are managed outside of the application schema.

TG Requirement 3 **Code Lists types**

Code lists shall be of one of the following types:

a) code lists whose allowed values comprise only the values specified in this TG;

b) code lists whose allowed values comprise the values specified in this TG and narrower values defined by data providers;

c) code lists whose allowed values comprise the values specified in this TG and additional values at any level defined by data providers.

The type of code list is represented in the UML model through the tagged value that describes its extensibility. It can take the following values:

— **none**, representing code lists whose allowed values comprise only the values specified in the TG (type a),

— **narrower**, representing code lists whose allowed values comprise the values specified in the TG and narrower values defined by data providers (type b),

— **open**, representing code lists whose allowed values comprise the values specified in the TG and additional values at any level defined by data providers (type c).

"Narrower" means a less aggregated value in a classification system. For example, durum wheat is a narrower value of cereals.

TG Requirement 4 **Code Lists extensibility**

Additional values defined by data providers shall not replace or redefine any value already specified in the TG.

TG Requirement 5 **Code Lists registers**

Where, for an attribute whose type is a code list as referred to in points (b) or (c) of TG Requirement 2, a data provider provides a value that is not specified in this TG, that value and its definition shall be made available in a publicly accessible register.

Regarding the code lists governance, two types of code lists are distinguished:

— Code lists that are governed by an EU organisation (e.g. DG-AGRI, Eurostat) (EU governed code lists). These code lists will be managed centrally in a dedicated EU code list register, publicly accessible at https://<Domain_name.eu>/codelist/<CodeListName>[21]. They will be available in SKOS/RDF, XML and HTML. The maintenance will follow the procedures defined in ISO 19135. This means that the only allowed changes to a code list are the addition, deprecation or supersession of values, i.e. no value will ever be deleted, but only receive different statuses (valid, deprecated superseded). Identifiers for values of EU governed code lists will be constructed using the pattern https://<Domain_name.eu>/codelist/<CodeListName>/<value>. The possibility that EU-governed code lists will be managed in the INSPIRE code list register will be investigated.

— Code lists that are governed by an organisation outside of DG-AGRI/Eurostat/INSPIRE (externally governed code lists). These code lists are managed by an organisation outside the Commission (e.g. the Paying

[20] Annex G of INSPIRE Generic Conceptual Model, v3.4

[21] The link will be updated as soon as a final or temporary agreement is reached concerning the location of the registries.

Agencies, or LPIS custodians.) A typical example of externally governed code list is represented by national code lists which may extend with narrower values the parent values of AgriculturalAreaTypeValue code list. The externally governed code lists will be managed in dedicated code list registers publicly accessible at https://<Domain_name.xx>/codelist/<CodeListName>. They will be available in SKOS/RDF, XML and HTML. The maintenance will follow the procedures defined in ISO 19135. This means that the only allowed changes to a code list are the addition, deprecation or supersession of values, i.e. no value will ever be deleted, but only receive different statuses (valid, deprecated superseded). Identifiers for values of externally governed code lists will be constructed using the pattern https://<Domain_name.xx>/codelist/<CodeListName>/<value>.

TG Requirement 6 **Code Lists encoding**
Code list values shall be encoded using http URIs and labels, to be generated according to the relevant rules specified by the organizations managing the code lists registers.

Regarding code list multilingualism, in order to preserve semantic interoperability, code lists values belonging to both types of code lists above described (EU and externally governed code lists) will be provided in English. Where data providers are willing to use code lists values in their national language, they will have to add the related national language translations in the original code list in English.

TG Requirement 7 **Code Lists multilingualism**
Code lists values of all types of code lists shall be provided in English. Code lists values provided in national languages may be used. In this case, their national language translations will be added in the original code lists in English.

3.2.5 Consistency between spatial data sets

Currently, there are no consistency rules other than those defined within the application schemas. Taking into account that the LPIS implementations of the MS can follow different conceptual design in terms of the reference parcel type, the consistency with the parent dataset used for the production (e.g. cadastral parcels, orthoimagery) should be preserved.

3.2.6 Identifier management

LPIS and GSA spatial objects identifiers are managed by means of character string type attributes in the relevant feature types (agriculturalAreaId, nonAgriculturalEligibleAreaId, referenceParcelId, landscapeFeatureId, ecologicalFocusAreaId).

TG Requirement 8 **Unique and persistent identifiers**
LPIS and GSA identifiers shall be unique and shall not change during the life-cycle of a spatial object.

TG Recommendation 1 **Syntax of unique and persistent identifiers**
To ensure uniqueness of the identifiers across Europe, PAs or other custodians of the related data should use a unique syntax for the identifiers according to the principles set in the INSPIRE Generic Conceptual Model.

3.2.7 Geometry representation

TG Requirement 9 **Geometry representation**
The value domain of spatial properties defined in this TG shall be restricted to the Simple Feature spatial schema as defined in Herring, John R. (ed.), OpenGIS® Implementation Standard for Geographic information – Simple feature access – Part 1: Common architecture, version 1.2.1, Open Geospatial Consortium, 2011, unless specified otherwise for a specific spatial data theme or type.

The specification restricts the spatial schema to 0-, 1-, 2-, and 2,5-dimensional geometries where all curve interpolations are linear and surface interpolations are performed by triangles.

The topological relations of two spatial objects based on their specific geometry and topology properties can in principle be investigated by invoking the operations of the types defined in ISO 19107 (or the methods specified in EN ISO 19125-1).

3.2.8 Temporality representation

To record the lifespan of a spatial object, the attributes "beginLifespanVersion" and "endLifespanVersion" of the FeatureLevelMetadata data type are used.

The attribute "beginLifespanVersion" specifies the date and time at which this version of the spatial object was inserted or changed in the spatial data set. The attribute "endLifespanVersion" specifies the date and time at which this version of the spatial object was superseded or retired in the spatial data set.

The attribute specifies the beginning of the lifespan of the version in the spatial data set itself, which is different from the temporal characteristics of the real-world phenomenon described by the spatial object. This lifespan information supports mainly two requirements: First, knowledge about the spatial data set content at a specific time; second, knowledge about changes to a data set in a specific time frame.

Changes to the attribute "endLifespanVersion" does not trigger a change in the attribute "beginLifespanVersion.

TG Requirement 10 **Life-cycle of Spatial Objects**
Where the attribute endLifespanVersion is used, its value shall not be before the value of beginLifespanVersion.

EXAMPLE. A reference parcel was created on 03 August 2004. This date is its beginLifespanVersion value. Then this parcel has been split due to a construction of a highway that intersects it. This change is registered in LPIS on 25 November 2007. This date is the value of the endLifespaVersion attribute of the original parcel, which is naturally later, then the date of creation.

To record the validity of the real-world phenomenon represented by a spatial object, the attributes "validFrom" and "validTo" of the FeatureLevelMetadata data type are used.

The attribute "validFrom" specifies the date and time at which the real-world phenomenon became valid in the real world. The attribute "validTo" specifies the date and time at which the real-world phenomenon is no longer valid in the real world.

TG Requirement 11 **Temporal validity of Spatial Objects**
Where the attribute validTo is used, its value shall not be before the value of validFrom.

3.3 Application schema LPIS

3.3.1 Description

3.3.1.1 Narrative description and UML overview

LPIS application schema consists of four main interrelated spatial objects:

- AgriculturalArea
- ReferenceParcel
- LandscapeFeature
- NonAgriculturalEligibleArea
- EcologicalFocusArea

whose definitions are provided in section 2.4. Please note that AgriculturalParcel belongs to the GSA application schema presented in Section 3.4. Each of these spatial objects is made of a series of object-specific attributes (of different types), constraints and relationships.

Some attributes and relationships are mandatory, some others are optional.

To preserve the semantic harmonisation and interoperability of LPIS datasets, the type of those attributes providing information about different classification systems is a code list.

In terms of relationships among the four main spatial objects:

— each AgriculturalArea and NonAgriculturalEligibleArea has to be mandatorily aggregated to one ReferenceParcel, whilst each ReferenceParcel is mandatorily associated to one or many AgriculturalArea(s), or NonAgriculturalEligibleArea(s). A ReferenceParcel cannot be associated at the same time to AgriculturalArea(s) and NonAgriculturalEligibleArea(s).

— each AgriculturalArea can be associated to one or many EcologicalFocusArea(s), whilst each EcologicalFocusArea, if existing, has to be mandatorily aggregated to one or many AgriculturalArea(s),

— each AgriculturalArea can be associated to one or many LandscapeFeature(s), whilst each LandscapeFeature, can be aggregated or spatially linked to one or many AgriculturalArea(s),

— each EcologicalFocusArea, if existing, can be composed by one LandscapeFeature and each LandscapeFeature, if existing, can be associated to one EcologicalFocusArea.

An overview of the LPIS UML model is given in **Figure 2**. The details of this model are provided in **Figure 3**, **Figure 4**, **Figure 5**, **Figure 6** and **Figure 8**. A complete and detailed description of all the application schema elements is contained in the LPIS Feature Catalogue (section 3.3.2).

Figure 2. LPIS UML model - overview

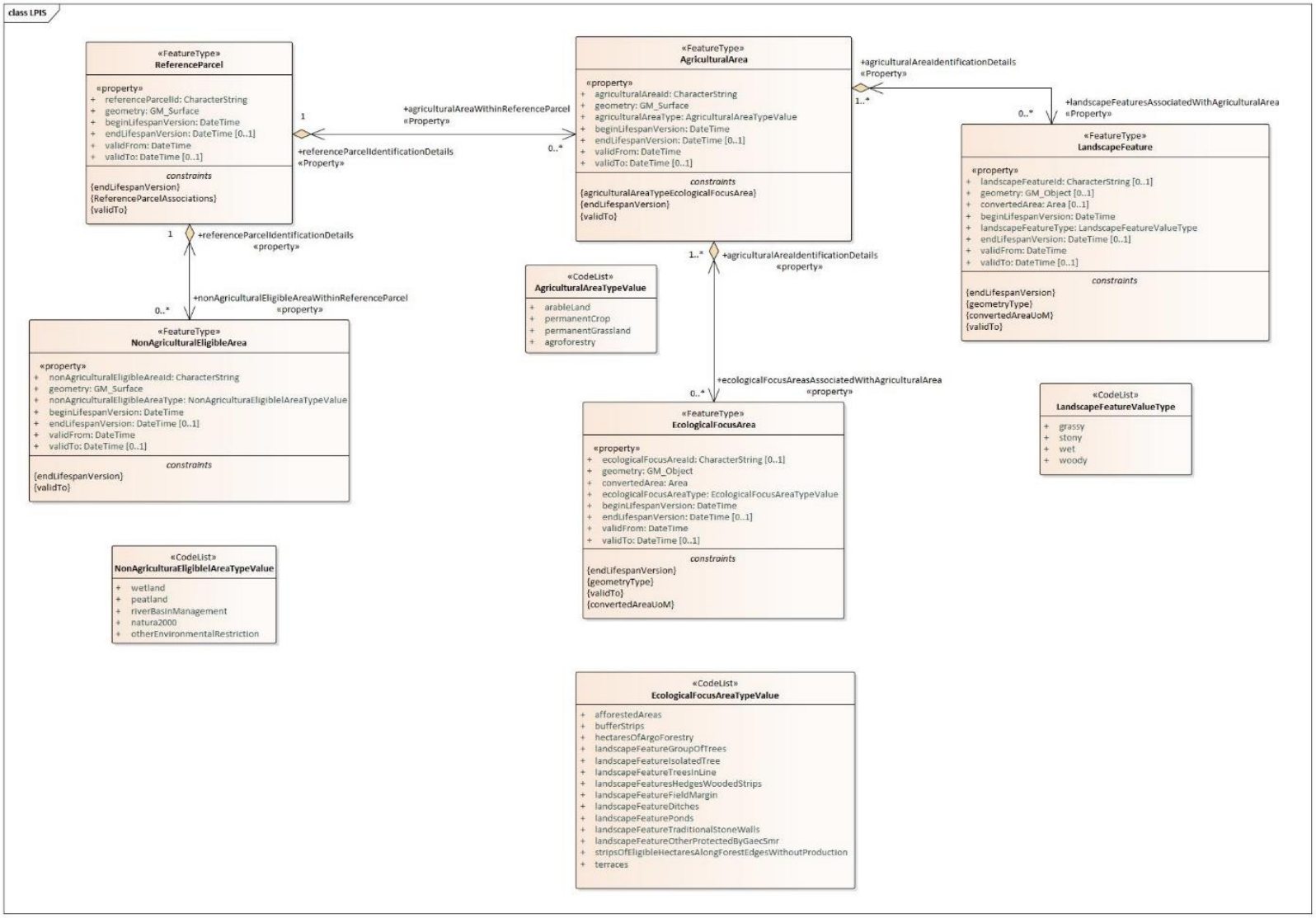


Figure 3. LPIS UML model - AgriculturalArea, LanscapeFeature and EcologicalFocusArea class diagrams and relationships

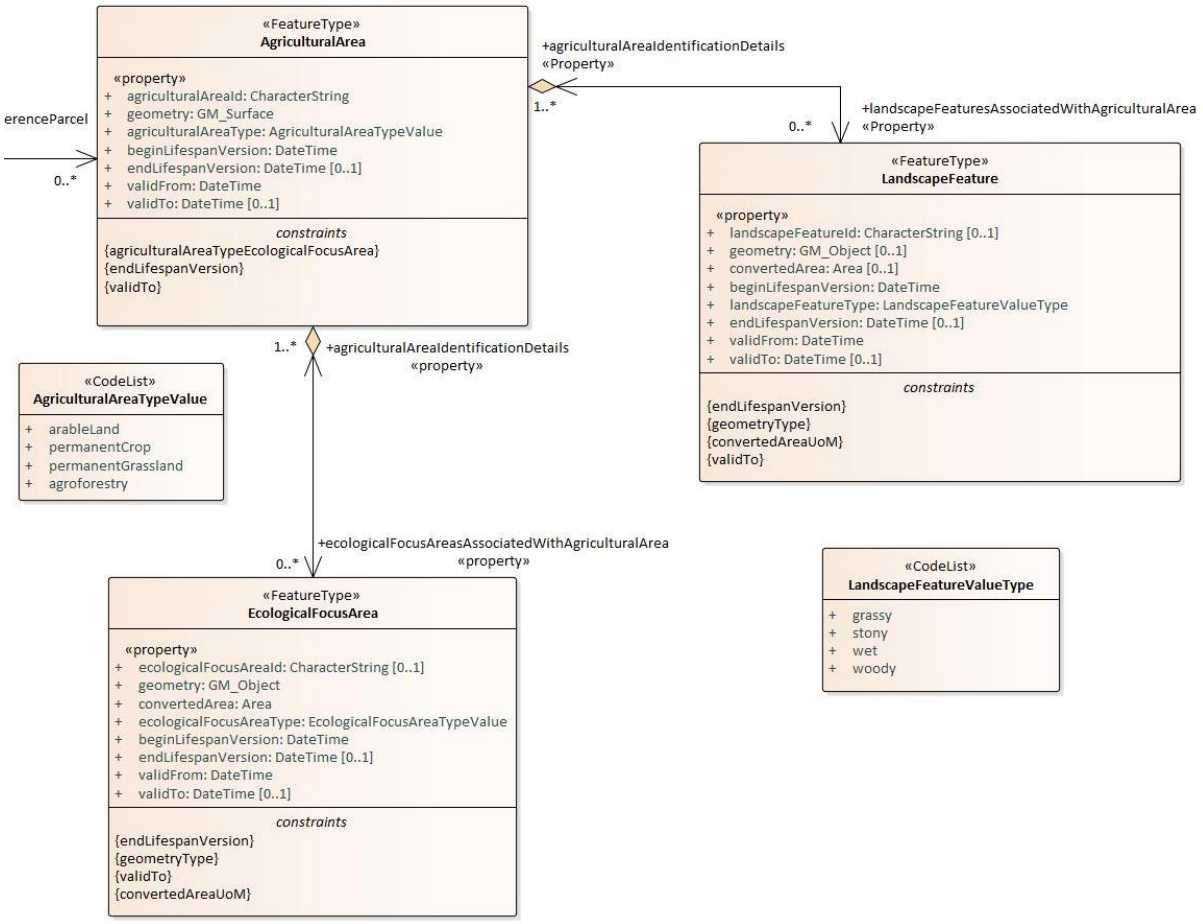


Figure 4. LPIS UML model – AgriculturalArea, NonAgriculturalEligibleArea and ReferenceParcel class diagrams and relationships

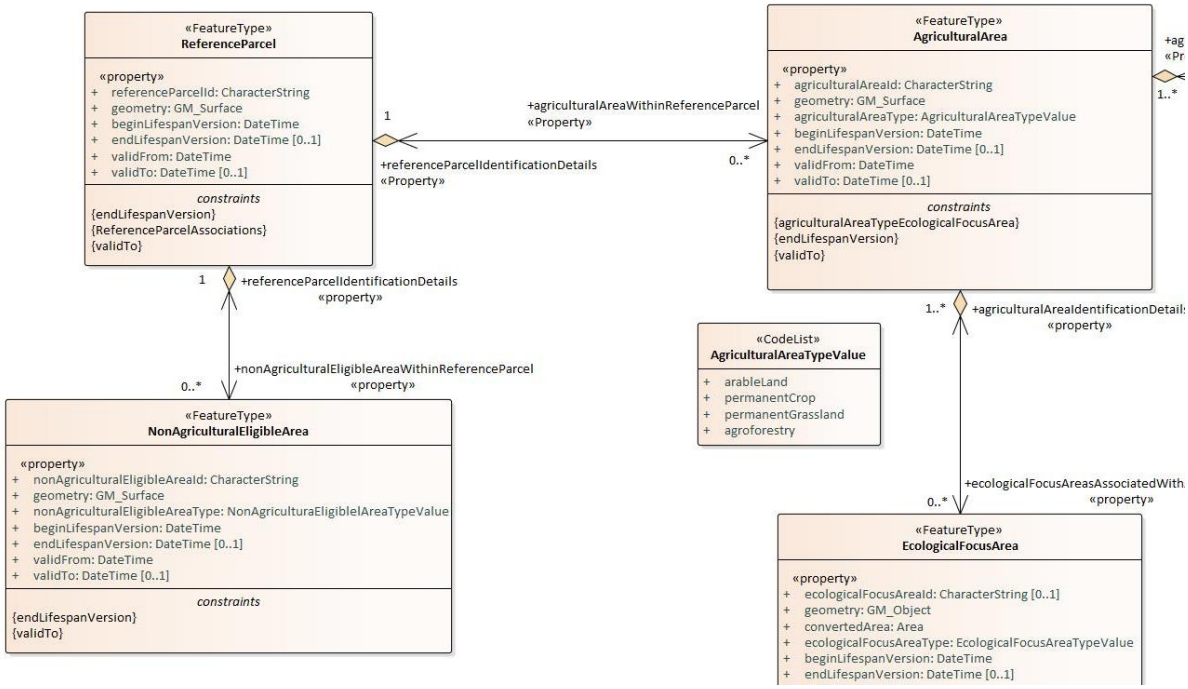


Figure 5. LPIS UML model - AgriculturalArea associated code list

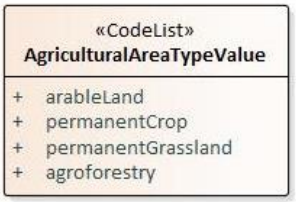
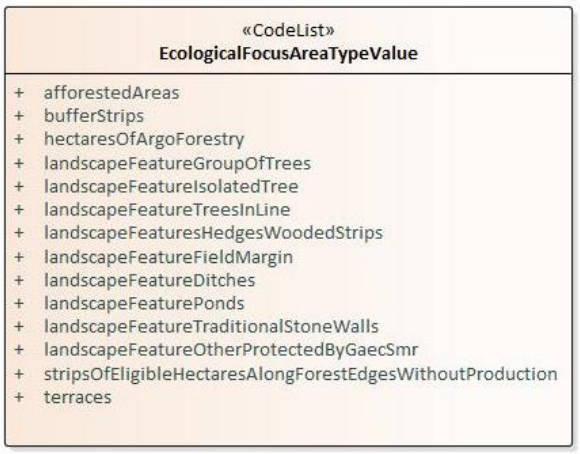


Figure 6. LPIS UML model - NonAgriculturalEligibleArea associated code list

Figure 7. LPIS UML model - LandscapeFeature associated code list

Figure 8. LPIS UML model - EcologicalFocusArea associated code list



3.3.2 LPIS Feature catalogue

Table 2. Types defined in the LPIS feature catalogue

Type	Package	Stereotypes
ReferenceParcel	LPIS	featureType
AgriculturalArea	LPIS	featureType
NonAgriculturalEligibleArea	LPIS	featureType
EcologicalFocusArea	LPIS	featureType
LandscapeFeature	LPIS	featureType
AgriculturalAreaTypeValue	LPIS	codeList
NonAgriculturalEligibleAreaValue	LPIS	codeList
EcologicalFocusAreaTypeValue	LPIS	codeList
LandscapeFeatureValueType	LPIS	codeList

3.3.2.1 Feature types

3.3.2.1.1 ReferenceParcel

--**Name**--

Reference parcel

-- **Definition** --

Means a geographically delimited continuous area retaining a unique identification as registered in the LPIS, having one or many land cover/land use categorisation, a.k.a. identification system for agricultural parcels referred to in Article 70 of R (EU) No 1306/2013 or Art.2 of R (EU) 2022/1172.

-- **Description** --

Basic spatial unit for the administration and geographical localisation of agricultural parcels. May contain one or more declared agricultural parcels in IACS and may be cultivated by one or more farmers (or producers association). Does not necessarily cover a territory nationwide, but overlaps are not allowed.

Attributes

Name	Type	Notes
referenceParcelId	CharacterString	--**Name**-- Reference parcel ID -- **Definition** -- Unique ID of reference parcel referred to in Article 70 of R (EU) No 1306/2013 or Art. 68 (2)(a) of R (EU) 2021/2116. -- **Description** -- European unique alphanumerical thematic identification code of reference parcel. It should follow the rules of INSPIRE when delivered for EU use.
geometry	GM_Surface	--**Name**-- Geometry -- **Definition** -- Spatial representation of the reference parcel as referred to in Art.5 of R (EU) 640/2014 or Art. 2(2) of R (EU) 2022/1172. -- **Description** -- Geometry of reference parcel, representing its geographical dimension and position.
beginLifespanVersion	DateTime	-- **Name**-- Begin life span version --**Definition**-- Set of properties of an object/feature that describes the temporal characteristics of a version or the changes between versions. [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was inserted or changed in the dataset.
endLifespanVersion	DateTime	--**Name** -- End life span version

		--**Definition** -- Set of properties of an object/feature that describe the temporal characteristics of a version or the changes between versions [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was superseded or retired in the dataset.
validFrom	DateTime	--**Name**— Valid from -- **Definition** – Official date and time when the object / feature has been (will be) in situ or legally established.
validTo	DateTime	--**Name** – Valid to --**Definition** – Official date and time at which the feature in situ (or legally) ceased (will cease) to be used.

Constraints

Name	**Notes**
ReferenceParcelAssociation	/* ReferenceParcel shall be composed either by AgriculturalArea or by NonAgriculturalEligibleArea */ inv: self.nonAgriculturalEligibleAreaWithinReferenceParcel.isEmpty() implies self.agriculturalAreaWithinReferenceParcel.notEmpty() and self.agriculturalAreaWithinReferenceParcel.isEmpty() implies self.nonAgriculturalEligibleAreaWithinReferenceParcel.notEmpty()
endLifespanVersion	/* If set, the date endLifespanVersion shall be later than beginLifespanVersion. */ inv: self.endLifespanVersion .isAfter(self.beginLifespanVersion)
validTo	/* If set, the date validTo shall be equal or later than validFrom. */ inv: self.validTo .isEqual(self.validFrom) or self.validTo .isAfter(self.validFrom)

Relationships

Association	Notes
0..* ReferenceParcel.agriculturalAreaWithinReferenceParcel **1** AgriculturalArea.referenceParcelIdentificationDetails	--**Name**-- Association role between RP and agricultural area. -- **Definition** -- Semantic relationship (aggregation) between ReferenceParcel and AgriculturalArea feature types. -- **Description** -- One reference parcel can be composed of one or more agricultural area types.
0..* ReferenceParcel.nonAgriculturalEligibleAreaWithinReferenceParcel **1** NonAgriculturalEligibleArea.referenceParcelIdentificationDetails	--**Name**-- Association role between RP and non-agricultural eligible area -- **Definition** -- Semantic relationship (aggregation) between ReferenceParcel and NonAgriculturalEligibleArea feature types. -- **Description** -- One reference parcel can be composed of one or more non-agricultural eligible area types.

3.3.2.1.2 AgriculturalArea

--**Name**--

Agricultural area

-- **Definition** --

Agricultural area means any area taken up by arable land, permanent grassland and permanent pasture, or permanent crops, including agroforestry systems on that area, as stipulated in Art. 4(1)(e) of R 1307/2013 or Art. 4(3) of R 2021/2115.

-- **Description** --

Areas taken by these land cover types, or their subtypes (narrower categories) comprising designated landscape features and/or trees included in these areas or adjacent to them. (European Commission DG AGRI 2016).

NOTE. MS may decide to implement LPIS as a full coverage of the country that also includes other land cover types including those, ineligible for any support scheme in IACS. Ineligible types cannot have spatial overlap with agricultural area and non-agricultural eligible area.

Attributes

Name	Type	Notes
agriculturalAreaId	CharacterString	--**Name**-- Agricultural area ID -- **Definition** -- Unique ID of agricultural area. -- **Description** -- European unique alphanumerical identification code of agricultural area.
agriculturalAreaType	AgriculturalAreaTypeValue	--**Name**-- Agricultural area type **-- Definition --** Agricultural area type. **-- Description --** Any area taken up by arable land, permanent grassland and permanent pasture, permanent crops or agroforestry system. 1307/2013 4(1)(e) or Art. 4(3) of R2021/2115.
geometry	GM_Surface	--**Name**-- Geomety -- **Definition** -- Spatial representation of agricultural area. -- **Description** -- Direct representation of the feature by coordinates of its boundary.
beginLifespanVersion	DateTime	-- **Name**-- Begin life span version --**Definition**-- Set of properties of an object/feature that describes the temporal characteristics of a version or the changes between versions. [Adapted from INSPIRE Generic Conceptual Model] -- **Description** --

		Date and time at which this version of the feature was inserted or changed in the dataset.
endLifespanVersion	DateTime	--**Name** -- End life span version --**Definition** -- Set of properties of an object/feature that describe the temporal characteristics of a version or the changes between versions [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was superseded or retired in the dataset.
validFrom	DateTime	--**Name**— Valid from -- **Definition** – Official date and time when the object / feature has been (will be) in situ or legally established.
validTo	DateTime	--**Name** – Valid to --**Definition** – Official date and time at which the feature in situ (or legally) ceased (will cease) to be used.

Constraints

Name	**Notes**
agriculturalAreaTypeEcologicalFocusArea	/* Ecological focus areas may be only on or adjacent to arable land */ inv: self.EcologicalFocusArea->isEmpty() or agriculturalAreaType = arableLand
endLifespanVersion	/* If set, the date endLifespanVersion shall be later than beginLifespanVersion. */ inv: self.endLifespanVersion .isAfter(self.beginLifespanVersion)
validTo	/* If set, the date validTo shall be equal or later than validFrom. */

	inv: self.validTo .isEqual(self.validFrom) or self.validTo .isAfter(self.validFrom)

Relationships

Association	Notes
0..* AgriculturalArea. ecologicalFocusAreasAssociatedWithAgriculturalArea **1..*** EcologicalFocusArea.agriculturalAreaIdentificationDetails	--**Name**-- Association role between agricultural area and EFA -- **Definition** -- Semantic relationship (aggregation) between AgriculturalArea and EcologicalFocusArea. -- **Description** -- EFA shall fulfil one of the following constraints [(Art.46(2) of R (EU) 1307/2013]: - shall be located on the arable land of the holding. - shall be adjacent to the arable land. NOTE. Ecological focus areas may be only on or adjacent to arable land.
0..* AgriculturalArea. landscapeFeaturesAssociatedWithAgriculturalArea **1..*** LandscapeFeature.agriculturalAreaDetailsForLandscapeFeature	--**Name**-- Association role between agricultural area and landscape feature -- **Definition** -- Semantic relationship (aggregation) between AgriculturalArea and LandscapeFeature.
0..* ReferenceParcel. agriculturalAreaWithinReferenceParcel **1** AgriculturalArea.referenceParcelIdentificationDetails	--**Name**-- Association role between RP and agricultural area -- **Definition** -- Semantic relationship (aggregation) between ReferenceParcel and AgriculturalArea feature types. -- **Description** -- One reference parcel can be composed of one or more agricultural area type.

3.3.2.1.3 NonAgriculturalEligibleArea

-- **Name** --

Non-agricultural eligible area

-- **Definition** --

Land containing non-agricultural areas considered eligible by the Member States for receiving payment under Titel III, Chapter 4 of R (EU) 2021/2115.

-- **Description** –-

Non-agricultural areas, such as wetlands, Natura 2000, river basin management etc., receiving rural development support according to the Strategic plans of the MS.

Attributes

Name	Type	Notes
nonAgriculturalEligibleAreaId	CharacterString	--**Name**-- Non-agricultural eligible area ID -- **Definition** -- Unique ID of non-agricultural eligible area. -- **Description** -- European unique alphanumerical identification code of agricultural area.
geometry	GM_Surface	--**Name**-- Geomety -- **Definition** -- Spatial representation of agricultural area. -- **Description** -- Direct representation of the feature by coordinates of its boundary.
nonAgriculturalEligibleAreaType	NonAgriculturalEligibleAreaTypeValue	--**Name**-- Non-agricultural eligible area type **-- Definition --** Types of land containing non-agricultural areas considered eligible by the Member States for receiving payment under Titel III, Chapter 4 of R (EU) 2021/2115 **-- Description --** Types of non-agricultural eligible area defined by the MS in their strategic plans.
beginLifespanVersion	DateTime	-- **Name**-- Begin life span version

		--**Definition**-- Set of properties of an object/feature that describes the temporal characteristics of a version or the changes between versions. [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was inserted or changed in the dataset.
endLifespanVersion	DateTime	--**Name** -- End life span version --**Definition** -- Set of properties of an object/feature that describe the temporal characteristics of a version or the changes between versions [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was superseded or retired in the dataset.
validFrom	DateTime	--**Name**— Valid from -- **Definition** – Official date and time when the object / feature has been (will be) in situ or legally established.
validTo	DateTime	--**Name** – Valid to --**Definition** – Official date and time at which the feature in situ (or legally) ceased (will cease) to be used.

Constraints

Name	Notes
endLifespanVersion	/* If set, the date endLifespanVersion shall be later than beginLifespanVersion. */ inv: self.endLifespanVersion .isAfter(self.beginLifespanVersion)
validTo	/* If set, the date validTo shall be equal or later than validFrom. */ inv: self.validTo .isEqual(self.validFrom) or self.validTo .isAfter(self.validFrom)

Relationships

Association	Notes
0..* ReferenceParcel. nonAagriculturalEligibleAreaWithinReferenceParcel **1** NonAgriculturalElibileArea.referenceParcelIdentificationDetails	--**Name**-- Association role between the RP and non-agricultural eligible area -- **Definition** -- Semantic relationship (aggregation) between ReferenceParcel and NonAgriculturalEligibleArea feature types. -- **Description** -- One reference parcel can be composed of one or more non-agricultural eligible area type.

3.3.2.1.4 EcologicalFocusArea

--**Name**--

Ecological Focus Area

-- **Definition** --

Ecological focus areas as referred to in Article 46 of R (EU) No1307/2013 and its Delegated Regulation (EU) No 639/2014.

-- **Description** --

Areas contributing to practices beneficial for the climate and the environment as referred to in Art. 43(2)(c) of (EU) R No 1307/2013.

NOTE. EFA is not applicable for datasets issued after 2023.

Attributes

Name	Type	Notes
ecologicalFocusAreaId	CharacterString	--**Name**-- Ecological focus area identifier -- **Definition** -- Unique thematic ID of ecological focus area.
geometry	GM_Object	--**Name**-- Geometry -- **Definition** -- Geometry of ecological focus area. -- **Description** -- Representation of the geographical dimension/position of the ecological focus area. EFA may be represented as , point, curve, or surface depending on the options allowed by Art 46(3) of R (EU) 1307/2013 and the choice of the MS/region. NOTE 1: The established area referred in DSCG/2014/31 is derived from surface representation of the geometric extent. NOTE 2: The converted area referred in DSCG/2014/31 is derived from a geometric representation with reduced dimensions (curves or points) NOTE 3: In case of GM_Point geometry - Clementini point should be used. NOTE 4: When GM_curve representation is applied, it should be within the polygon that would represent the feature if full geometric extent was used.
convertedArea	Area	--**Name**-- Ecological focus area -- **Definition** -- Official area of EFA that can be accounted for fulfilling the obligation detailed in Art. 46(1) of R (EU) 1307/2013. -- **Description** -- This is the area value after applying the eventual conversion and weighting factors (DSCG/2014/31).

		NOTE 1: According to DSCG/2014/31 **- Established area:** Area resulting from direct field measurement or from delineation using ortho imagery **- Converted area**: Virtual area of EFAs obtained when using the conversion factors of Annex II of R (EU) No 639/2014. NOTE 2: EFA area shall be given in ha.
ecologicalFocusAreaType	EcologicalFocusAreaTypeValue	--**Name**-- Ecological focus area type -- **Definition** -- Ecological focus area type as listed in Art. 46(2) of R (EU) 1307/2013. -- **Description** -- The value of this attribute shall be taken from the EcologicalFocusAreaTypeValue code list.
beginLifespanVersion	DateTime	-- **Name**-- Begin life span version --**Definition**-- Set of properties of an object/feature that describes the temporal characteristics of a version or the changes between versions. [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was inserted or changed in the dataset.
endLifespanVersion	DateTime	--**Name** -- End life span version --**Definition** -- Set of properties of an object/feature that describe the temporal characteristics of a version or the changes between versions [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was superseded or retired in the dataset.
validFrom	DateTime	--**Name**— Valid from

		-- **Definition** – Official date and time when the object / feature has been (will be) in situ or legally established.
validTo	DateTime	--**Name** – Valid to --**Definition** – Official date and time at which the feature in situ (or legally) ceased (will cease) to be used.

Constraints

Name	**Notes**
geometryType	/* Type of geometry shall be GM_Surface or GM_Curve or GM_Point*/ inv: geometry.oclIsKindOf(GM_Surface) or geometry.oclIsKindOf(GM_Curve) or geometry.oclIsKindOf(GM_Point)
convertedAreaUoM	/* Value of convertedArea shall be given in hectars. */ inv: self.convertedArea.uom.uomSymbol='ha'
endLifespanVersion	/* If set, the date endLifespanVersion shall be later than beginLifespanVersion. */ inv: self.endLifespanVersion .isAfter(self.beginLifespanVersion)
validTo	/* If set, the date validTo shall be equal or later than validFrom. */ inv: self.validTo .isEqual(self.validFrom) or self.validTo .isAfter(self.validFrom)

Relationships

Association	**Notes**
0..* AgriculturalArea. ecologicalFocusAreasAssociatedWithAgriculturalArea **1..*** EcologicalFocusArea.agriculturalArealDentificationDetails	--**Name**-- Association role between agricultural area and EFA -- **Definition** -- Semantic relationship (aggregation) between AgriculturalArea and EcologicalFocusArea. -- **Description** --

Association	Notes
	EFA shall fulfil one of the following constraints [(Art.46(2) of (EU) R No 1307/2013]: - shall be located on the arable land of the holding. - shall be adjacent to the arable land. NOTE. Ecological focus areas may be only on or adjacent to arable land.

3.3.2.1.5 LandscapeFeature

--**Name**--

Landscape feature

-- **Definition**--

Elements of the agricultural area that are traditionally part of good agriculture cropping or utilization practices according to R (EU) 640/2014 Art. 9(1)] or elements of the agricultural area that contribute to protection of biodiversity, conservation or restoration of habitats or species as stipulated by Art. Art.4 (b)(i) of R (EU) 2021/2015.

-- **Description** --

Landscape features are the fragments of permanent non-productive areas embedded in agricultural landscapes. They are subject to the retention obligation under GAEC standard 8 listed in Annex III of R (EU) 2021/2015.

Attributes

Name	Type	Notes
landscapeFeatureId	CharacterString	--**Name**-- Landscape feature identifier -- **Definition** -- Unique thematic ID of landscape feature.
geometry	GM_Object	--**Name**-- Geometry -- **Definition** -- Geometry of landscape feature. -- **Description** -- Representation of the geographical dimension/position of the landscape feature. LF may be represented as point, curve, or surface depending on the

		options allowed by Art 46(3) of R (EU) 1307/2013 and the choice of the MS/region, or Art. 7(d)(ii) and Art 7(e) of R (EU) 2022/1172.
convertedArea	Area	--**Name**-- Landscape feature area -- **Definition** -- Official area of LF recorded in LPIS. --**Description**-- This area can be defined by measurement (delineation) or by numeric estimation. NOTE: Geometric representation and area are mandatory when a LF becomes an EFA element.
landscapeFeatureType	LandscapeFeatureValueType	--**Name**-- Landscape feature type -- **Definition** -- Landscape feature type as listed in Art. 46(2) of R (EU) 1307/2013. -- **Description** -- The value of this attribute are taken from the LandcapeFeatureValueType code list of the eligibility profile.
beginLifespanVersion	DateTime	-- **Name**-- Begin life span version --**Definition**-- Set of properties of an object/feature that describes the temporal characteristics of a version or the changes between versions. [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was inserted or changed in the dataset.
endLifespanVersion	DateTime	--**Name** -- End life span version --**Definition** --

		Set of properties of an object/feature that describe the temporal characteristics of a version or the changes between versions [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was superseded or retired in the dataset.
validFrom	DateTime	--**Name**— Valid from -- **Definition** – Official date and time when the object / feature has been (will be) in situ or legally established.
validTo	DateTime	--**Name** – Valid to --**Definition** – Official date and time at which the feature in situ (or legally) ceased (will cease) to be used.

Constraints

Name	Notes
geometryType	/* Type of geometry shall be GM_Surface or GM_Curve or GM_Point*/ inv: geometry.oclIsKindOf(GM_Surface) or geometry.oclIsKindOf(GM_Curve) or geometry.oclIsKindOf(GM_Point)
convertedAreaUoM	/* Value of convertedArea shall be given in hectars. */ inv: self.convertedArea.uom.uomSymbol='ha'
endLifespanVersion	/* If set, the date endLifespanVersion shall be later than beginLifespanVersion. */ inv: self.endLifespanVersion .isAfter(self.beginLifespanVersion)
validTo	/* If set, the date validTo shall be equal or later than validFrom. */ inv: self.validTo .isEqual(self.validFrom) or self.validTo .isAfter(self.validFrom)

Relationships

Association	Notes
0..* AgriculturalArea. landscapeFeaturesAssociatedWithAgriculturalArea **1..*** LandscapeFeature.agriculturalArealDentificationDetails	--**Name**-- Association role between agricultural area and landscape feature -- **Definition** -- Semantic relationship (aggregation) between AgriculturalArea and LandscapeFeature. -- **Description** -- Landscape features must be within (or adjacent in case of arable land) Agricultural areas (peer to peer Composition).

3.3.2.2 Code lists

3.3.2.2.1 AgriculturalAreaTypeValue

--**Name**--

Agricultural area type value

-- **Definition** --

Types of agricultural area.

-- **Description** --

List of agricultural area type values.

NOTE 1: According to DSCG/2014/33 arableLand, permanentCrop and permanetGrassland are the minimum level of details of land cover types needed for distinction of agricultural area.

NOTE 2: This code list can be extended with narrower categories replacing the listed broader code list values.

NOTE 3: This code list can be extended with any values, but these values cannot have a semantic overlap with the specified values. Furthermore, when implemented, no overlap of the representation geometries is allowed.

Attributes

Name	Type	Notes
arableLand		--**Name**--

		Arable land -- **Definition** -- Land cultivated for crop production or areas available for crop production or lying fallow. --**Description**-- It includes areas set aside in sense of Annex III to R(EU) 2021/2115, or with Articles 22, 23 or 24 of R (EC) 1257/1999, or with Article 39 of R (EC) No 1698/2005, or with Article 28 of R (EU) 1305/2013. This definition also applies to greenhouses under fixed or mobile cover.
permanentCrop		--**Name**-- Permanent crop -- **Definition** -- Non-rotational crops other than permanent grassland and permanent pasture that occupy the land for five years or more. --**Description**-- It yields repeated harvests, including nurseries and short rotation coppice. [Art. 4 (1)(g) of R (EU)1307/2013 and Art. 4(3)(b) of R (EU) 2021/2125].
permanentGrassland		--**Name**-- Permanent grassland -- **Definition** -- Permanent grassland and permanent pasture (together referred to as "permanent grassland") mean land used to grow grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown) and that has not been included in the crop rotation of the holding for five years or more. --**Description**-- It may include other species, such as shrubs or trees, which can be grazed and, where Member States so decide, other species such as shrubs or trees which produce animal feed, provided that the grasses and other herbaceous forage remain predominant. Member States may also decide to consider the following types of land to be permanent grassland: - land which is covered by any of the species referred to in this point and which forms part of established local practices, where grasses and other herbaceous forage are traditionally not predominant or absent in grazing areas; - land covered by any of the species referred to in this point, where grasses and other herbaceous forage are not predominant or are absent in grazing areas. [Art. 4(3)(c) of R (EU) 2021/2125].
agroforestry		--**Name**-- Agroforestry

		-- **Definition** -- Area supported for afforestation. --**Description**— Complex of arable land, permanent crops and permanent grassland supported for agroforestry. [Art. 4(3) of R (EU) 2021/2115.

In Annex 1 we provide the example of the LPIS implementation in Bulgaria, with extensions of the agricultural area types.

3.3.2.2.2 NonAgriculturalEligibleArea

--**Name**—

Non-agricultural eligible area type value

-- **Definition** –

Types of the non-agricultural eligible area

-- **Description** --

Values of non-agricultural eligible area types as defined in the strategic plans of the MS.

NOTE: This code list is extensible by the MS, according to the types defined in their Strategic Plans.

Attributes

Name	Type	Notes
wetland		--**Name**-- Wetland -- **Definition** -- Wet area protected under GAEC 2. -- **Description** -- Area under a measure for protecting carbon-rich soils.
peatland		--**Name**-- Peatland -- **Definition** -- Peatland area protected under GAEC 2. -- **Description** --

		Area under a measure for protecting carbon-rich soils.
riverBasinManagement		--**Name**-- River basin management -- **Definition** -- Areas included in river basin management plans pursuant to Directive 2000/60/EC eligible for rural development support as defined in the Strategic plans of the MS. -- **Description** -- Non-agricultural areas eligible for rural development measures supporting the Water Framework Directive. The measures may include buffer strips, investments in irrigation systems in sense of Art. 74 (2) and (4) of R (EU) 2021/2115, improving water quality, use of reclaimed water, etc.
natura2000		--**Name**-- Natura 2000 -- **Definition** -- Natura 2000 areas located on non-agricultural area, eligible for support under Rural development as defined in the Strategic plans of the MS. -- **Description** -- Includes forest areas designated pursuant to Directives 92/43/EEC and 2009/147/EC.
otherEnvironmentalRestriction		--**Name**-- Other environmental restriction -- **Definition** -- Non-agricultural area including forestry, which contribute to the implementation of Article 10 of Directive 92/43/EEC, provided that those areas do not exceed 5 % of the designated Natura 2000 areas covered by territorial scope of each CAP Strategic Plan.

3.3.2.2.3 EcologicalFocusAreaTypeValue

--**Name**--

Ecological focus area type value

-- **Definition** --

Types of EFA as listed in Art. 46(2) of R (EU) 1307/2013.

-- **Description** --

MS shall decide that one or more values of this code list are considered to be ecological focus area.

NOTE 1: The extension of this code list shall be documented in the eligibility profile of the MS/region in a register / registry service to publish the extended values and their definitions.

NOTE 2. This concept is relevant only for period covered by CAP before 2023.

Attributes

Name	Type	Notes
afforestedAreas		--**Name**-- Afforested areas -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Afforested areas referred to in point (b)(ii) of Article 32(2) of R (EU) 1307/2013.
bufferStrips		--**Name**-- Buffer strips -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Buffer strips, including those covered by permanent grassland, provided that these are distinct from adjacent eligible agricultural area [Art. 46(2) (d) of (EU) R 1307/2013].
hectaresOfArgoForestry		--**Name**-- Hectares of agro-forestry -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU)1307/2013 -- **Description** -- Hectares of agro-forestry - are those that receive, or have received, support under Article 44 of R (EC) 1698/2005 and/or Article 23 of R (EU) 1305/2013

		- shall be arable land eligible for the basic payment scheme or the single area payment scheme for which support under Article 44 of R (EC) 1698/2005 or Article 23 of R (EU) 1305/2013 was or is granted.
landscapeFeatureDitches		--**Name**-- LF ditches -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, **ditches** with a maximum width of 6 meters, including open watercourses for the purpose of irrigation or drainage. Channels with walls of concrete shall not be considered ecological focus area. [Art. 45(3)(g) of (EU) R No 639/2014]. NOTE : When this type of LF is protected under SMR 3, MS may specify other width based on national requirements.
landscapeFeatureFieldMargin		--**Name**-- LF field margin -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, **field margin** with a width between 1 and 20 meters, on which there shall be no agricultural production. [Art. 45(3)(e) of R (EU) 639/2014].
landscapeFeatureGroupOfTrees		--**Name**-- LF Group of trees -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, group of trees, where trees are connected by overlapping crown cover, and field copses of maximum 0.3 ha in both cases. [Art. 45(3)(d) of R (EU) 639/2014].
landscapeFeatureIsolatedTree		--**Name**-- LF isolated tree -- **Definition** --

		Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, isolated tree with a crown diameter of minimum 4 meters. [Art. 45(3)(b) of R (EU) 639/2014].
landscapeFeatureOtherProtectedByGaecSmr		--**Name**-- Other LF protected by GAEC or SMR. -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, other features not listed in this code list but protected under GAEC7, SMR 2 or SMR 3. [Art. 45(3)(a) of R (EU) 639/2014].
landscapeFeaturePonds		--**Name**-- LF ponds -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, **ponds** of up to a maximum of 0.1 ha. Reservoirs made of concrete or plastic shall not be considered ecological focus area; [Art. 45(3)(f) of R (EU) 639/2014].
landscapeFeaturesHedgesWoodedStrips		--**Name**-- LF hedges and wooded strips -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of (EU) R 1307/2013 -- **Description** -- Landscape features: Hedges/wooded strips with a width of up to 10 meters [Art. 45(3)(a) of R (EU) 639/2014] NOTE : When such LF are protected under GAEC 7, SMR 2 and SMR 3, MS may specify other width based on national requirements.
landscapeFeatureTraditionalStoneWalls		--**Name**-- LF traditional walls

		-- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature **traditional stone walls**. [Art. 45(3)(a) of R (EU) 639/2014].
landscapeFeatureTreesInLine		--**Name**-- LF trees in line -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013. -- **Description** -- Landscape feature, trees in line trees in line with a crown diameter of minimum 4 meters. The space between the crowns shall not exceed 5 meters. [Art. 45(3)(c) of R (EU) 639/2014].
stripsOfEligibleHectaresAlongForestEdgesWithoutProduction		--**Name**-- Strips of eligible hectares without production -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013 -- **Description** -- Strips of eligible hectares along forest edges without production.
terraces		--**Name**-- Terraces -- **Definition** -- Ecological focus area type as defined by Art. 46(2) of R (EU) 1307/2013 -- **Description** -- Terraces shall be terraces that: -are protected under GAEC 7 as referred to in Annex II to Regulation (EU) 640/2014; -other terraces established based on criteria defined by MS.

3.3.2.2.4 LandscapeFeatureValueType

--**Name**--

Landscape feature value type

-- **Definition** --

Types of landscape features.

-- **Description** --

MS shall decide that one or more values of this code list are considered to be landscape feature. The code list can be extended by narrower values. The broad functional LF types have been defined by (Czucz et al. 2022)

Attributes

Name	Type	Notes
woody		--**Name**-- Woody -- **Definition** -- Functional LF feature type in sense of Section 1.2.2 of Czucz at al. -- **Description** -- Isolated trees, tree lines and avenues, hedges, woody strips, trees in group, field coppices and riparian woody vegetation.
grassy		--**Name**-- Grassy -- **Definition** -- Functional LF feature type in sense of Section 1.2.2 of Czucz at al. -- **Description** -- Grassy strips, field margins, embankments, buffer strips, grassed thalweg.
stony		--**Name**-- Stony -- **Definition** -- Functional LF feature type in sense of Section 1.2.2 of Czucz at al. -- **Description** -- Dry stone walls, terrace elements, rock outcrops, natural or artificial stacks of stone.
wet		--**Name**-- Wet -- **Definition** --

		Functional LF feature type in sense of Section 1.2.2 of Czucz at al. -- **Description** -- Inland channels of fresh water, standing small water bodies such as natural or man-made ponds, ditches.

3.4 Application schema GSA

3.4.1 Description

3.4.1.1 Narrative description and UML overview

GSA application schema consists of one spatial object:

— AgriculturalParcel

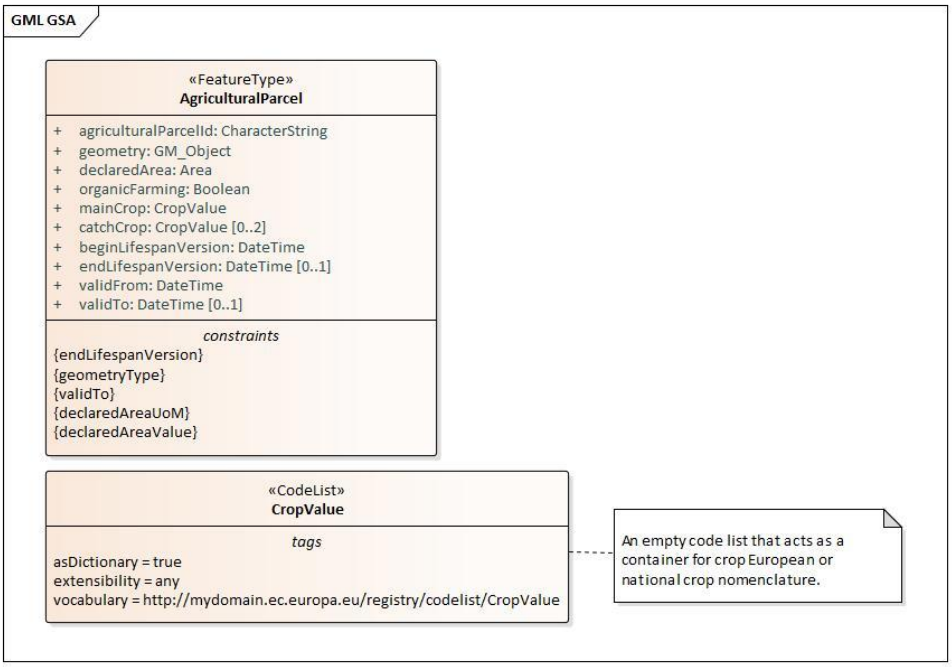
whose definitions is provided in section 2.4.

This spatial object is made of a series of object-specific attributes (of different types) and constraints. The usual spatial representation geometry of this feature type is surface. However, for sake of protecting the economic interest of the farmers or fulfilling national data protection regulations, simplified geometries, such as points of multipoints are also allowed[22].

To preserve the semantic harmonisation and interoperability of GSA datasets, the type of those attributes providing information about different classification systems is a code list.

An overview of the GSA UML model is provided in the **Figure 9**, whilst a complete and detailed description of all the application schema elements is contained in the GSA Feature Catalogue (section 3.4.2).

Figure 9. GSA UML model



[22] Result of the crop classification pilot project.

3.4.2 GSA Feature catalogue

Table 3. Types defined in the GSA feature catalogue

Type	Package	Stereotypes
AgriculturalParcel	GSA	featureType
CropValue	GSA	codeList

3.4.2.1 Feature types

3.4.2.1.1 AgriculturalParcel

--**Name**--

Agricultural parcel

-- **Definition** --

Agricultural parcel means a unit, defined by Member States, of agricultural area as determined in accordance with Article 4(3) of R (EU) 2021/2115.

-- **Description** --

Agricultural parcel within agricultural areas (and/or reference parcels) declared by farmer.

Attributes

Name	Type	Notes
agriculturalParcelId	CharacterString	--**Name**-- Agricultural parcel ID -- **Definition** -- Unique ID of agricultural parcel. -- **Description** -- Europe-wide unique alphanumerical identification code of agricultural parcel.
geometry	GM_Object	--**Name**-- Geometry -- **Definition** -- Geometry of agricultural parcel. -- **Description** -- Representation of the geographical dimension/position of the agricultural parcel.
declaredArea	Area	--**Name**--

		Area declared. -- **Definition** -- Value for the quantification of area as referred to in Art. 5(3) of R (EU) 640/2014 or Art. 8 (2)(b) of R (EU) 1173/2022.
organicFarming	Boolean	**--Name--** organicFarming **--Definition--** Areas under commitments for fulfilling conditions of R (EU) 2018/848 on organic production. **--Description--** Organic production is an overall system of farm management and food production that combines best environmental and climate action practices, a high level of biodiversity and the preservation of natural resources. Organic farming promotes sustainable food production and preserving natural environment.
mainCrop	CropValue	--**Name**-- mainCrop **-- Definition --** Main crop grown within the campaign year (growing season). **-- Description --** Crop occupying the parcel in most of the time of the growing season. It also includes fallow land.
catchCrop	CropValue	--**Name**-- catchCrop **-- Definition --** Fast-growing crop that is grown between successive plantings of a main crop. **-- Description --** Crop used for N fixing, as green manure, etc.
beginLifespanVersion	DateTime	-- **Name**-- Begin life span version --**Definition**--

		Set of properties of an object/feature that describes the temporal characteristics of a version or the changes between versions. [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was inserted or changed in the dataset.
endLifespanVersion	DateTime	--**Name** -- End life span version --**Definition** -- Set of properties of an object/feature that describe the temporal characteristics of a version or the changes between versions [Adapted from INSPIRE Generic Conceptual Model] -- **Description** -- Date and time at which this version of the feature was superseded or retired in the dataset.
validFrom	DateTime	--**Name**— Valid from -- **Definition** – Official date and time when the object / feature has been (will be) in situ or legally established.
validTo	DateTime	--**Name** – Valid to --**Definition** – Official date and time at which the feature in situ (or legally) ceased (will cease) to be used.

Constraints

Name	**Notes**
geometryType	/* Type of geometry shall be GM_Surface or GM_Point or GM_MultiPoint*/ inv: geometry.oclIsKindOf(GM_Surface) or geometry.oclIsKindOf(GM_MultiPoint) or geometry.oclIsKindOf(GM_Point)
declaredAreaUoM	/* Value of declaredArea shall be given in hectars. */ inv: self.declaredArea.uom.uomSymbol='ha'

declaredAreaValue	As regards the area-related direct payment, each Member State shall determine the minimum size of agricultural parcels in respect of which an application may be made..
endLifespanVersion	/* If set, the date endLifespanVersion shall be later than beginLifespanVersion. */ inv: self.endLifespanVersion .isAfter(self.beginLifespanVersion)
validTo	/* If set, the date validTo shall be equal or later than validFrom. */ inv: self.validTo .isEqual(self.validFrom) or self.validTo .isAfter(self.validFrom)

3.4.2.2 Code lists

3.4.2.2.1 CropValue

Even though there is a big users' interest in a harmonised and unique European crop classification, such agreement has not yet been reached. Indeed, the level of the required details defines the number of types. However, a hierarchic and harmonised classification system that is easily accessible, would support coherence of the related initiatives.

Annex III of Regulation (EU) 2018/1091[23] and the Manual of Integrated Farms Statistics[24] (European Commission 2020) provides a detailed multi-level hierarchical classification for arable, permanent crop and permanent grassland categories as follows below:

- cereals,
- dry pulses,
- root crops,
- industrial crops,
- plants harvested green,
- fresh vegetables,
- other arable crops,
- fallow land,
- pastures and meadows,
- rough grazing,
- permanent grassland, not used,
- permanent crops for human consumption,
- other permanent crop,
- nurseries.

An alternative is to use of national code lists defined by MS. In this case the related TG requirements have to be respected.

TG Recommendation 2. **Crop code lists**

When publishing GSA dataset in INSPIRE, one of the following code lists should be used:

- "Variables of land" provided in Annex III of R (EU) 2018/1091
- National code lists published in a multilingual registry as defined in TG Requirement 5, 6 and 7.

[23] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32018R1091
[24] In pp 90 - 148

4 Reference systems, units of measure and grids

4.1 Default reference systems, units of measure and grid

The reference systems, units of measure and geographic grid systems included in this sub-section are the defaults to be used for all INSPIRE data sets, unless theme-specific exceptions and/or additional requirements are defined in section 6.2.

4.1.1 Coordinate reference systems

4.1.1.1 Datum

TG Requirement 12 **Datum for three-dimensional and two-dimensional coordinate reference systems**

For the three-dimensional and two-dimensional coordinate reference systems and the horizontal component of compound coordinate reference systems used for making spatial data sets available, the datum shall be the datum of the European Terrestrial Reference System 1989 (ETRS89) in areas within its geographical scope, or the datum of the International Terrestrial Reference System (ITRS) or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. Compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well-documented relationship between both systems, according to EN ISO 19111.

4.1.1.2 Coordinate reference systems

TG Requirement 13 **Coordinate reference systems**

Spatial data sets shall be made available using at least one of the coordinate reference systems specified below in sections paragraphs 1, .2 and 3, unless one of the conditions specified in paragraph 4 holds.

1. Three-dimensional Coordinate Reference Systems

- Three-dimensional Cartesian coordinates based on a datum specified in 1.2 and using the parameters of the Geodetic Reference System 1980 (GRS80) ellipsoid.
- Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.

2. Two-dimensional Coordinate Reference Systems

– Two-dimensional geodetic coordinates (latitude and longitude) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.

- Plane coordinates using the ETRS89 Lambert Azimuthal Equal Area coordinate reference system.
- Plane coordinates using the ETRS89 Lambert Conformal Conic coordinate reference system.
- Plane coordinates using the ETRS89 Transverse Mercator coordinate reference system.

3. Compound Coordinate Reference Systems

1. For the horizontal component of the compound coordinate reference system, one of the coordinate reference systems specified in section 1.3.2 shall be used.
2. For the vertical component, one of the following coordinate reference systems shall be used:

– For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope. Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS.

- For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere, or other linear or parametric reference systems shall be used. Where other parametric reference systems are used, these shall be described in an accessible reference using EN ISO 19111-2:2012.
- For the vertical component in marine areas where there is an appreciable tidal range (tidal waters), the Lowest Astronomical Tide (LAT) shall be used as the reference surface.
- For the vertical component in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 meters, the Mean Sea Level (MSL) or a well-defined reference level close to the MSL shall be used as the reference surface.

4. Other Coordinate Reference Systems
Exceptions, where other coordinate reference systems than those listed in 1, 2 or 3 may be used, are:
a). Other coordinate reference systems may be specified for specific spatial data themes in this Annex.
b). For regions outside of continental Europe, Member States may define suitable coordinate reference systems.
The geodetic codes and parameters needed to describe these coordinate reference systems and to allow conversion and transformation operations shall be documented and an identifier shall be created, according to EN ISO 19111 and ISO 19127.

4.1.1.3 Display

TG Requirement 14 **Coordinate Reference Systems used in the View Network Service**
For the display of spatial data sets with the view network service as specified in Regulation No 976/2009, at least the coordinate reference systems for two-dimensional geodetic coordinates (latitude, longitude) shall be available.

4.1.1.4 Identifiers for coordinate reference systems

TG Requirement 15 **Coordinate Reference System Identifiers**
1. Coordinate reference system parameters and identifiers shall be managed in one or several common registers for coordinate reference systems.
2. Only identifiers contained in a common register shall be used for referring to the coordinate reference systems listed in this Section.

This TG proposes to use the http URIs provided by the Open Geospatial Consortium as coordinate reference system identifiers (see identifiers for the default CRSs below). These are based on and redirect to the definition in the EPSG Geodetic Parameter Registry (http://www.epsg-registry.org/).

The identifiers listed in shall be used for referring to the coordinate reference systems used in a data set.

NOTE CRS identifiers may be used e.g. in:

— data encoding,

— data set and service metadata, and

— requests to INSPIRE network services

Table 4. http URIs for the default coordinate reference systems

Coordinate reference system	Short name	http URI identifier
3D Cartesian in ETRS89	ETRS89-XYZ	*http://www.opengis.net/def/crs/EPSG/0/4936*
3D geodetic in ETRS89 on GRS80	ETRS89-GRS80h	*http://www.opengis.net/def/crs/EPSG/0/4937*
2D geodetic in ETRS89 on GRS80	ETRS89-GRS80	*http://www.opengis.net/def/crs/EPSG/0/4258*
2D LAEA projection in ETRS89 on GRS80	ETRS89-LAEA	*http://www.opengis.net/def/crs/EPSG/0/3035*
2D LCC projection in ETRS89 on GRS80	ETRS89-LCC	*http://www.opengis.net/def/crs/EPSG/0/3034*
2D TM projection in ETRS89 on GRS80, zone 26N (30°W to 24°W)	ETRS89-TM26N	*http://www.opengis.net/def/crs/EPSG/0/3038*
2D TM projection in ETRS89 on GRS80, zone 27N (24°W to 18°W)	ETRS89-TM27N	*http://www.opengis.net/def/crs/EPSG/0/3039*

2D TM projection in ETRS89 on GRS80, zone 28N (18°W to 12°W)	ETRS89-TM28N	*http://www.opengis.net/def/crs/EPSG/0/3040*
2D TM projection in ETRS89 on GRS80, zone 29N (12°W to 6°W)	ETRS89-TM29N	*http://www.opengis.net/def/crs/EPSG/0/3041*
2D TM projection in ETRS89 on GRS80, zone 30N (6°W to 0°)	ETRS89-TM30N	*http://www.opengis.net/def/crs/EPSG/0/3042*
2D TM projection in ETRS89 on GRS80, zone 31N (0° to 6°E)	ETRS89-TM31N	*http://www.opengis.net/def/crs/EPSG/0/3043*
2D TM projection in ETRS89 on GRS80, zone 32N (6°E to 12°E)	ETRS89-TM32N	*http://www.opengis.net/def/crs/EPSG/0/3044*
2D TM projection in ETRS89 on GRS80, zone 33N (12°E to 18°E)	ETRS89-TM33N	*http://www.opengis.net/def/crs/EPSG/0/3045*
2D TM projection in ETRS89 on GRS80, zone 34N (18°E to 24°E)	ETRS89-TM34N	*http://www.opengis.net/def/crs/EPSG/0/3046*
2D TM projection in ETRS89 on GRS80, zone 35N (24°E to 30°E)	ETRS89-TM35N	*http://www.opengis.net/def/crs/EPSG/0/3047*
2D TM projection in ETRS89 on GRS80, zone 36N (30°E to 36°E)	ETRS89-TM36N	*http://www.opengis.net/def/crs/EPSG/0/3048*
2D TM projection in ETRS89 on GRS80, zone 37N (36°E to 42°E)	ETRS89-TM37N	*http://www.opengis.net/def/crs/EPSG/0/3049*
2D TM projection in ETRS89 on GRS80, zone 38N (42°E to 48°E)	ETRS89-TM38N	*http://www.opengis.net/def/crs/EPSG/0/3050*
2D TM projection in ETRS89 on GRS80, zone 39N (48°E to 54°E)	ETRS89-TM39N	*http://www.opengis.net/def/crs/EPSG/0/3051*
Height in EVRS	EVRS	*http://www.opengis.net/def/crs/EPSG/0/5730*
3D compound: 2D geodetic in ETRS89 on GRS80, and EVRS height	ETRS89-GRS80-EVRS	*http://www.opengis.net/def/crs/EPSG/0/7409*

5 Data quality

Both the LPIS and GSA datasets have strict functional requirements, also expressed with data quality (DQ) elements. In case of LPIS, the quality assessment (LPIS QA) process is detailed in the corresponding Technical guidance (European Commission DG JRC 2016), a.k.a ETS guidance. This technical guidance incudes sampling procedures, DQ elements and sub-elements as well as the corresponding data quality measures that should be used to evaluate and document data quality. For the GSA datasets, at the moment, no formal quality assessment process is in place.

In particular, the DQ elements, sub-elements and measures specified in section 5.1 should be used for:

— evaluating and documenting DQ properties and constraints of spatial objects, where such properties or constraints are defined as part of the application schema(s) (see section 3);

— evaluating and documenting DQ metadata elements of spatial data sets (see section 6); and/or

— specifying minimum requirements or recommendations on the DQ (see sections 5.2).

The information about data quality could, in principle, be published as formal metadata elements. However the INSPIRE metadata profile targets metadata for discovery only. The only exception is "Conformance" that can be directly reported as described in Part 1 Data discovery TG (Tóth and Milenov 2020). If the data provider wishes to publish further metadata elements it is recommended to do so in a standalone report. The link to such report can be provided in the Abstract metadata element.

5.1 Data quality elements

In this section, the DQ elements applicable for the LPIS dataset are described. The DQ elements and measures are based on Annex D of ISO 19157 Geographic information – Data quality and ISO 2859-2:1985 Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection. To align LPIS QA with the presentation of INSPIRE, which is based in ISO 19157, a mapping is provided in Table 4. In addition to the DQ elements used in LPIS QA, Logical consistency with the Domain consistency sub-element is also included. This latter is evaluated based on the adherence of the LPIS and the GSA datasets to the respective data schemas in Section 3.

Table 5. Data quality elements used in the spatial data themes LPIS and GSA

Section	Data quality element	Data quality sub-element	Definition (according to ISO 19157)	Evaluation Scope	Reference
5.1.1	Completeness	Commission	Excess data present in the dataset, as described by the scope.	spatial object type	QE3 of the LPIS ETS guidance
5.1.2	Logical consistency	Domain consistency	Adherence of values to the value domains.	spatial object	Application schemas in section 3.
5.1.3	Logical consistency	Topological consistency	Correctness of the explicitly encoded topological characteristics and rules of the dataset, as described by the scope	spatial object	If applicable: application schemas of the local implementations of the MS.
5.1.4	Positional accuracy	Absolute or external accuracy	closeness of reported coordinate values to	dataset	Art. 68(1) of Regulation 2021/2116

			values accepted as or being true		(1:5000 equivalent scale)
5.1.5	Positional accuracy	Relative or internal accuracy	Closeness of reported coordinate values to values accepted as or being true	dataset	
5.1.6	Thematic accuracy	Quantitative attribute accuracy - percentage	Closeness of the value of a quantitative attribute to a value accepted or known to be true,	dataset	QE1a of the LPIS ETS Guidance
5.1.7	Thematic accuracy	Quantitative attribute accuracy – conformance	Closeness of the value of a quantitative attribute to a value accepted or known to be true,	dataset	QE1a of the LPIS ETS Guidance

Source: INSPIRE Data Specifications.

TG Recommendation 3. Quantitative evaluation of data quality elements

Where it is impossible to express the evaluation of a data quality element in a quantitative way, the evaluation of the element should be expressed with a textual statement as a data quality descriptive result.

The following subsections include the documentation of the data quality elements according to the standard documentation of ISO 19157. The measure identifiers included in the tables are the references from this standard.

5.1.1 Completeness – Commission

Data quality element 3 (QE3) aggregated at the level of the LPIS dataset informs about the reference parcels with critical defects. These reference parcels either holds a fundamental effect regarding the eligibility, in particular:

- in delineation of eligible area, or
- including such instances of a feature type that don't have any eligibility ground (parcels that don't include agricultural area, or non-agricultural eligible area)

These extra items in the LPIS dataset can be documented with the Commission data quality element according to ISO 19157.

TG Recommendation 4. Commission

Commission should be evaluated and documented using **excess item** as specified in the table below.

Name	**Excess item**
Alternative name	-
Data quality element	completeness
Data quality sub-element	commission

Data quality basic measure	error indicator
Definition	indication that an item is incorrectly present in the data
Description	-
Evaluation scope	spatial objects: ReferenceParcel
Reporting scope	data set: LpisDataSet,
Parameter	-
Data quality value type	Boolean (true indicates that the item is in excess)
Data quality value structure	-
Source reference	ISO 19157 Geographic information – Data quality
Example	Presence of excess items in a dataset: - Two reference parcels with critical defects have been found in the inspected sample.
Measure identifier	1

5.1.2 Logical consistency – Domain consistency

TG Recommendation 5 . Domain consistency

Domain consistency should be evaluated and documented using *value domain non-compliance* as specified in the table below.

Name	**Value domain non-conformance**
Alternative name	-
Data quality element	logical consistency
Data quality sub-element	domain consistency
Data quality basic measure	error indicator
Definition	indication of if an item is not in conformance with its value domain
Description	-
Evaluation scope	spatial objects: AgriculturalArea, NonAgriculturalReferenceArea, ReferenceParcel, AgriculturalParcel, LandscapeFeature, EcologicalFocusArea
Reporting scope	data set: LpisDataSet, GsaDataSet
Parameter	-

Data quality value type	Boolean (true indicates that an item is not in conformance with its value domain)
Data quality value structure	-
Source reference	ISO 19157 Geographic information – Data quality
Example	Presence of extra items in a non-extensible code list violating domain consistency: - Code list contains values out of attribute domain (e.g. non existing class codes)
Measure identifier	14
Comment	The evaluation is done against the LPIS/GSA data models as presented in Section 3 of this TG.

5.1.3 Logical Consistency – Topological consistency

This DQ element can be evaluated and reported when topology is directly encoded in the dataset. Such encoding is not specified in the data model presented in section 3. Nevertheless, the local implementations in the MS may include such encoding.

TG Recommendation 6 . Topological consistency

Topological consistency should be evaluated and documented using **number of invalid self-intersect errors, number of overlaps and number of slivers** as specified in the table below.

Name	**Number of invalid self-intersect errors**
Alternative name	loops
Data quality element	logical consistency
Data quality sub-element	topological consistency
Data quality basic measure	error count
Definition	count of all items in the data that illegally intersect with themselves
Description	-
Evaluation scope	spatial objects: AgriculturalArea, NonAgriculturalEligibleArea, ReferenceParcel, EcologicalFocusArea, LandscapeFeature, AgriculturalParcel
Reporting scope	data set: LpisDataSet, GsaDataSet
Parameter	-
Data quality value type	Integer
Data quality value structure	-

Source reference	ISO 19157 Geographic information – Data quality
Example	Number of loops („figure eight" forming AgriculturalArea or AgriculturalParcel polygons) present
Measure identifier	26
Comment	This measure is applicable to EcologicalFocusArea and LandscapeFeature only if they are represented with GM_surface.

5.1.4 Data Quality – Positional accuracy – Absolute or external accuracy

TG Recommendation 7 . Absolute or external accuracy

Absolute or external accuracy should be evaluated and documented using **root mean square error of planimetry** as specified in the table below.

Name	**Root mean square error of planimetry**
Alternative name	RMSEP
Data quality element	positional accuracy
Data quality sub-element	absolute or external accuracy
Data quality basic measure	-
Definition	radius of a circle around the given point, in which the true value lies with probability P.
Description	-
Evaluation scope	spatial objects: AgriculturalArea, ReferenceParcel, EcologicalFocusArea, NonAgriculturalEligibleArea, LandscapeFeature AgriculturalParcel
Reporting scope	data set: LpisDataSet, GsaDataSet
Parameter	-
Data quality value type	Real
Data quality value structure	-
Source reference	ISO/DIS 19157 Geographic information – Data quality
Example	Absolute or external positional accuracy of LPIS/GSA data can be determined based on control points directly measured on the terrain by and independent method (e.g. GPS measurement, surveying).
Measure identifier	47
Comment	This measure is applicable to EcologicalFocusArea and LandscapeFeature only if they are represented with GM_surface.

5.1.5 Data Quality – Positional accuracy – Relative or internal accuracy

TG Recommendation 8 . Relative or internal accuracy

Relative or internal accuracy should be evaluated and documented using **root mean square error of planimetry** as specified in the table below.

Name	**Root mean square error of planimetry**
Alternative name	RMSEP
Data quality element	positional accuracy
Data quality sub-element	relative or internal accuracy
Data quality basic measure	-
Definition	radius of a circle around the given point, in which the true value lies with probability P
Description	-
Evaluation scope	spatial objects: AgriculturalArea, NonAgriculturalEligibleArea, ReferenceParcel, EcologicalFocusArea, LandscapeFeature AgriculturalParcel
Reporting scope	data set: LPISDataSet, GSADataSet
Parameter	-
Data quality value type	Real
Data quality value structure	-
Source reference	ISO 19157 Geographic information – Data quality
Example	Relative or internal accuracy of LPIS/GSA data is usually determined as the accuracy of delineation of LPIS/GSA boundaries relative to the underlying Earth Observation imagery which serves as basis for derivation of the LPIS/GSA data.
Measure identifier	47
Comment	This measure is applicable to EcologicalFocusArea and LandscapeFeature only when they are represented with GM_surface.

5.1.6 Data Quality – Thematic accuracy – Quantitative attribute accuracy - percentage

TG Recommendation 9 **. Quantitative attribute accuracy**
Thematic accuracy should be evaluated and documented using **Quantitative attribute accuracy - percentage** as specified in the table below.

Name	**Quantitative attribute accuracy - percentage**
Alternative name	QE1a - percentage
Data quality element	thematic accuracy
Data quality sub-element	Quantitative attribute accuracy - percentage
Data quality basic measure	Percentage of correctly quantified area
Definition	Percentage of the eligible hectares as observed, with respect to all eligible hectares recorded
Description	-
Evaluation scope	spatial objects: ReferenceParcel,
Reporting scope	data set: LpisDataSet,
Parameter	-
Data quality value type	Real
Data quality value structure	-
Source reference	LPIS Technical Guidance for ETS
Example	The rate of missing agricultural area is 0.24
Measure identifier	10201

5.1.7 Data Quality – Thematic accuracy – Quantitative attribute accuracy - conformance

TG Recommendation 10 **. *Non-quantitative attribute accuracy***
Non-quantitative attribute accuracy should be evaluated and documented using **Quantitative attribute accuracy - conformance** as specified in the table below.

Name	**Quantitative attribute accuracy - conformance**
Alternative name	QE1a - conformance
Data quality element	thematic accuracy
Data quality sub-element	Quantitative attribute accuracy - conformance

Data quality basic measure	pass
Definition	Closeness of the value of a quantitative attribute to a value accepted or known to be true.
Description	-
Evaluation scope	spatial objects: ReferenceParcel
Reporting scope	data set: LpisDataSet
Parameter	-
Data quality value type	Boolean
Data quality value structure	-
Source reference	ISO/DIS 19157 Geographic information – Data quality
Example	Pass: true
Measure identifier	10201

5.2 Minimum data quality requirements

Minimum quality requirements are defined for the following data quality elements:

- Positional accuracy
- Completeness – Commission
- Thematic accuracy – Quantitative and qualitative attribute accuracy (percentage and conformance)

A general requirement against the LPIS and GSA datasets stipulated by Art 70(1) of R 1306/2013[25] Art. 68(1) or R (EU) 2021/2116 is that they have to fulfil the requirements of positional accuracy of mapping in scale 1:5000.

As for Completeness and Thematic accuracy please refer to the ETS guidance (European Commission JRC 2016).

[25] Until 2016 positional accuracy corresponding to scale 1:10 000 was sufficient.

6 Dataset level metadata

Dataset level metadata are currently dealt with in JRC Technical Report "Technical Guidelines on IACS Spatial Data Sharing – Part 1 – Data discovery" (Tóth and Milenov 2020), which may be updated, based on the outcomes of the review process of this TG which will lead to the endorsement of its final version.

7 Delivery

7.1 Updates

According to INSPIRE the changes within a dataset have to be published within 6 month. In case of bulk changes (corrections) this time starts from the date when the last change has been approved or validated in the dataset.

TG Requirement 16 Updates
1. Member States shall make available updates of data on a regular basis.
2. All updates shall be made available at the latest 6 months after the change was applied in the source data set.

7.2 Delivery medium

According to Article 11(1) of the INSPIRE Directive, Member States shall establish and operate a network of services for INSPIRE spatial data sets and services. The relevant network service types for making spatial data available are:

— view services making it possible, as a minimum, to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata;

— download services, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly;

— transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability.

For the relevant requirements and recommendations for network services, see the relevant INSPIRE Implementing Rules and Technical Guidelines available at https://inspire.ec.europa.eu/network-services/41.

EXAMPLE 1 Through the Get Spatial Objects function, a download service can either download a pre-defined data set or pre-defined part of a data set (non-direct access download service), or give direct access to the spatial objects contained in the data set, and download selections of spatial objects based upon a query (direct access download service). To execute such a request, some of the following information might be required:

— the list of spatial object types and/or predefined data sets that are offered by the download service (to be provided through the Get Download Service Metadata operation),

— and the query capabilities section advertising the types of predicates that may be used to form a query expression (to be provided through the Get Download Service Metadata operation, where applicable),

— a description of spatial object types offered by a download service instance (to be provided through the Describe Spatial Object Types operation).

EXAMPLE 2 Through the Transform function, a transformation service carries out data content transformations from native data forms to the INSPIRE-compliant form and vice versa. If this operation is directly called by an application to transform source data (e.g. obtained through a download service) that is not yet conformant with this data specification, the following parameters are required:

Input data (mandatory). The data set to be transformed.

— Source model (mandatory, if cannot be determined from the input data). The model in which the input data is provided.

— Target model (mandatory). The model in which the results are expected.

— Model mapping (mandatory, unless a default exists). Detailed description of how the transformation is to be carried out.

7.3 Encodings

TG Requirement 17 **Encoding**
1. Every encoding rule used to encode spatial data shall conform to EN ISO 19118. In particular, it shall specify schema conversion rules for all spatial object types and all attributes and association roles and the output data structure used.
2. Every encoding rule used to encode spatial data shall be made available.

ISO 19118:2011 specifies the requirements for defining encoding rules used for interchange of geographic data within the set of International Standards known as the "ISO 19100 series". An encoding rule allows geographic information defined by application schemas and standardised schemas to be coded into a system-independent data structure suitable for transport and storage. The encoding rule specifies the types of data being coded and the syntax, structure and coding schemes used in the resulting data structure. Specifically, ISO 19118:2011 includes:

— requirements for creating encoding rules based on UML schemas,

— requirements for creating encoding services, and

— requirements for XML-based encoding rules for neutral interchange of data.

This TG proposes to make LPIS and GSA datasets available at least in the default encoding(s) specified in section 7.3.1. In this section, a number of TG requirements are listed that need to be met in order to be conformant with the default encoding(s).

The proposed default encoding(s) are conformant with ISO 19118.

7.3.1 Default Encoding(s)

7.3.1.1 Specific requirements for GML encoding

This data specification proposes the use of GML as the default encoding, as recommended in sections 7.2 and 7.3 of DS-D2.7 - Guidelines for the encoding of spatial data (INSPIRE Data Specifications Drafting Team 2010). GML is an XML encoding in compliance with ISO 19118. For details, see [ISO 19136], and in particular Annex E (UML-to-GML application schema encoding rules).

The following TG requirements need to be met in order to be conformant with GML encodings.

TG Requirement 18 **Encoding**
Data instance (XML) documents shall validate without error against the provided XML schema.

Not all constraints defined in the application schemas can be mapped to XML. Therefore, the following requirement is necessary.

NOTE: The obligation to use only the allowed code list values specified for attributes and most of the constraints defined in the application schemas cannot be mapped to the XML schema. They can therefore not be enforced through schema validation. It may be possible to express some of these constraints using other schema or rule languages (e.g. Schematron), in order to enable automatic validation.

7.3.1.2 Default encoding(s) for LPIS and GSA application schemas

Name: LPIS GML Application Schema and GSA GML Application Schema

Version: version 1.0; Specification: This TG; Character set: UTF-8

For testing purposes the xml schemas document is available[26] at https://www.epsilon-italia.it/public/IACS/LPIS.xsd and at https://www.epsilon-italia.it/public/IACS/GSAA.xsd.

[26] The finalised schemas will be uploaded in a registry operated in the EU domain.

7.3.1.3 Alternative Encoding

TG Recommendation 11. Use of GeoPackage encoding

Data providers should create their data using the OGC GeoPackage encoding standard, particularly suitable for managing and exchanging large datasets and optimised for data usability in GIS environments. In that case, the INSPIRE Good Practice for the GeoPackage encoding of INSPIRE datasets should be referenced.

Note. Other alternative encodings (apart from GeoPackage), duly endorsed by the INSPIRE Maintenance and Implementation Group (MIG), might be defined as INSPIRE Good Practices in the INSPIRE Good Practice library[27]:

[27] https://inspire.ec.europa.eu/portfolio/good-practice-library

8 Data Capture

The data capture should follow the general rules of mapping in scale 1:5000. In addition, for specific procedures of digitising elements of the LPIS dataset, refer to the current version of the Technical Guidance of LPIS Update (European Commission, JRC 2015)

9 Portrayal

This clause defines the rules for layers and styles to be used for portrayal of the spatial object types defined for LPIS and GSA data model.

TG Requirement 19 **Portrayal**
For the portrayal of spatial data sets using a view network service as specified in Commission Regulation No 976/2009, the following should be available:
(a) the layers specified in Section 9.1;
(b) for each layer at least a default portrayal style, with as a minimum an associated title and a unique identifier.

For each layer, Section 9.1 defines the following:
(a) a human readable title of the layer to be used for display in user interface;
(b) the spatial object type(s), or sub-set thereof, that constitute(s) the content of the layer.

9.1 Layers to be provided by INSPIRE view services

Table 6. LPIS layers to be provided by INSPIRE view services

Layer Name	Layer Title	Spatial object type(s)	Keywords
LPIS.AgriculturalArea	LPIS Agricultural Area	Agricultural Area	LPIS, Agricultural Area
LPIS NonAgriculturalEligibleArea	LPIS Non Agricultural Eligible Area	Non Agricultural Eligible Area	LPIS, Non Agricultural Eligible Area
LPIS ReferenceParcel	LPIS Reference Parcel	Reference Parcel	LPIS, Reference Parcel
LPIS.LandscapeFeature	LPIS Landscape Feature	Landscape Feature	LPIS, Landscape Feature
LPIS.EcologicalFocusArea	LPIS Ecological Focus Area	Ecological Focus Area	LPIS, Ecological Focus Area

Table 7. GSA layer to be provided by INSPIRE view services

Layer Name	Layer Title	Spatial object type(s)	Keywords
GSA.AgriculturalParcel	GSA Agricultural Parcel	Agricultural Parcel	GSA, Agricultural Parcel

TG Recommendation 12. Keywords in Layers Metadata parameters of the INSPIRE View service

It is recommended to use the keywords specified in Section 9.1 in the Layers Metadata parameters of the INSPIRE View service (see Annex III, Part A, section 2.2.4 in Commission R (EC) No 976/2009).

The layers specified in Table 5 can be further classified using a code list-valued attribute.

TG Requirement 20 **Portrayal**

For spatial object types whose objects can be further classified using a code list-valued attribute, several layers may be defined. Each of these layers shall include the spatial objects corresponding to one specific code list value. In the definition of such sets of layers:

(a) the placeholder <CodeListValue> shall represent the values of the relevant code list, with the first letter in upper case;

(b) the placeholder <human-readable name> shall represent the human-readable name of the code list values;

(c) the spatial object type shall include the relevant attribute and code list, in parentheses;

(d) one example of a layer shall be given.

Section 9.2 specifies one style for each of layer specified in this section. It is proposed that INSPIRE view services support this style as the default style required by TG Requirement 19.

TG Requirement 21 **Styles**

For each layer specified in this section, the styles defined in section 9.2 shall be available.

9.2 Styles required to be supported by INSPIRE view services

9.2.1 Styles for the layer LPIS.AgriculturalArea

<table>
<tr><th>Style Name</th><th>LPIS.AgriculturalArea.Default</th></tr>
<tr><td>Default Style</td><td>yes</td></tr>
<tr><td>Style Title</td><td>Agricultural Area Default Style</td></tr>
<tr><td>Style Abstract</td><td>AgriculturalArea objects filled with a colour depending on the value of the attribute from agriculturalAreaType nomenclature and their boundaries as black lines of 2 pixels
<table>
<tr><th>AgriculturalAreaTypeValue</th><th>colour</th><th>red</th><th>Green</th><th>blue</th></tr>
<tr><td>arableLand</td><td></td><td>180</td><td>230</td><td>110</td></tr>
<tr><td>permanentCrop</td><td></td><td>180</td><td>120</td><td>240</td></tr>
<tr><td>permanentGrassland</td><td></td><td>240</td><td>120</td><td>100</td></tr>
<tr><td>afforestedArea</td><td></td><td>152</td><td>72</td><td>6</td></tr>
</table></td></tr>
<tr><td>Symbology</td><td>The SLD specifying the symbology is distributed in a file separately from the data specification document.</td></tr>
<tr><td>Minimum & maximum scales</td><td>No scale limit.</td></tr>
</table>

9.2.2 Styles for the layer LPIS.NonAgriculturalEligibleArea

Style Name	LPIS.NonAgriculturalEligibleArea.Default
Default Style	yes

Style Title	Non Agricultural Eligible Area Default Style
Style Abstract	NonAgriculturalEligibleArea objects filled with a colour depending on the value of the attribute from nonAgriculturalEligibleAreaType nomenclature and their boundaries as black lines of 2 pixels

NonAgriculturalEligibleAreaTypeValue	*colour*	*red*	Green	blue
wetland		93	104	249
peatland		102	153	0
riverBasinManagement		149	179	215
Natura2000		0	255	0
otherEnvironmentalRestriction		79	98	40

Symbology	The SLD specifying the symbology is distributed in a file separately from the data specification document.
Minimum & maximum scales	No scale limit.

9.2.3 Styles for the Layer LPIS.ReferenceParcel

Style Name	**LPIS.ReferenceParcel.Default**
Default Style	yes
Style Title	ReferenceParcel Default Style
Style Abstract	ReferenceParcel objects filled with yellow colour (#FFFFCC) and their boundaries as black lines of 2 pixels.
Minimum & maximum scales	No scale limit.

9.2.4 Styles for the layer LPIS.LandscapeFeature

Style Name	**LPIS.LandscapeFeature.Default**
Default Style	yes
Style Title	Landscape Feature Default Style
Style Abstract	LandscapeFeature objects filled with a colour depending on the value of the attribute from landscapeFeatureType nomenclature and their boundaries as black lines of 2 pixels.

	LandscapeFeatureTypeValue	*colour*	*red*	Green	blue
	grassy		0	176	80
	stony		166	166	166
	wet		49	132	155
	woody		153	51	0
Symbology	The SLD specifying the symbology is distributed in a file separately from the data specification document.				
Minimum & maximum scales	No scale limit				

9.2.5 Styles for the layer LPIS.EcologicalFocusArea

Style Name	**LPIS.EcologicalFocusArea.Default**				
Default Style	yes				
Style Title	Ecological Focus Area Default Style				
Style Abstract	EcologicalFocusArea objects filled with a colour depending on the value of the attribute from ecologicalFocusAreaType nomenclature and their boundaries as black lines of 2 pixels.				
	LandscapeFeatureTypeValue	*colour*	*red*	Green	blue
	afforestedAreas		152	72	6
	bufferStrips		0	204	0
	hectaresOfArgoForestry		153	102	0
	landscapeFeatureDitches		141	179	226
	landscapeFeatureFieldMargin		194	214	155
	landscapeFeatureGroupOfTrees		102	51	0
	landscapeFeatureIsolatedTree		148	138	84
	landscapeFeatureOtherProtectedByGaecSmr		255	0	102
	landscapeFeaturePonds		23	54	93
	landscapeFeaturesHedgesWoodedStrips		196	188	150

	landscapeFeatureTraditionalStoneWalls		128	128	128
	landscapeFeatureTreesInLine		152	72	6
	stripsOfEligibleHectaresAlongForestEdgesWithoutProduction		220	60	240
	terraces		191	191	191
Symbology	The SLD specifying the symbology is distributed in a file separately from the data specification document.				
Minimum & maximum scales	No scale limit.				

10 Conclusions

A proposal to solve the lack of harmonisation of LPIS and GSA datasets across Europe, which is currently a big obstacle to IACS data sharing and interoperability, has been provided in this technical guidance TG.

A common data model for LPIS datasets and another for GSA datasets, together with a full data specification in INSPIRE compliant form have been provided, along with the related gml application schemas. These artefacts are supposed to solve interoperability within INSPIRE and thus, reusability of the data.

Besides preserving the IACS semantics, the proposed solution has the additional advantage of supporting the relevance of IACS spatial datasets to INSPIRE. The adoption of the LPIS data model for the harmonisation of LPIS datasets facilitates the creation of three INSPIRE conformant LU/LC datasets from each harmonised LPIS dataset.

A preliminary test of this TG, described in Annex 1, has been executed, producing a harmonised LPIS dataset from the original 'as-is' LPIS dataset.

A conceptual mapping from the LPIS data model to two INSPIRE data themes (LU/LC) and from the GSA data model to the INSPIRE theme LU have been developed[28] and provided in Annexes 2, 3 and 4.

Regarding the roadmap to endorse the LPIS and GSA data specifications, the TG contained in this report will be shared with DG AGRI, the Paying Agencies (PA) and the custodians of the LPIS and GSA data. The specifications in this TG will be tested by means of voluntary pilots. The feedback collected will lead to a revision of the TG and the publication of the final version. In parallel, the endorsement procedure will be discussed and agreed with JRC, DG AGRI and the INSPIRE MIG (Maintenance and Implementation Group).

[28] Mapping to LC and LU INSPIRE data themes is not mandatory.

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List of abbreviations and definitions

a.k.a	Also known as
AECM	Agri-environment-climate Measures.
AM	Area management / restriction / regulation zones & reporting units
Art.	Article
CAP	Common Agricultural Policy
CP	Cadastral Parcels
CRS	Coordinate Reference System
DG AGRI	Directorate General Agriculture
DQ	Data quality
ID	Identifier
EFA	Ecological Focus Area
EN	European norm
EPSG	European Petroleum Survey Group
ETS	Executive Test Suite
GAEC	Good agricultural and environmental conditions
GIS	Geographic Information System
GML	Geography Markup Language
GSA	Geo Spatial Application
GSAA	Geo Spatial Aid Application
IACS	Integrated Administration and Control Systems
INSPIRE	Infrastructure for Spatial Information in Europe
ISO	International Standards Organisation
JRC	Joint Research Centre
LC	Land Cover
LF	Landscape feature
LUCAS	Land Use / Cover Area Frame Survey
LQ	Limiting Quality
LPIS	Land Parcel Identification System
LU	Land Use
LUCAS	Land Use/Cover Area frame Survey
MIG	(INSPIRE) Maintenance and Implementation Group
MS	Member States
OGC	Open Geospatial Consortium
PA	Paying Agencies
QA	Quality assessment
QE	Quality element
R	Regulation
RDF	Resource Description Framework

SKOS	Simple Knowledge Organisation System
SMR	Statutory management requirements
TC	Technical Committee
TG	Technical Guidelines
UML	Unified Modeling Language
XML	Extensible Markup Language
XSD	XML Schema Definition

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Annex 1. Extension example of the agricultural area code list in Bulgaria

Art. 4(1)(e) of R 1307/2013 and Art. 4(3) of R2021/2115 define arable land, permanent grassland and permanent crop as applicable categories of agricultural area. This is the minimum semantic content and granularity that has to be included in the LPIS dataset. According to the principle of subsidiarity, MS have the right to define such implementation options that fit the best to their local practices. Such implementation option is extending the AgriculturalAreaType code list with any value, provided that none of the values overrides the Further original definitions of these types.

Bulgaria has developed the LPIS system based on measurement of the visible physical boundaries on a digital orthophoto map of aerial/satellite photography and as a type of reference parcel – a physical block. The physical block is continuous land occupied by one or more crop groups within single agricultural land cover, declared by one or more farmers, limited most often by natural boundaries.

The most important characteristic of the Bulgarian LPIS design is that LPIS has a full coverage of the country's territory with PhB – agricultural and non-agricultural lands which give reliable information about the land cover and land use. The types presented in **Table 7** are used:

Table 8. Extended code list for the LPIS implementation in Bulgaria

Type	**Description**	**Extension method**	**Parent type (only for narrower)**
areasaassociateToSettlements	Areas associated to settlements	any	n.a..
courtyards	Courtyards within the settlements with mixed land cover.	any	n.a.
mixedLandUse	Mixed land use. Areas with more than one permanent use (arable land, grassland, or permanent crop), with areas less than 0.2 ha or not separated from a permanent topographic element,	any	n.a.
shrub	Area covered with shrub and grass, currently defined as non-agricultural area.	any	n.a.
shortRotationCoppice	Perennial crops with short rotation cycle. For eligibility,	narrower	permanentCrop
forest	Wooded lands, suitable for silvicultural activities	any	n.a.
waterAndWetZones	Water areas and wet zones	any	n.a.

Annex 2. Extension of the functional LF types in Lithuania

The granularity of LF types used in the MS is finer than the four functional categories defined in (Czucz et al. 2022). When publishing LF data in INSPIRE, MS may opt to:

— Map their original types to the four functional types and publish the latter only,

— Publish the original types together with their code list in an INSPIRE conformant register (see TG Requirements 5 ,6 and 7)

In the following table we provide an example of mapping national LF types to the functional classes. In case of Lithuania, only three functional types are applicable, as stony features are not present in the country. The mapping provided in **Table 9** was performed in course of the IACS/INSPIRE interoperability pilots.

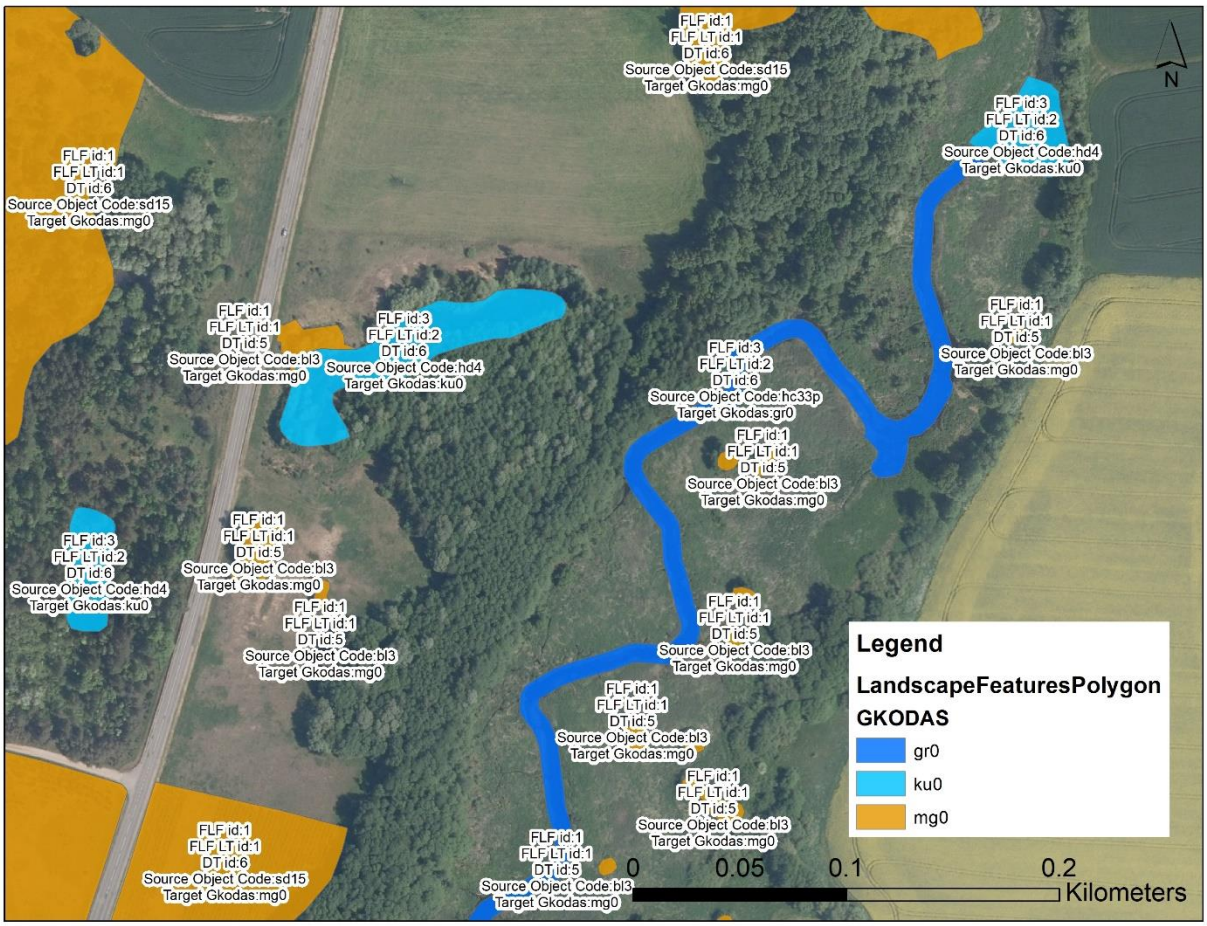
Table 9. Lithuanian LF classes and coded values mapped to the functional LF types

Functional LF (FLF) class	Description	National code	Feature class delineation conditions	Geometric specifications
Woody features	Trees in group	mg0	The element must be interspersed with or limited to the arable land. It is also permissible to limit to: - ineligible areas; - declared areas of permanent grassland and / or permanent crops.	0.01 ha >= area <= 0.3 ha
	Woody vegetation	mg0		
Wet features	Ponds with riparian vegetation	ku0		0.005 ha >= area <= 0.3 ha
	Ditches	gr0	Not more than 5 m from the arable land	width >= 10 m
	Inland channels of fresh water from 1 m wide	gr0		
Grassy features	Grassy strips (field margins) those area and configuration unchanged for 3 years or more	az0	Areas adjacent to arable land, woodlands, roads, ditches, other bodies of water	1m >= width <= 20m OR area >=0,1 ha

Source: Kuciene 2002. (link will be inserted after uploading the reports in MarsWiki).

The landscape features as appear on orthoimagery are shown in **Figure 10**.

Figure 10. Mapping example of Lithuanian LF types mapped to the woody, grassy and wet functional classes



Source: Source Kuciene 2002. (link will be inserted after uploading the reports in MarsWiki).

Annex 3. Example of LPIS harmonised dataset in Lithuania

In order to test the usability of the LPIS application schema described in this report, a data harmonisation exercise has been done, consisting in the transformation of a source LPIS sample datasets of Lithuanian and Slovakian test areas. Here we provide the results of the Lithuanian test case. The Slovakian test case concluded with similarly positive feasibility results.

The Lithuanian sample data was accessed through the INSPIRE geoportal in "as-is" form, i.e. in ESRI geodatabase format. In course of testing, a harmonised GML LPIS dataset has been produced using Hale Studio software.

Screenshots of its visualisation in QGIS, obtained using the portrayal styles described in sections 9.2.1 and 9.2.2, are shown in the following figures, from which the benefits of the availability of LPIS harmonised datasets across EU are evident.

Figure 11. Thematisation of AgriculturalArea features according to agriculturalAreaType values

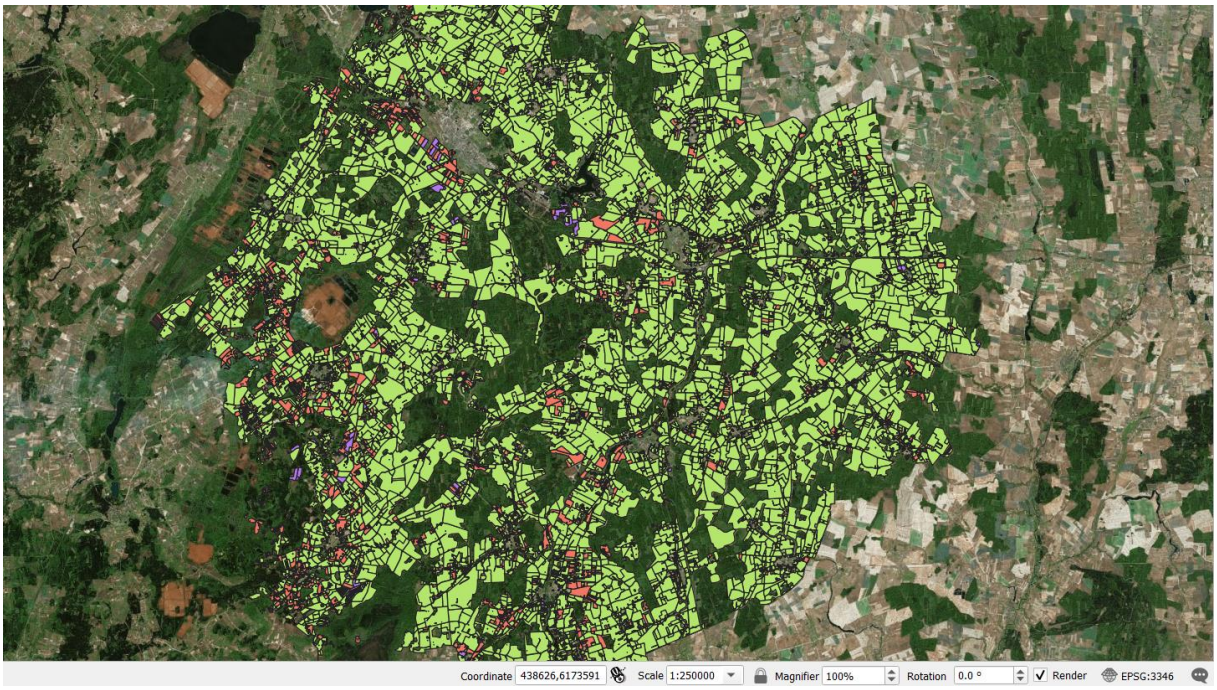


Figure 12. Attributes of a selected AgriculturalArea feature

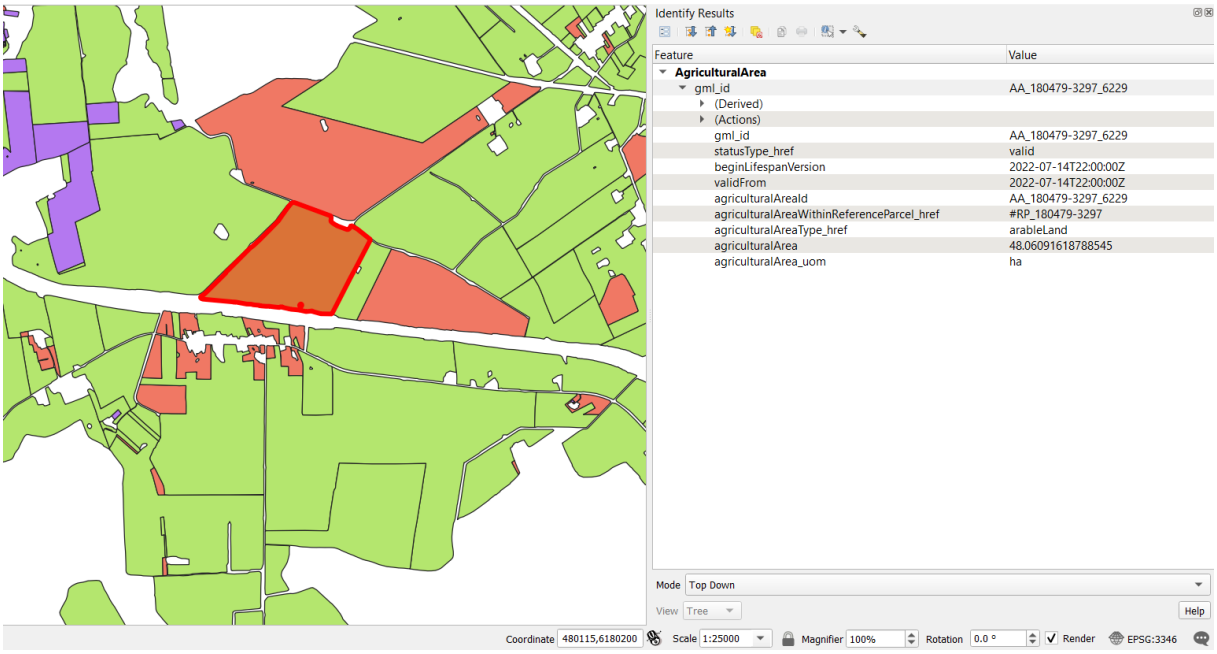
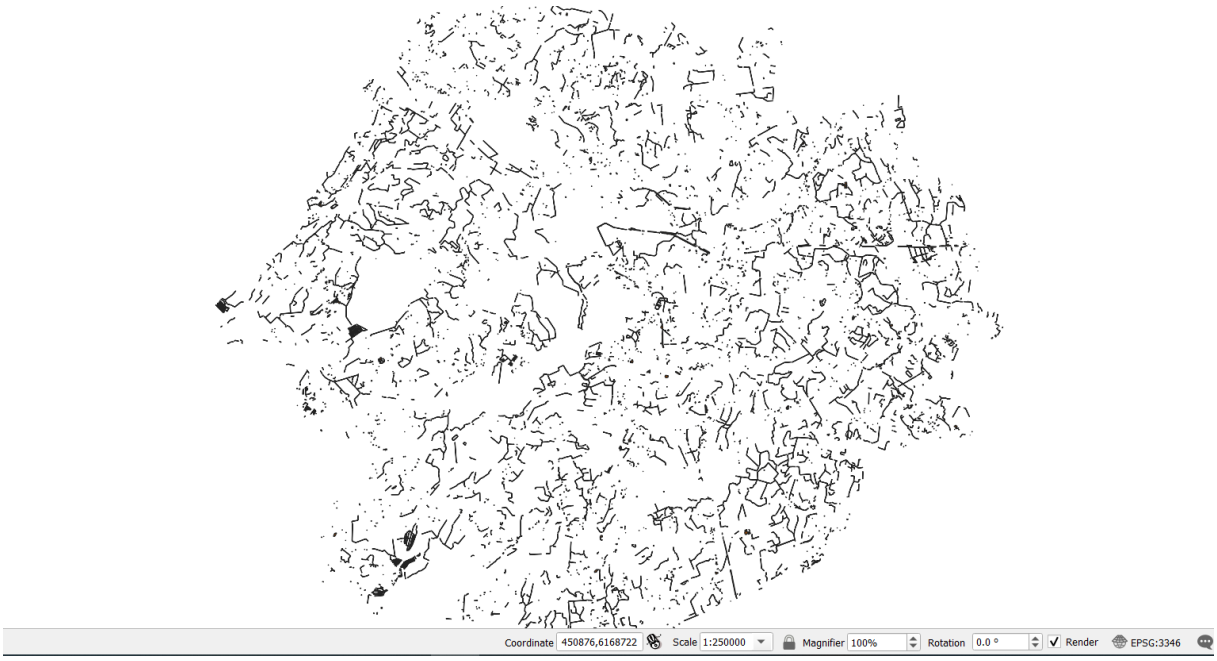


Figure 13. Thematisation of LanscapeFeature features according to landscapeFeatureType values



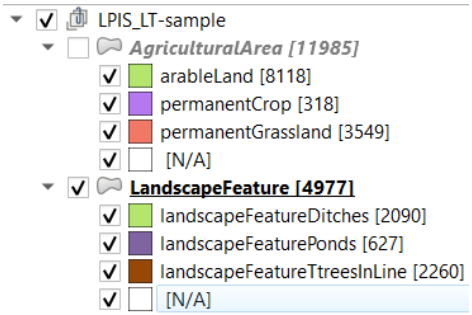
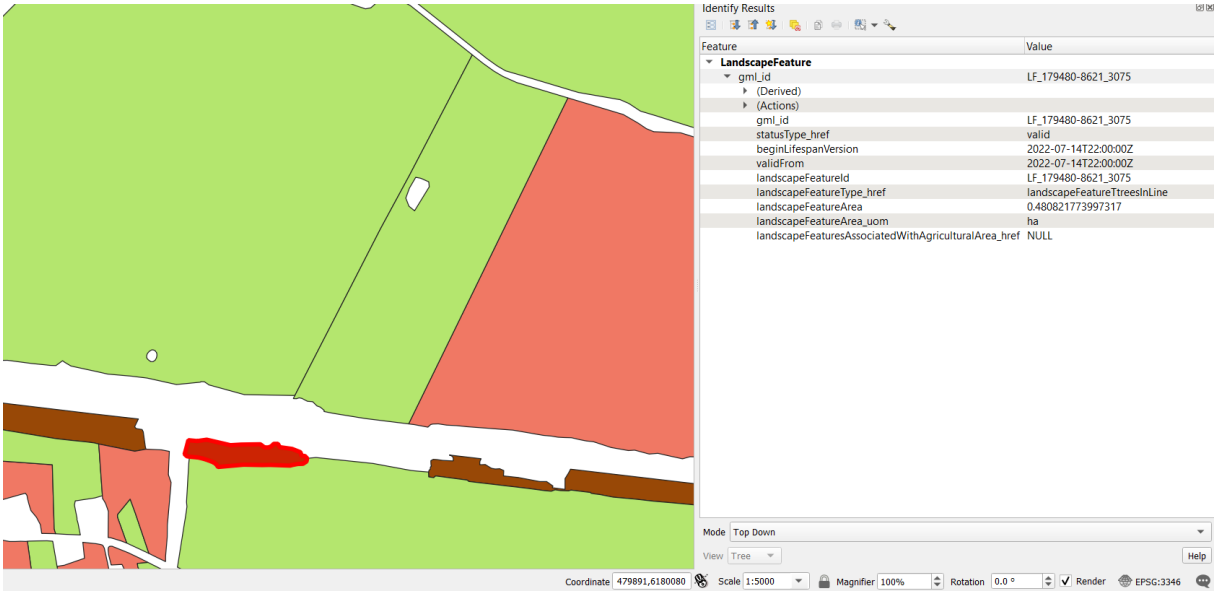


Figure 14. Attributes of a selected LandscapeFeature feature



Annex 4. Example of LPIS data transformation toward INSPIRE LC data theme

The similarity in scope between the LPIS LandscapeFeature and EcologicalFocusArea featureTypes and the INSPIRE LandCoverUnit featureType enables the creation of two INSPIRE LC datasets (conformant to the LandCoverVector and LandCoverNomenclature application schemas) from a LPIS dataset (harmonised according to the LPIS schema described in this report). A conceptual mapping from LPIS LandscapeFeature featureType to INSPIRE LandCoverUnit featureType is shown in **Figure 15** and **Error! Reference source not found.**, whilst a conceptual mapping from LPIS EcologicalFocusArea featureType to INSPIRE LandCoverUnit featureType is shown in **Figure 16** and **Table 11**.

Figure 15. Conceptual mapping from LPIS LandscapeFeature featureType to INSPIRE LandCoverUnit featureType

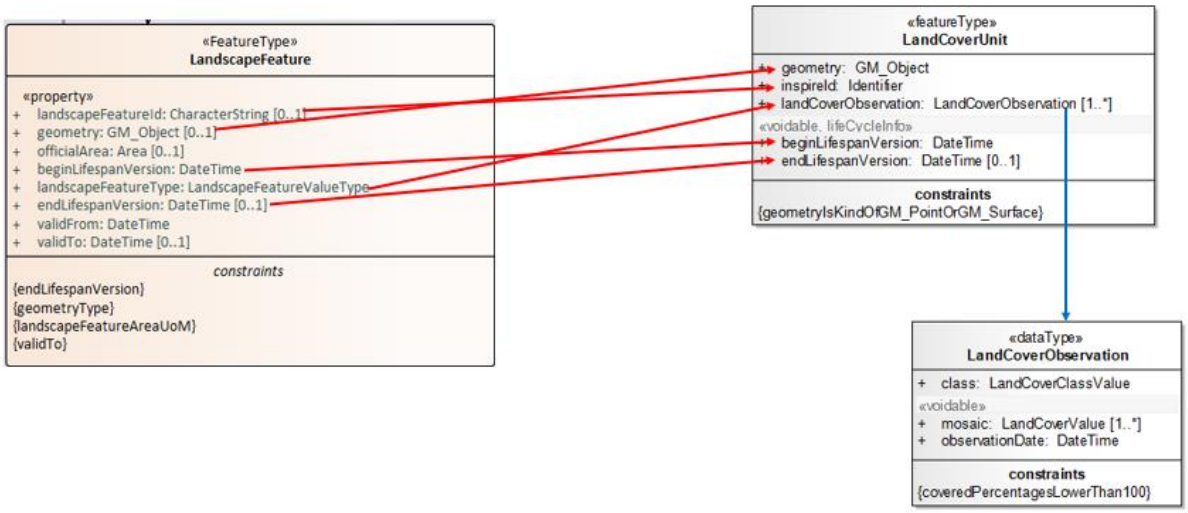


Table 10. Conceptual mapping table from LPIS LandscapeFeature featureType to INSPIRE LandCoverUnit featureType

LPIS – Landscape feature	**INSPIRE – Land cover unit**
landscapeFeafureId	inspireId
geometry	geometry
landscapeFeatureType	landCoverObservation
beginLifespanVersion	beginLifespanVersion
endLifespanVersion	endLifespanVersion

Figure 16. Conceptual mapping from LPIS EcologicalFocusArea featureType to INSPIRE LandCoverUnit featureType

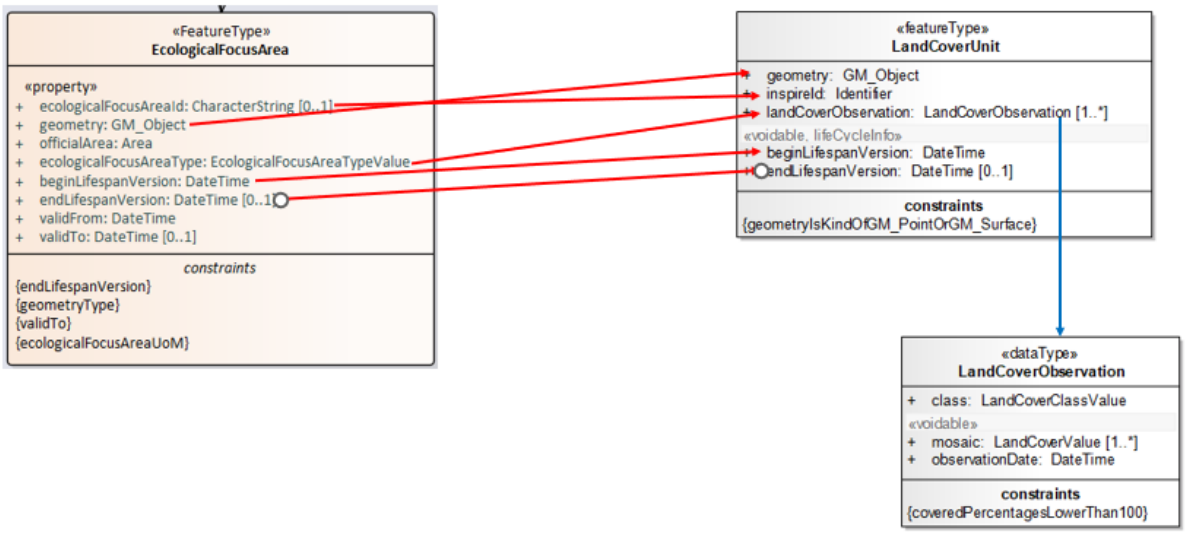


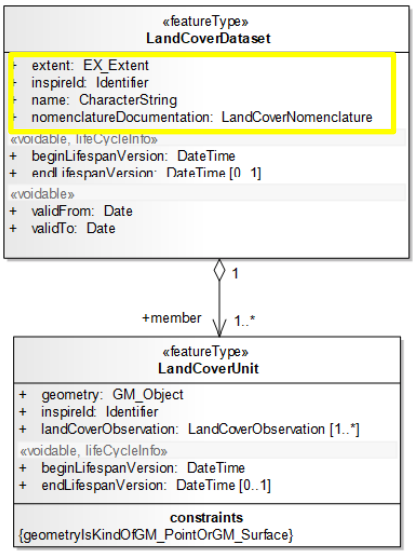
Table 11 Conceptual mapping table from LPIS EcologicalFocusArea featureType to INSPIRE LandCoverUnit featureType

LPIS – Ecological focus area	**INSPIRE – Land cover unit**
ecologicalFocusareaId	inspireId
geometry	geometry
ecologicalFocusAreaType	landCoverObservation
beginLifespanVersion	beginLifespanVersion
endLifespanVersion	endLifespanVersion

Starting from this conceptual mapping, a detailed mapping table could be created, facilitating the final data transformation step consisting in the implementation of the mapping rules in a data transformation software, such as Hale Studio or FME.

It is to be highlighted that creating an INSPIRE LC dataset (conformant to the LandCoverVector schema) requires to create one LandCoverDataset feature, of which one to many LandCoverUnits are members, as shown in **Figure 17**.

Figure 17. Relationship between INSPIRE LandCoverDataset featureType and LandCoverUnit featureType



Therefore, one LandCoverDataset feature has to be created and a value has to be assigned to the attributes in the yellow box in **Figure 17**:

- extent: according to ISO 19115, it can be realized through a bounding polygon, a geographic bounding-box or a geographic description (e.g. name of a region …),
- inspireId: an identifier has to be assigned, according to the instructions provided in section 3.2.5,
- name: a textual name has to be assigned by the data provider,
- nomenclatureDocumentation: this attribute allows to provide documentation on the nomenclature used in the data set. Please note that the core model supports only one nomenclature per data set. According to the INSPIRE LandCoverVector application schema, this nomenclature "can be CORINE, another European nomenclature, a national one or any other LC nomenclature", modelled with the UML class LandCoverNomenclature. In this specific case it will be related to the nomenclature used in the LandscapeFeatureValueType codeList, whose values will be used to populate the class attribute of LandCoverObservation.

Annex 5. Example of GSA data transformation toward INSPIRE LU data theme

The similarity in scope between the GSA AgriculturalParcel featureType and the INSPIRE ExistingLandUseObject featureType enables the creation of an INSPIRE LU dataset (conformant to the ExistingLandUse application schema) from a GSA dataset (harmonised according to the GSA schema described in this report). A conceptual mapping from GSA AgriculturalParcel featureType to INSPIRE ExistingLandUseObject featureType is shown in **Figure 18**.

Figure 18. Conceptual mapping from GSA AgriculturalParcel featureType to INSPIRE ExistingLandUseObject featureType

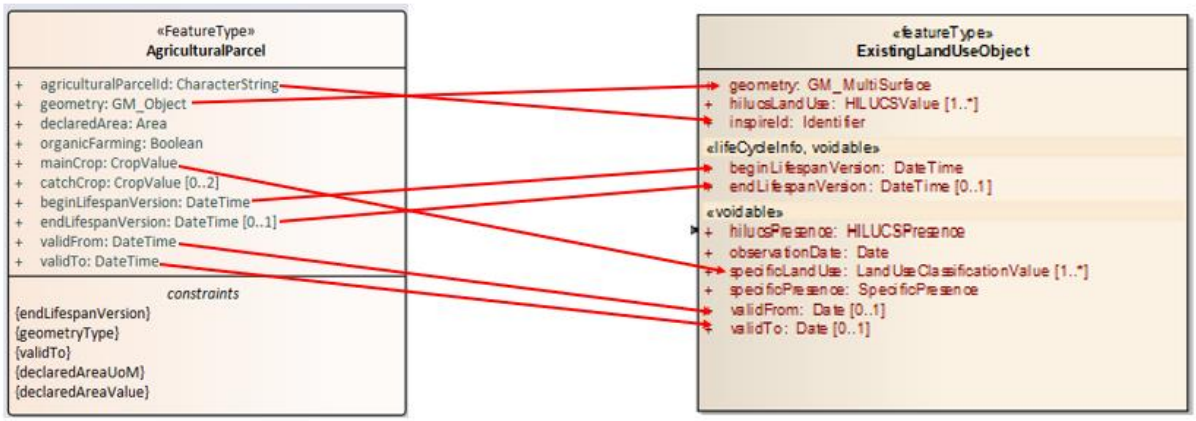


Table 12. Conceptual mapping table from GSA AgriculturalParcel featureType to INSPIRE ExistingLandUseObject featureType

GSA – Agricultural parcel	**INSPIRE – Land use unit**
agriculturalParcelId	inspireId
geometry	geometry
mainCropValue	specificLandUse
beginLifespanVersion	beginLifespanVersion
endLifespanVersion	endLifespanVersion
validFrom	validFrom
validTo	validTo

Starting from this conceptual mapping, a detailed mapping table could be created, facilitating the final data transformation step consisting in the implementation of the mapping rules in a data transformation software, such as Hale Studio or FME.

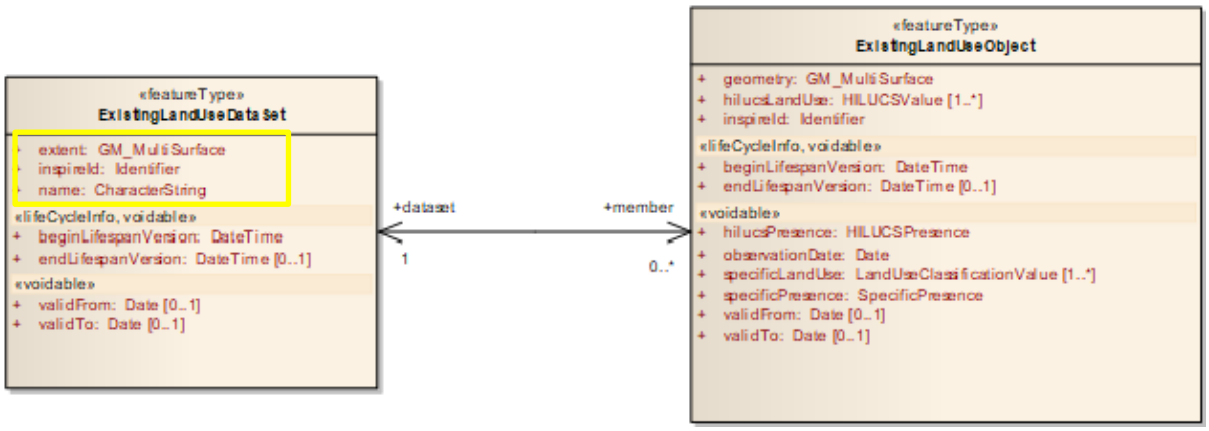
Regarding the INSPIRE mandatory attribute hilucsLandUse, it will be populated with the value "agriculture"[29] taken from the INSPIRE HILUCS codeList[30], whilst the GSA attribute crop will be mapped to the INSPIRE

[29] https://inspire.ec.europa.eu/codelist/HILUCSValue/1_1_Agriculture
[30] https://inspire.ec.europa.eu/codelist/HILUCSValue

specificLandUse attribute, whose related LandUseClassificationValue codeList will be created and populated with the values of the GSA CropValue codeList.

It is to be highlighted that creating an INSPIRE LU dataset (conformant to the ExistingLandUse schema) requires to create one ExistingLandUseDataSet feature, of which one to many ExistingLandUSeObject are members, as shown in **Figure 19**.

Figure 19. Relationship between INSPIRE ExistingLandUse featureType and ExistingLandUseObject featureType



Therefore, one ExistingLandUseDataSet feature has to be created and a value has to be assigned to the attributes in the yellow box in **Figure 19**:

- extent: the extent of an ExistingLandUseDataset is defined as the boundary of the union of all the polygons (ExistingLandUseObject) that are a member of the ExistingLandUseDataset,
- inspireId: an identifier has to be assigned, according to the instructions provided in section 3.2.5,
- name: a textual name has to be assigned by the data provider.

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