UN-GGIM EUROPE

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Core Spatial Data Theme Land Use Recommendation for Content

Working Group A - Deliverable of Task 1.b

Version 1.1- 2024-01-10

Version History

Version number	Date	Modified by	Comments
1.0	2022-05-05	WG A	Consolidated draft, for review by geographical and statistical community
1.1	2024.01.10	WG A	Comments from geographic and statistic community taken into account Definitive deliverable

Warning: in the following parts of this document, the paragraphs written in grey, e.g. "This document has annexes containing more detailed explanations" are common to all core spatial data themes; they aim to provide context and objectives of core data. The paragraphs written in black are specific to core spatial data theme Land Use.

Content

1 Executive Summary

In September 2015 the countries of the United Nations adopted the 2030 Agenda for Sustainable Development; a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. The 17 Sustainable Development Goals (SDGs) of the 2030 Agenda are supported by 169 targets and 230 indicators.

Geospatial data supports the measuring, achieving and monitoring of many of the goals and targets set by the 2030 Agenda. The 2030 Agenda demands new data acquisition and integration approaches to improve the availability, quality, timeliness and disaggregation of data. Goal 17 explicitly emphasizes the need for developing capacities and partnerships. In this context the success of the 2030 Agenda depends on senior administrators owning and leading the geospatial efforts in their respective countries.

In Europe, building on the INSPIRE Directive redirecting the focus on a cohesive spatial data infrastructure without gaps in content and discrepancies in quality, stakeholders are working on geospatial standardization and increasing richness of data through Core Data Recommendations for Content that correspond to the first phase of WGA work program. Core data is primarily meant for fulfilling the common user requirements related to SDGs in Member States and European institutions.

Spatial planning is a key tool for achieving several SDGs as it is the way to ensure best balance between requirements for human activities and preservation of natural resources.

In the preparation phase, a state-of-play of is required; this is why existing Land Use data has been considered as core sub-theme. Though being different concepts, existing Land Use and Land Cover have strong interrelations and more or less similar requirements. Therefore, as for Land Cover, the main core product consists in a large-scale dataset, covering whole land territory and updated ideally each 3 years. The classification of land use types should be based on the higher level of the INSPIRE related code list (HILUCS). However, it should be recognized that there are various practices depending on national context with their advantages and drawbacks therefore this document allows some flexibility for instance in the choice of the geographic object (parcel, homogeneous polygon).

In addition, this document recommends also yearly crop maps on agricultural areas, as agriculture has a strong impact on food production and on environmental issues.

The existing Land Use data is expected to be captured (new production or existing product upgrade) mainly from images and cadastres.

In the implementation phase, the spatial planning results in planned Land Use data. As for any regulated zone, the planned Land Use data should be made publicly available in convenient way. New spatial plans should be natively captured in digital vector formats. For spatial plans still not in such formats, this deliverable provides a few recommendations about smart digitalisation priorities and methods.

2 Foreword

2.1 Document purpose and structure

2.1.1 Purpose

This document provides the main characteristics of core data for theme Land Use with focus on the recommendation for content. This document aims to help decision makers (from governments, data producers, national coordination bodies, etc.) to define their policy regarding the improvement of existing data and production of new geospatial data. It addresses digital data.

This document has Annexes containing more detailed explanations targeting the technical people who will be in charge of implementing or adapting core data recommendations (e.g., for production purpose, as source of other standards, etc.).

2.1.2 Structure

The executive summary synthesizes the main conclusions of the Working Group A (WG A) process and results to develop the recommendation for content. It is meant mainly for high level decision makers.

The foreword reminds the general context of core data, the first step achieved by WG A (i.e., selecting core data themes), and it explains the general principles set by WG A to develop the recommendations for content of core data specifications for all selected themes.

The 'recommendation for content' document itself includes four chapters:

- Overview: it provides the general scope of the theme and describes the main use cases addressed;
- Data content: it provides the main characteristics of the recommended content, such as the list of core features and attributes (for vector data), as well as data capture and quality rules;
- Other recommendations: e.g., Coordinate Reference System, Metadata, Delivery;
- Considerations for future: this chapter addresses some key trends or significant user requirements that cannot be considered as core today but that might be considered in future.

The 'recommendation for content' document is meant for medium level decision makers. It is written in natural and not too technical language.

The technical explanations included in annexes describe the relationship between the recommendation for content and the corresponding INSPIRE specification, and contain any other appropriate information useful for this theme.

2.2 Core data context

2.2.1 Rationale for core data

The following background of harmonised pan-European data was identified.[1]

Authoritative geospatial data are used to support both the implementation of public policies and the development of downstream services. Moreover, geospatial data are required to be homogenous to enable the implementation of public policies in a coherent and coordinated way among countries and at regional or global level. Likewise, significant opportunities exist if services developed by industry can be exploited without requiring country specific adaptation.

The INSPIRE Directive has set up the legal and technical framework for harmonisation of the existing data related to the themes in annexes I, II and III. INSPIRE specifications provide common data models that ensure a first step towards interoperability, however ensuring homogeneous content is outside their scope, as they contain no indication about levels of detail, very few recommendations about quality, and as most features and attributes are "voidable", i.e., to be supplied if available or derivable at reasonable cost.

This background led the UN-GGIM: Europe Regional Committee to setup in 2014 the Working Group A on Core Data to deal with core data content and quality, production issues, funding and data availability.

Recommendations for content of core data will complement INSPIRE data specifications by defining the priorities on the core content that is encouraged to be made available in Europe in order to fulfil the main user requirements that are common to many countries, with focus on the SDG related ones.

Core data availability may be ensured either through upgrading of existing data when feasible or through production of new data when necessary.

2.2.2 Core data scope

In its first phase, WG A selected core data themes according to the following criteria: core data is the geospatial data that is the most useful, either directly or indirectly, to analyse, to achieve and to monitor the Sustainable Development Goals.

Among the 34 INSPIRE data themes, 14 have been considered as core including theme Land Use.

More information about the selection process and results may be found in document 'Core Data Scope - Working Group A - First Deliverable of Task 1.a - Version 1.2' on http://un-ggim-europe.org/content/wg-a-core-data

[1] Extract from the Report by the Preparatory Committee on the establishment of the UN-GGIM: Europe Regional Committee, European Commission Ref. Ares(2014)1491140 - 09/05/2014.

2.3 Document objectives and principles

2.3.1 Encouraging content availability

This deliverable provides recommendations for national governments and data producers, aiming to help them to define their priorities for enriching existing data or producing new data. This deliverable is meant mainly for data producers; however, it defines the recommended result and target but not the production process.

2.3.2 Complementing INSPIRE

Core data specifications are built upon INSPIRE data specifications. On one hand, they often simplify INSPIRE by selecting core feature types and attributes and by restricting or clarifying the scope; On the other hand, they enrich INSPIRE by recommending specific levels of detail, quality rules and sometimes data model extensions. Besides, the INSPIRE common terminology is thoroughly used for naming core features and attributes.

Regarding the levels of detail, the ELF (European Location Framework) project terminology has been used. The ELF levels of detail are the following: Global, Regional, Master level 2, Master level 1, Master level 0. These terms are defined in the glossary.

Regarding delivery, core data may be supplied according to several ways. It is expected that, very often, the core data recommendations will be used to enrich and upgrade existing products. In this case, core data will be available through these improved products. Core data may also be delivered through INSPIRE conditions (specifications and services).

2.3.3 Status of core data recommendations

This document contains recommendations that are not legally binding. However, some recommendations are more important than others. This order is indicated as follow:

Core Recommendation X

It is first priority recommendation, considered as both necessary and achievable in principle. Ideally, it should encourage involved stakeholders to launch short-term actions (typically within a couple of years).

Core recommendations are usually addressing only technical aspects and are meant for the organisations in charge of producing this theme. The set of core recommendations defines the basic expectations on core data.

Good Practice X

It is second priority recommendation; if adopted, it will provide significant added value to core data; it indicates a relevant trend to be adopted as much as possible. It encourages involved stakeholders to take these recommendations into account in long term, if not possible in short term.

NOTE: some of these good practices may be quite easy to achieve and are already effective in some countries whereas some others may be more difficult to achieve. This is typically the case when these good practice recommendations involve other stakeholders in addition to the organisations in charge of producing this theme, and when they address not only technical aspects but also legal or organisational ones.

A “core data set” should contain the minimum data defined by the core recommendations (and ideally also by the good practices) of this deliverable but may of course contain more and/or better information.

2.4 Abbreviations

CAP	Common Agricultural Policy
CRS	Coordinate Reference System
ELF	European Location Framework
GSAA	Geo Spatial Aid Application
HILUCS	Hierarchical INSPIRE Land Use Classification System
IACS	Integrated Administration and Control System (for CAP payments)
LC	INSPIRE theme Land Cover
LPIS	Land Parcel Identification System
LU	INSPIRE theme Land Use
LUCAS	Land Use/Cover Area frame Survey
NIVA	New IACS Vision in Action
SDG	Sustainable Development Goal
UN-GGIM	United Nations initiative on Global Geospatial Information Management
URL	Unique Resource Locator
WG A	(UN-GGIM: Europe) Working Group on Core data

2.5 Glossary

2.5.1 Levels of detail

Global	Level of detail defined by ELF: data to be used generally at scales between 1:500 000 and 1:1 000 000, i.e. mainly at international level
Regional	Level of detail defined by ELF: data to be used generally at scales between 1:100 000 and 1:500 000; data mainly for national or regional (European or cross-border) actions.
Master level 2	Level of detail defined by ELF: data to be used generally at scales between 1:25 000 and 1:100 000); data mainly for regional (sub-national) actions.
Master level 1	Level of detail defined by ELF: data to be used generally at scales between 1:5 000 and 1:25 000; data mainly for local level actions.
Master level 0	Level of detail defined by ELF: data to be used generally at scales larger than 1:5 000; typically, data at cadastral map level, mainly for local level actions.

NOTE: the above definitions are indicative; in practice, detailed data (Master levels) may also be required also by national, European or international users.

2.6 Reference documents

INSPIRE Data Specification on LU– Technical Guidelines 3.1:
http://inspire.ec.europa.eu/id/document/tg/lu

3 Overview

3.1 General scope

Definition:

Territory characterised according to its current and future planned functional dimension or socio–economic purpose (e.g., residential, industrial, commercial, agricultural, forestry, recreational). [INSPIRE Directive 2007/2/EC]

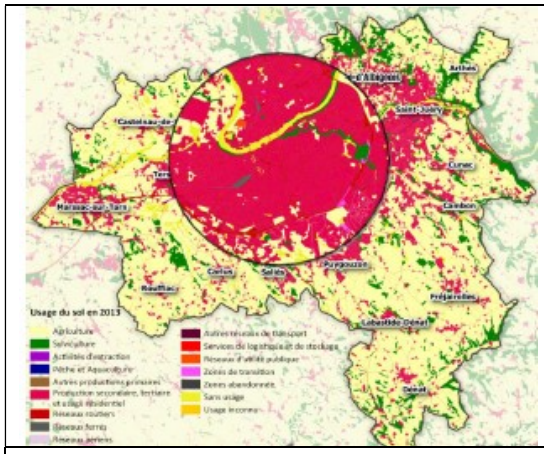
Core data theme Land Use theme is related to the INSPIRE data theme Land Use. More detailed comparison with INSPIRE is available in Annex A.

Description:

Land Use is defined as the use and functions of a territory. It is the description of land in terms of its socio-economic and ecological purpose.

Land Use is itself split up into two different sub-themes:

- The existing land use (current land use), which objectively depicts the use and functions of a territory as it has been and effectively still is in real life.
- The Planned Land Use (future planned land use), which is composed of spatial plans, defined by spatial planning authorities, depicting the possible utilization of the land in the future.



Existing Land Use

Planned land Use

Figure 1: Illustrations of Land Use data

NOTE 1: For many years, existing Land Use and Land Cover have often been combined in practical applications and data sets. However, this was not conceptually correct as Land Cover is dedicated to the description of the surface of the earth by its (bio-)physical characteristics.

NOTE 2: Planned Land Use is a specific case of Regulated or Managed Areas (that is another core data theme) but carrying specific information about the land use and function.

3.2 Use cases

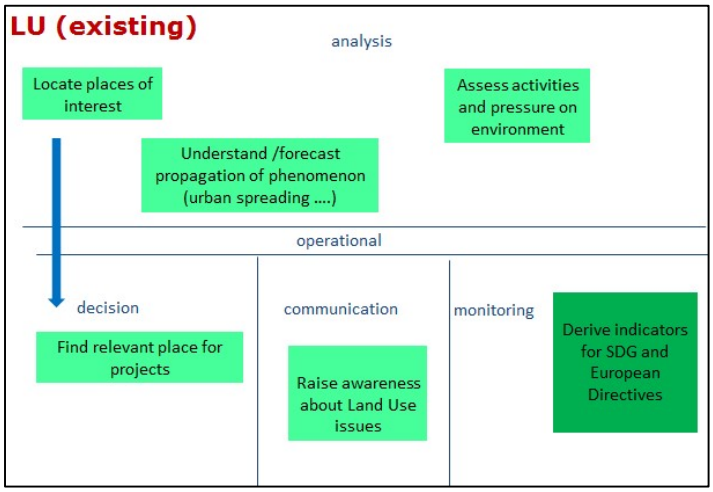


Figure 2: Use Case map for existing Land Use

Existing Land Use data enables to locate human activities, to assess their pressure on environment and on natural resources and therefore to find right balance between different uses of same natural resource. Existing Land Use is key data to understand urban areas where most of human population is currently living and to analyse the related issues due to this concentration of people.

Agriculture is the main activity to achieve SDG 2 (no hunger) and it also strongly impacts SDG 6 (water quality), SDG 13 (climate change) and SDG 15 (life on land). Therefore, there is a strong demand for crop maps (that are considered to be Land Use data).

Land Use is generalised data that makes it quite suitable for monitoring, at various levels of government.

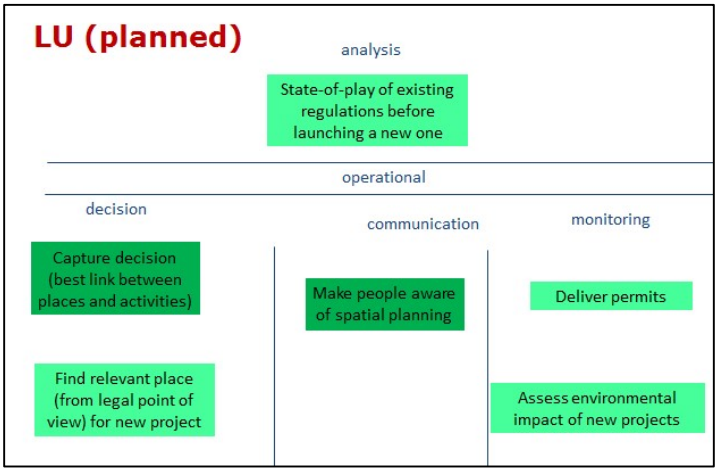


Figure 3: Use case map for planned Land Use

Main objective of planned land use is to affect the most relevant land use to a given area; so, planned Land Use is a key tool to achieve most of the SDGs. Planned Land Use defines the uses that are allowed, prohibited or mandated on land; these rules have often legal value and therefore geographic data on this core theme is necessary to ensure that every interested stakeholder is aware of the use planned for a given territory; it is a condition of good governance.

3.3 General approach

3.3.1 Existing versus planned land use

The objectives are quite different according to land use sub-themes

- For sub-theme existing land use, the main purpose is to ensure the availability of data fulfilling the core recommendations (and ideally good practices) below. This might be done through maintenance or upgrade of existing products but it will likely also imply **new data collection**.
- For sub-theme planned land use, the objective is not to create data (this is the role of governments at various levels) but to make this existing data easily accessible and usable. In practice, it is about **smart data digitalisation** as data already exists but may be of poor quality or available only in non-vector formats (e.g., CAD, .pdf or even just paper maps). Smart digitalisation should be understood as getting vector data fulfilling the core recommendations (and ideally good practices) below.

3.3.2 Existing Land Use data

The general trend is towards the production of a reference large scale Land Use data set covering whole country. Regarding this kind of data set, there is a wide variety of practices depending on national requirements (e.g., support of specific regulations), on general context (e.g., involved data producers), on the envisaged production process, etc. As a result, this document is proposing a flexible approach with some common guidelines on a few topics but also with possibility of options on other points.

In addition, there is a growing demand for crop maps on agricultural areas. These crop maps are produced according their specific annual cycle.

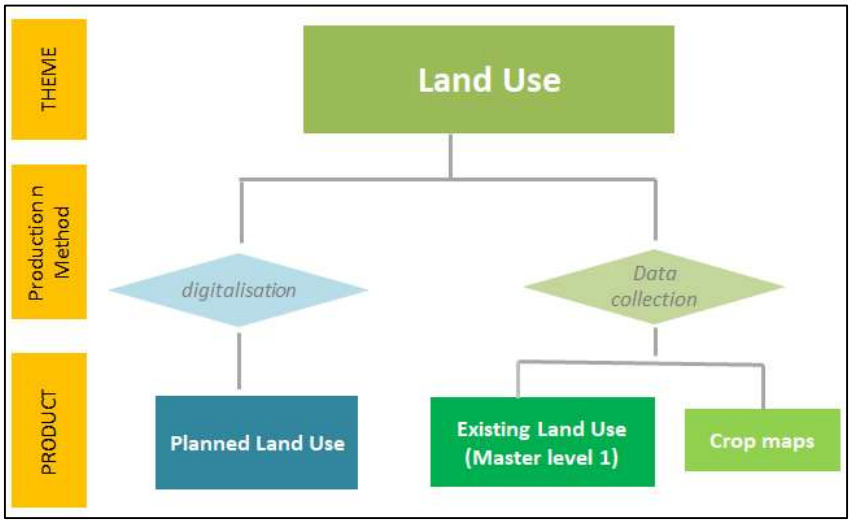


Figure 4: Core data products for theme Land Use

4 Data content

4.1 Existing Land Use (Master level 1)

4.1.1 Features types and attributes

Core Recommendation 1
Core data should include feature type LandUseZone with following attributes:

- Geometry (as surface or as pixel)

- Land use type(s)

NOTE 1: Main purpose is to get partition of territory, which implies surface geometries, such as GM_Surface or GM_MultiSurface or pixels in case of grid representation.

NOTE 2: There are several options regarding the choice of the geometry for LandUseZone, the most widely spread options being:

- The use of a geometry especially created for the theme Land Use, in order to get zones that are as homogeneous as possible regarding land use aspects.
- The reuse of an existing geometry, such as Cadastral Parcel or LandCoverZone; cadastral parcels are often a key source of land use information whereas a common geometry for Land Cover and Land Use (but with separate classifications) enables numerous and rich combinations.

NOTE 3: It may occur there are several land use types on a LandUseZone; this may be due to the reuse of an existing geometry or to generalisation impact (in order to respect the Minimum Unit of Capture) or to mixed land use in real world (some surfaces can simultaneously have different types of land use, e.g., residential and commercial). The basic option is to provide the main land use type. However, it is better to provide the whole set of land uses; some indication should be given about the relative importance of these various land use types, by providing an ordered list of land use value or better by providing the percentage of surface concerned by each land use type. These various solutions are described in INSPIRE data specifications.

Core Recommendation 2
The code list used for the land type use should be easily matchable with HILUCS (Hierarchical NSPIRE Land Use Classification System) at least for the highest level of HILUCS (primary, secondary, tertiary, residential use, transport network & utilities, other); it should include more details on transport networks.

NOTE 1: Theme Transport Networks is part of core data and data from its sub-themes (road, railway, air, water, cable) may be used to provide the third level values under the HILUCS value “4. Transport Networks Logistics And Utilities/4.1 Transport Network/ 4.1.n road, railway, air, water, other.

NOTE 2: It is advised to use a hierarchical code list for core theme Land Use.

This deliverable is proposing some minimum guidelines regarding Land Use classification. However, due to the national context, it may be required and/or (relatively) easy to get more detailed data.

Good Practice 1
Member States should agree on national classification(s) for land use data, both for existing and planned land use.

NOTE 1: In other words, it is advised to have a national standard both for existing and planned land use classification. A national standard ensures comparability between territories within a Member State. Ideally, the standards for existing and planned land use should be the same or at least, they should be easily matchable.

4.1.2 Temporal aspects

Core Recommendation 3
Current, valid features are considered as core data.

NOTE 1: In other words, efforts to capture features of the past are not considered as a priority. Current, valid features are the existing (current) land use zones.

There are two main approaches:

- The first one is driven by the will to have a snapshot of land use data at given reference dates, generally at regular intervals. This makes data very suitable for reliable temporal comparisons and so for monitoring purposes. In this case, the reference date should be documented at dataset level, through metadata.
- The second one is driven by the will to have data as fresh as possible and implies some continuous update. In this case, the timestamp may vary according to the Land Use Zone instances; so, it is advised to document the temporal information at feature level.

Good Practice 2
If an existing land use dataset is continuously updated, it is recommended to manage the history of features, using the mechanism provided by the INSPIRE data specifications: versioning and life-cycle attributes.

NOTE 1: The versioning and life-cycle attributes enable change-only updates; they also enable to retrieve the status of geographic Land Use data, at any time of the past (since the adoption of these mechanisms).

4.1.3 Levels of detail

Existing land use is required at various levels of detail by various levels of governments (and other stakeholders).

Core Recommendation 4
It is recommended to produce existing land use data at large scale (Master level 1).

NOTE 1: Once available, large-scale data may be reused to provide derived and generalised products at smaller scales

4.1.4 Geographical extent

Core Recommendation 5
Existing land use data should form a partition of whole land territory.

NOTE 1: As general rule, existing land use data should cover whole territory, without gaps or overlaps. Data is required in all types of landscapes (urban, agricultural, natural).

NOTE 2: In case of areas without any use, it is advised to include in the LU classification one or several values dedicated to this case. For instance, HILUCS (the INSPIRE classification) has a value called "natural areas not in other economic use", that may be split into natural land or water areas not in economic use. If these areas cover wide and continuous part(s) of national territory, an exception to the general rule (i.e., gaps in the LU layer) may be envisaged.

4.1.5 Data capture - Production method

There are various practices depending on the requirements to be fulfilled in priority and/or of the potential production methods, depending themselves on the available data sources within a country. In other words, there is no perfect product and not even a consensus about a minimum product; therefore, some choices should be done.

Good Practice 3
There should be a clear policy regarding Land Use data and the production method should be consistent with the main target characteristics of the land use product (or vice versa).

EXAMPLE 1: The choice of a Land Use product with a reference date will generally imply to use orthoimage as one of the main data sources, the date the image was taken providing the reference date.

EXAMPLE 2: The existence of a cadastre covering whole land territory and including the land use information declared by land owners may be a good starting point for a national land product. In addition, the choice of cadastre as main source may lead to the adoption of cadastral parcels for the geometry of land use zones and to the adoption of a continuously updated product.

NOTE 1: The clear policy may come from a top-down approach (e.g., government mandating production of land use data for fulfilling requirements of national regulations) or from a bottom-up approach (land use stakeholders coordinating to find a compromise between various requirements and constraints) or even better by a mix of these two approaches.

4.1.6 Quality

4.1.6.1 Resolution

The expected level of detail (Master level 1) corresponds to a scale around 1:10 000 or even better.

Good Practice 4
The MMU (Minimum Unit of Capture) should be adapted to the target scale (1/ 10 000) and be around 0.25 ha or smaller.

NOTE 1: The MMU may depend on the type of landscape, for instance it may be smaller in urban areas than in rural areas.

NOTE 2: There are some countries which actually generated LU geometries referenced to cadastral or LPIS parcel geometries, which in practice means a 0.05 ha spatial resolution or equivalent cartographic scales associated with cadastral resolution. This trend should be encouraged in order to favour integration of LU data with other Core data Themes such as Cadastral data.

4.1.7 Consistency with other themes

Good Practice 5
Land Use data should be geometrically and semantically consistent with other core data themes.

EXAMPLE 1: At least, a road link centreline or a road service of theme Transport Network should be present in a Land Use Zone of type “Road Transport”. In similar way, instances of theme Buildings should be found in a Land Use Zone of type “Residential Use”.

EXAMPLE 2: When relevant, there should be geometry sharing between the cadastral parcel boundaries and the limits of land use zones.

NOTE 1: This consistency might be ensured by using other core data themes (mainly Buildings and Transport Networks) as data sources for the Land Use production.

4.1.8 Update frequency

Good Practice 6
The update frequency cycle should be ideally be3 years or better and generally not more than 6 years.

NOTE 1: There is a growing demand for short update cycles. However, this may be difficult to achieve and the cycle might be adapted to the real-world evolutions.

NOTE 2: In some cases, update cycle may be longer: vast unpopulated areas without intense land use could be updated at more sparse intervals, e.g., at 10 years.

NOTE 3: In case cadastre is used as main source for Land Use, the Land Use data update cycle will generally follow the life-cycle of cadastre that may be continuous.

4.1.9 Comparability across time

Land Use data is often used for evolution indicators; this implies that data should be comparable across time, i.e., with well-documented and persistent specifications and capture & generalisation rules. However, this requirement should be balanced with the trend to better products due on more demanding user requirements and/or allowed by technology progress.

4.2 Crop maps

4.2.1 Features types and attributes

Core Recommendation 6
Core data should include CropPlot feature type with following attributes:

- geometry (GM_Surface)

- crop type

NOTE 1: The crop type is a specific case of land use type.

NOTE 2: Crop type should be understood in a wide meaning, including the crops on arable land, grasslands and permanent crops (orchards, vineyards …).

Good Practice 7
It is advised to provide the crop type according to a simple botanical classification.

NOTE 1: Botanical classifications are based on same principles and so relatively easy to be matched, if there is need to combine data from various areas.

NOTE 2: Botanical classifications are generally following hierarchical order.

NOTE 3: In this context, a "simple classification" should be understood as a classification with a relatively limited number of classes. This number may vary according to national context (mainly capture method and agricultural practices). A few tens of values are considered as reasonable number of crop types.

NOTE 4: The Eurostat classification LUCAS may be a good starting point to define a national simple botanical classification. It would imply to select relevant values (e.g., only crops cultivated in the country, appropriate level of detail) mainly under the CROPLAND and GRASSLAND high values of Lucas.

4.2.2 Temporal aspects

Core recommendation 3 (priority on valid current features) also applies to Crop maps.

4.2.3 Levels of detail

Core recommendation 4 (Master level 1) also applies to Crop maps.

In EU countries, the Crop Plots correspond to the Agricultural Parcels of the LPIS-GSAA data bases that are at scale 1:5,000.

4.2.4 Geographical extent

Core Recommendation 7
Crop maps should cover whole agricultural territory.

NOTE 1: Whole agricultural territory includes not only arable land but also grasslands and permanent crops. As a consequence, crop type should be understood in a wide meaning.

4.2.5 Data capture

Crop maps are expected to be captured mainly from satellite images, such as Sentinel (S-1 and S-2). Most of the current automatic classification methods are using Artificial Intelligence that may enable to make distinction between around 100 crops as maximum. However, a balance has to be found between detailed data (large number of crop types) and reliable data (smaller set of crop types).

In addition, in EU countries, the LPIS-GSAA data bases managed by Paying Agencies to ensure CAP payments may also provide this type of data. However, LPIS-GSAA data is not always covering whole agricultural territory of a country. A mixed approach using farmer declarations (GSAA) as training data, satellite images and AI processes looks the best option and is already widely spread in the context of the new Area Monitoring System of CAP subsidies. In addition, though LPIS-GSAA may provide more detailed crop classification, publishing data under a "simple" botanical classification is still advised as it may be enough to satisfy most user requirements, it will make the data easier to be handled and it is more acceptable for farmers (who are initial data providers) than data publication under a very detailed classification that could be seen as breaking privacy or business secret.

4.2.6 Quality

4.2.6.1 Semantic accuracy

The risk of confusion between crop type classes increases with the number of classes. It is advised to give priority to data reliability, i.e., to semantic accuracy rather than to very detailed classification. This is why good practice 7 recommends use of a simple classification with limited number of classes.

The quality of the data produced by artificial intelligence is not 100%. Although it is theoretically possible to distinguish relatively easily between more than 100 types of crops, one has to take into account the accuracy limit of the AI processes and not to multiply the categories, which would increase the risk of producing inaccurate data. In other words, using a smaller list of crop types would provide more robust and reliable results; this is why it is a recommended practice for core data.

4.2.6.2 Update frequency

Core Recommendation 8
Crop maps should be provided at least once a year.

NOTE 1: This core recommendation is due to the fact that most crops have an annual cycle.

NOTE 2: A balance has to be found between the user need of fresh data and the user need of reliable data. Fresh data generally means data supplied at the beginning of the agricultural campaign (spring) but in practice, with the AI processes using the temporal series of satellite images, the data is getting more or more reliable when closer to the end of the agricultural campaign (autumn). A potential option to solve this issue is to provide preliminary crop maps early in the agricultural season, with mention of the uncertainties; typically, data might include the crop type that is best candidate with its probability score.

4.3 Planned Land Use

4.3.1 Features types and attributes

Core Recommendation 9
Core data should include feature type ZoningElement with following attributes:

- geometry

- land use type(s)

The ZoningElement should be part of a SpatialPlan carrying the necessary legal information, such as an official title, the validity period, the concerned territory and a link to the associated regulation text (as URL).

Regarding the classification of land use types, Core recommendation 2 (classification based on HILUCS) and good practice 1 (national standard) also apply for planned land use.

4.3.2 Temporal aspects

Core recommendation 3 (priority on valid current features) also applies to planned Land Use.

NOTE 1: In other words, efforts to capture features of the past are not considered as a priority. Current, valid features the planned zoning elements included in a spatial plan that is currently valid.

For planned land use, the main temporal information is the validity period that should be documented as an attribute of feature type SpatialPlan as indicated in Core recommendation 9.

4.3.3 Levels of detail

There are planned land use data at various levels of detail and for different purposes. In practice, there are mainly strategic plans covering a wide territory and providing the main orientations for future and local plans covering a smaller territory and providing the detailed and binding land use.

Priority should be given to the binding land use data. Therefore, scope of core data is related to the large scale planned land use data that is generally elaborated at local level, by municipalities.

4.3.4 Geographical extent

Core Recommendation 10
The geographic extent of planned land use data should at least correspond to the extent of the current valid and binding spatial plans.

NOTE 1: There may be gaps in land territory if there are areas without planning regulations. On the other side, it is also advised to apply the recommendations of this document to the maritime areas that are subject to spatial planning (though the theme is called “Land use”).

4.3.5 Data capture – priority scope

In most countries, there is generally a big number of spatial plans. Big efforts have been done during previous years to migrate this traditional data into GIS formats and this is a trend to be encouraged.

Core Recommendation 11
New spatial plans (existing land use data) should be natively captured in digital vector format.

However, in some countries, capturing under digital data the geometry and other core attributes of all these spatial plans and related zoning elements may still be difficult to achieve. It is why it may be of interest to define some priorities.

Core Recommendation 12
Priority should be given to spatial plans and related zoning elements that are under legal force and that are binding.

NOTE 1: If even the goal indicated in Core Recommendation 11 is considered as too challenging for short term, Member States should prepare a progressive work plan, including for instance the scanning of existing plans and the obligation of providing new plans directly under the recommendations of this document.

4.3.6 Data quality

4.3.6.1 Topological consistency

In general, the ZoningElements should form a partition of the Spatial Plan extent; at least, they should not overlap. This is point to be checked before publishing data.

4.3.6.2 Topological and cross-theme consistency

The main risk is coming from spatial plans that have not been initially captured as vector data. The digitalisation and vectorisation process should be conducted with great care in order to ensure that the cross-theme consistency rules of the initial spatial plan have been kept (e.g. a Zoning Element composed of several cadastral parcels or a Zoning Element limited by cadastral and/or topographic features).

5 Other recommendations

5.1 Coordinate Reference System (CRS)

5.1.1 Horizontal component

Good Practice 8
Core data should be stored and managed in a CRS based on datum ETRS89 in areas within its geographical scope, either using geographic or projected coordinates.

NOTE 1: Geographical scope of ETRS-89 excludes over-sea territories, such as Canary Islands or French Guyana or Madeira Islands and Azores Islands. In these cases, it is recommended to use a CRS based on ITRS (International Terrestrial Reference System).

NOTE 2: Storing and managing data in CRS based on international datum facilitates the import of measures from modern sensors, ensures that data is managed in a well-maintained geodetic framework and of course, facilitates the export of data into international CRS (e.g., those mandated by INSPIRE).

5.2 Metadata

Good Practice 9
Core data should be documented by metadata for discovery and evaluation, as stated in the INSPIRE Technical Guidelines for metadata and for interoperability.

NOTE: This is an INSPIRE recommendation (only the INSPIRE Implementing Rules are legally binding for the Member States belonging to the European Union, but the Technical Guidelines are considered necessary to make the European Spatial Data Infrastructure work in practice). For the other countries, this is a way to make their data easily manageable by transnational users.

5.3 Delivery

It is expected that core data will be made available through improved existing products (or new products) or as INSPIRE data, and perhaps as specific core products.

Good Practice 10
Core data corresponding to INSPIRE theme Land Use should be made available according to the INSPIRE Technical Guidelines for interoperability, for metadata and for services.

NOTE 1: This is an INSPIRE recommendation (only the INSPIRE Implementing Rules are legally binding for the Member states belonging to the European Union, but the Technical Guidelines are considered necessary to make the European Spatial Data Infrastructure work in practice). For the other countries, this is a way to make their data easily manageable by transnational users.

NOTE 2: Vector data is generally considered as more user-friendly than image data. However, image data may be more convenient for some specific uses. Therefore, in case that existing land use data is mainly derived from images with preliminary results available as raster data, the provision of this raster data may be envisaged in addition to the delivery of vector data.

In most countries (if not all), data on planned land use is scattered between many local public authorities and so, not easily accessible by users.

Good Practice 13
Member States are encouraged to set up efficient and user-friendly mechanisms to deliver geographic data on planned land use to all potential users.

NOTE 1: In addition to a national standard, convenient mechanism would generally consist in a single access point for users (e.g., thematic Geoportal).

6 Considerations for future

6.1 Other Land Use data

6.1.1 Point representation

The representation by pixels or polygons ensuring whole coverage of territory is most common user requirements. This is why this document recommends a polygon or pixel representation for core land use data.

However, for some purposes, a point-based approach offers significant advantages. A point-based approach allows a more accurate classification of the land use, especially in complex areas (e.g., urbanised areas) where a polygon-based approach tends to make small features disappear because they are merged into larger features.

A point-based approach also has advantages for classifying phenomena with unclear margins: in most cases, it is possible to assign an unambiguous classification to a given point, whereas it is difficult to delimit the contour between two phenomena when the transition zone is wide. This precision of classification offers significant benefits for statistical analysis as well as for monitoring the land use change.

A point approach also makes it easier to avoid erroneous changes due to methodological developments. Unlike a polygon whose delimitation can be affected by the methodology used, the point is not affected in its geometry. This is particularly important for monitoring land use change.

Therefore, Land Use point based data may be useful complementary product, in addition to polygon or pixel core data. It is true that this point approach requires dense sampling with a relative high cost.

Research, knowledge sharing, cost-benefit analysis are encouraged to better understand how point-based land use data may be produced, if it is worth to maintain such a product in addition of core (polygon or pixel) core data and how these two products can be articulated one with another.

6.1.2 Dealing with mixed values

It may occur there are several land use types on a LandUseZone; this may be due to the reuse of an existing geometry (such as cadastral parcel or land cover zone) or to generalisation impact (in order to respect the Minimum Unit of Capture) or to mixed land use in real world (some surfaces can simultaneously have different types of land use, e.g., residential and commercial). Core data recommendations include the possibility to document several land use values on a given geometry. However, even if data producer employs the most detailed way to do so, i.e., the list of LU values with their percentage of surface, this solution implies some lack of information about the positioning of these values.

To cope with the two first issues (reuse of existing geometry, generalisation impact), the potential solution might be to design a product without any generalisation, by choosing homogeneous LU zones, even if very small (e.g., raster data). As some users would have difficulties to handle such detailed data, generalisation services should be offered to users, in order to let them choose the simplification rules that are relevant for them. Nevertheless, this possible scenario raises many difficulties, such as the production cost of very detailed data, the understanding of user requirements regarding generalised products, the design of sets of generalisation rules, the user training once the solution is mature.

Dealing with the third issue (mixed land uses in real world) may be even more complex. Mixed land may occur for several reasons, such as different uses according to time or different uses according to the vertical position (e.g., shops at first floor of a building & residential flats above, solar panels on grasslands). Investigation should be conducted in order to collect a catalogue of the various cases or at least of the most frequent ones and then to make proposals about modelling and representation of these complex cases of mixed land uses.

Research, experimentations with wide user contribution, knowledge exchange on these two topics should be encouraged.

6.2 Modelling of urbanism rules

Spatial Planning is generally not only about allowing, prohibiting or mandating a given land use; it often occurs that the land use is allowed under a set of conditions. This is typically the case in urban areas where spatial planning provides rules about potential constructions.

These rules are generally provided as textual description in the legal document accompanying the spatial plan. This textual description may be source of ambiguities and of some legal uncertainty but above all, it does not enable automatic (and so objective) check of building permits though these permits are more and more often provided in digital formats.

Research and knowledge exchange activities should also be encouraged regarding methods to model the content of urbanism rules. There have been some attempts to promote such approach in INSPIRE, through the attribute about dimensioning indication on feature type Supplementary Regulation in theme LU. There are also several initiatives at national level or at European level. For instance,there is a EuroSDR Working Group dealing with modelling of urbanism rules and automation of controls when a building permit includes BIM (Building Information Model) data.

6.3 Exploiting existing Land Use data

This document recommends separate products (or at least separate attributes) for Land Use and Land Cover whereas during years, these concepts were often mixed in a common classification. Though most users are understanding the interest of this separation, they may have some difficulties in using these relatively new products. Good explanations, guidelines for use, forum to share user experiences are among the possible ways to help users to migrate to these new products.

This document focuses on large scale (Master level 1) data that targets local users and partly national users. However, more generalized data is also required for higher levels of government requirements or for specific applications. The investigation conducted by UN-GGIM: Europe WGA has not shown any common trend for this generalized data. However, sharing of experiences should be encouraged in order to propagate good practices;

7 Annex A: Relationship with INSPIRE

7.1 Data model

The UML models provided in this annex are only graphical illustrations of the core recommendations and of the good practices present in this document.

The recommendations for content are represented by highlighted the selected attributes in the following way:

Core recommendation

Good practice

7.1.1 Comparison between Core Data and INSPIRE content

Core Recommendation 1

Core data should include feature type LandUseZone with following attributes:

- Geometry (as surface or as pixel)

- Land use type(s)

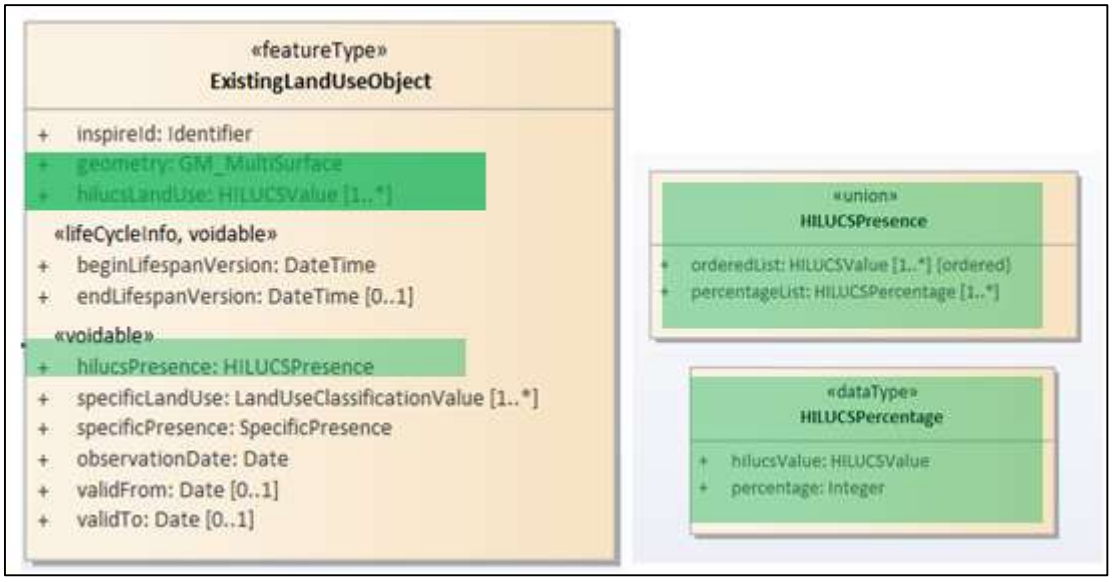


Figure 5: Core information for vector existing land use

NOTE 1: In case of raster product, the attribute “geometry” would be replaced by the domain range of the grid representation.

NOTE 2: The point representation (allowed by INSPIRE) has not been considered for core data as not enabling a whole partition of territory that is a key requirement for existing Land Use.

NOTE 3: In case of several LU values on a given geometry, it is advised to use the mechanism offered by the hilucsPresence INSPIRE attribute, i.e., an ordered list or better a set of LU values with their relative percentage.

Core Recommendation 9

Core data should include feature type ZoningElement with following attributes:

- geometry

- land use type(s)

The ZoningElement should be part of a SpatialPlan carrying the necessary legal information, such as an official title, the validity period, the concerned territory and a link to the associated regulation text.

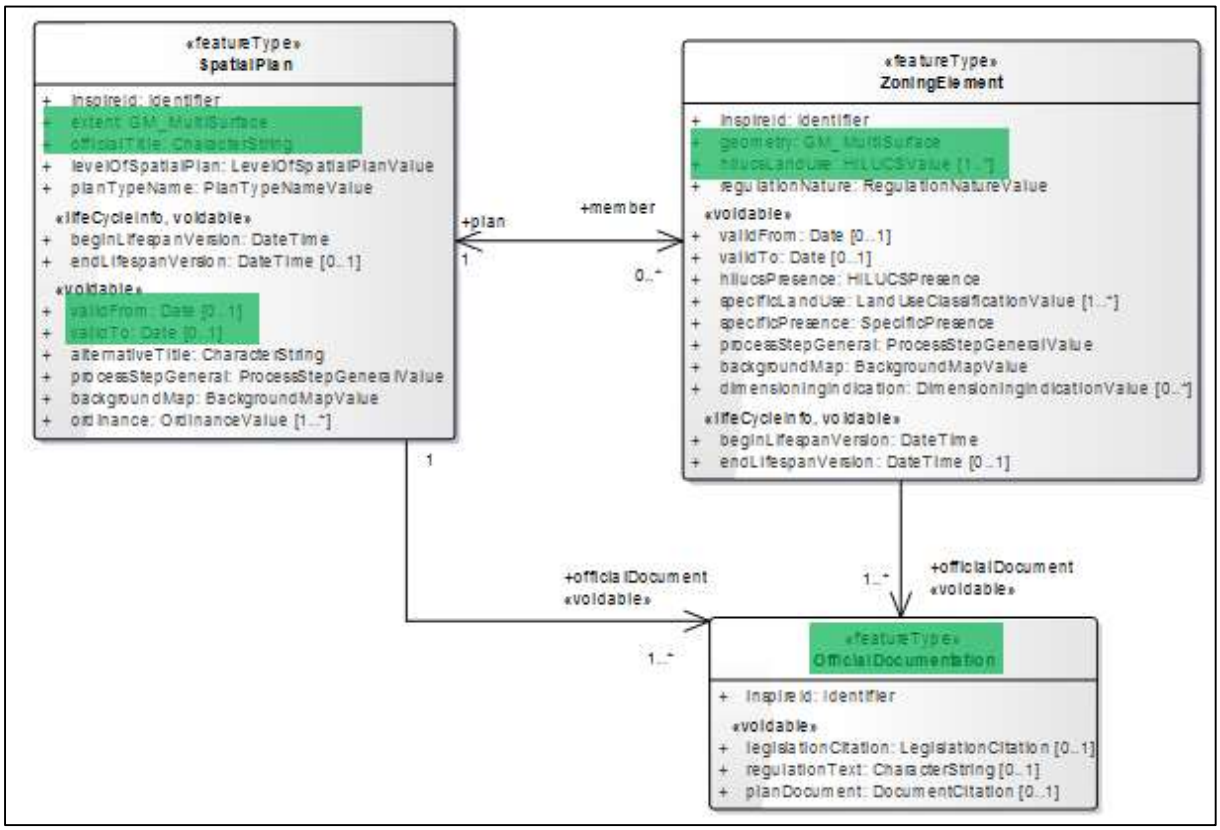


Figure 6: Core information for planned land use

NOTE 1: The concerned territory is provided by the INSPIRE attribute ”extent”.

Good practice 2
If an existing land use dataset is continuously updated, it is recommended to manage the history of features, using the mechanism provided by the INSPIRE data specifications: versioning and life-cycle attributes.

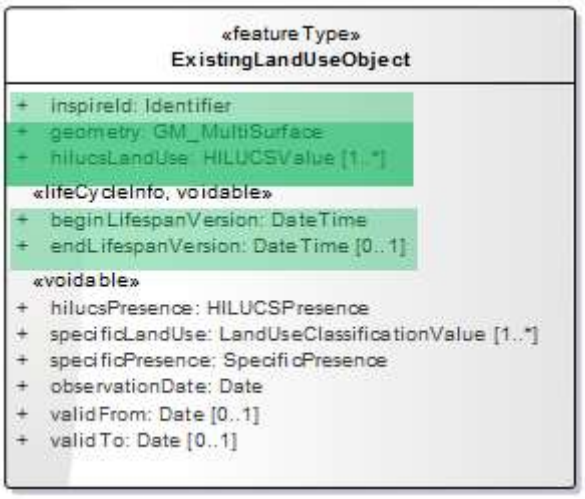


Figure 7: INSPIRE mechanisms for managing temporal aspects of existing land use data

NOTE 1: In case of a LandUse product that is captured as temporal snapshot, the temporal attributes should be documented at dataset level. It is also advised to provide a unique identifier (e.g. just a database identifier) but it should be recognised that getting persistent identifiers would be hardly feasible and not really meaningful.

7.2 Other topics

7.2.1 Priority scope

Core recommendation 3 puts priority on current, valid features (both for existing and planned land use) whereas core recommendation 11 explains more explicitly priority data for planned land use.

Core recommendation 12

Priority should be given to spatial plans and related zoning elements that are under legal force and that are binding.

Figure 8 : Priority scope for planned LandUse

7.2.2 Levels of detail

Core data focus on the requirement for large scale data as this level corresponds to the general trend. Based on this large-scale data, more generalised products may then be derived.

8 Annex B: Methodology

8.1 A specific document for core theme Land Use?

The Land Use theme is composed of sub-theme existing Land Use and of sub-theme planned Land Use. On one side, existing Land Use is generally considered as relatively closed to Land Cover as many past or existing products are mixing these two concepts. On the other side, planned Land Use might be considered a specific case of theme "Regulated or Managed Zones".

The first question UN-GGIM: Europe WGA had to cope with was "Is core theme Land Use deserving a "Recommendations for content" document by itself or wouldn't it be better to include in same document existing Land Use and the Land Cover and to include planned Land Use under "Regulated or Managed Zones"?

The first option was chosen due to the fact that, despite of their (significant) differences, both planned Land Use and existing Land Use carry a key specific information, the land use type itself. In addition, the current trend is to separate clearly Land Cover and Land Use concepts, what was another reason to have separate documents for Land Cover and Land Use.

8.2 General methodology

The elaboration of data specifications for core theme Land Use has been based on several main sources:

- The investigations done by WG A focusing on Land Cover but also addressing existing Land Use
- The investigations done by WG A about Regulated or Managed Zones
- The INSPIRE specifications on theme Land Use

More details about the two first sources may be found in the "Recommendations for content" of the core themes "Land Cover" and "Regulated or Managed Zones ". These sources have given the general architecture of Land Use main products. For existing Land Use, the core requirement is to have large scale data, covering whole land territory, with update frequency around 3 years and generally captured from images and/or cadastre. For planned Land Use, the main requirement is to make data easily accessible in a convenient digital vector format, to provide the link with the legal text, i.e. the Spatial Plan and priority should be given to valid and binding plans, so mainly to local data.

The INSPIRE specifications on theme Land Use have provided a good starting point for higher level of harmonisation, through the HILUCS standard (Hierarchical INSPIRE Land Use Classification System).

In addition, the work conducted by the NIVA project about IACS data sharing has identified a strong interest of various users for annual crop maps. NIVA is an EU funded project aiming to develop open-source tools for better CAP management and to promote broader use of IACS data.

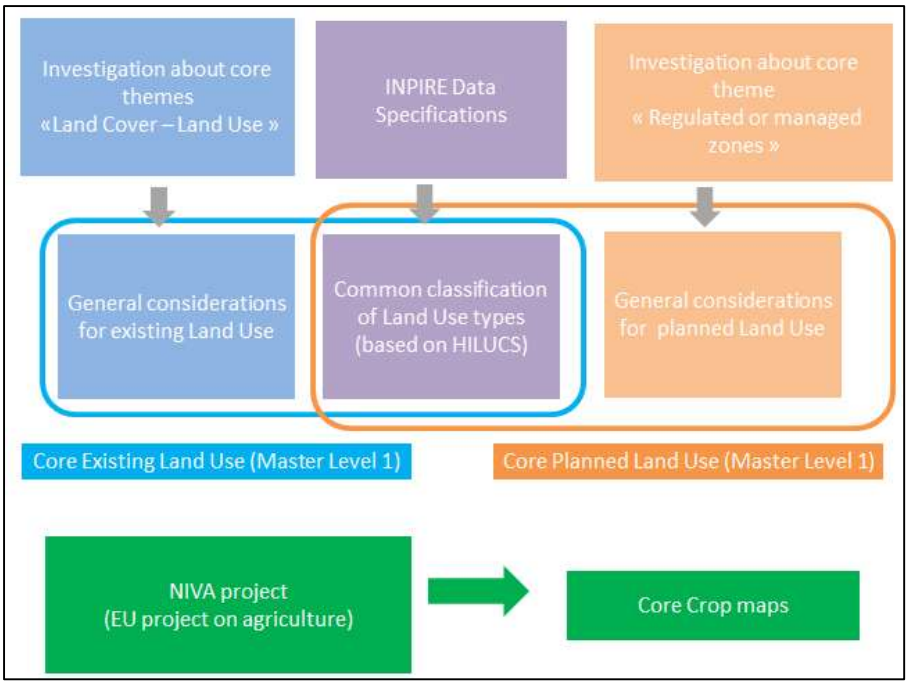


Figure 9: Methodology overview