
INDICATOR 15.1.1 | Forest area as a proportion of total land area

[Tier I indicator]

A | *Global metadata*

B | *National practices: Austria (NMCA), Finland (NMCA), France (NMCA), Germany (NMCA), Italy (e-GEOS) and Spain (NMCA)*

C | *EU SDG indicator: 15.11 Forest area as a proportion of total land area (Eurostat)*

A. GLOBAL METADATA | UN SDG Metadata

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

Data that will be used for the indicator will be provided to FAO by countries in the form of a country report following a standard format, which includes the original data and reference sources and descriptions of how these have been used to estimate the forest area for different points in time. Detailed methodology and guidance on how to prepare the country reports and to convert national data according to national categories and definitions to FAO's global categories and definitions is found in the document "*Guide for country reporting for FRA 2015*", http://www.fao.org/3/a-au190e.pdf

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

The indicator is provided at country level, with no further disaggregation.

Potential disaggregation could be operated according to administrative units of each Country

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

The monitoring of the indicator can be repeated at regular intervals of 5 years, allowing for three reporting points until the year 2030. FAO has been collecting and analysing data on forest area since late 40's. This has been done at intervals of 5-10 years as part of the Global Forest Resources Assessment (FRA). The last one, FRA 2015, contains some 120 variables covering the period 1990-2015: 1990, 2000, 2005, 2010 and 2015.

Anyway data adopted by single Countries for the provision of information to FAO could foresee more than five years for their updating

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

Data collection for the FRA used for the computation of forest area actually takes place during the three years before the release year. Release is operated at the end of the reference year. The possibilities of a more frequent reporting on forest area and other key indicators are currently being evaluated

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

The Global Forest Resources Assessments (FRA) is based on two primary sources of data:

- Country Reports prepared by National Correspondents
- Remote Sensing analysis that is conducted by FAO together with national focal points and regional partners.

All data are provided to FAO by Country in the form of a Country Report following a standard format, which includes the original data and reference sources and descriptions of how these have been used to estimate the forest area.

The bulk of data collected through the FRA comes from submissions to FAO by National Governments through their officially nominated National Correspondents and their teams, which prepare the Country reports following a standardized format and methodology. Some of them prepare more than one report as they also report on dependent territories. For the remaining Countries and territories where no information is provided, a report is prepared by FAO using existing information and a literature search. In this framework, National Governments are critical partners in the FRA, because without them the FRA would not have access to official data forest-related data. Therefore Government commitments to submit data to FAO for the FRA are fundamental to the FRA process.

The Country reporting process, that is the backbone of FRA since 2005, is where the best available and most recent information from all Countries and territories is compiled and analyzed. It is a continuously evolving process which seeks to meet the changing information needs and produce relevant information for forest related decision making by using the latest available data, methods and technologies

For FRA 2015, there were two options for submitting the reports, either in word format via e-mail or using the Forest Resources Information Management System (FRIMS), which is an online portal for FRA 2015 data entry. Country reports underwent a review by a team of reviewers and once the review was completed, Countries were asked to confirm the report before its publishing. Final Country reports were sent to the respective Head of Forestry for confirmation.

Recent significant advances in the international forest policy arena set new demands for the FRA process, both in terms of scope and reporting periods. Therefore FRA Expert Consultations have been organized since 30 years at regular intervals to receive technical guidance and support on the scope and standards of the global assessment to ensure consistent and accurate reporting across Countries, organizations and processes.

When FRA began in 1948, FAO was the only organization collecting and reporting global forest resource information. Today there are many international and regional organizations involved in measuring, monitoring and reporting forest resource data, mostly using Remote Sensing with little or no information other than tree cover area estimates. In 2011, six international organizations came together to create the Collaborative Forest Resources Questionnaire (CFRQ), representing some 100

Countries and 88 percent of the world's forest area. These organizations now jointly collect and share data on over 60 percent of the total number of variables collected through the FRA process. These data are then shared among the CFRQ partners so that Countries are asked only once for this information. In other words, the data are collected once and used many times. This both reduces the reporting burden and increases data consistency across organizations. The CFRQ partnership has in the process also helped to standardize definitions and timing of data collection.

The data collection process for FRA is carried out with a high degree of Country participation. 172 national correspondents were officially nominated for first time for FRA 2005, many of whom were backed by a team of national experts, worked in close collaboration with FAO staff in the compilation of the data to be reported. The collaboration with countries has been further strengthened in each assessment. For FRA 2015, 288 national correspondents and alternates have been nominated.

This close involvement of Countries through the global network of National Correspondents is crucial to the success of the FRA process and leads to better use of existing data (better estimates, improved capacity) and an increased feeling of ownership of the process by Countries.

The tasks of the National correspondent to FRA are the following:

- act as focal points for communications with FAO on matters related to the Global Forest Resources Assessment Programme;
- provide feedback on the design and process of the Global Forest Resources Assessment (FRA), including Country reports and special studies and a global remote sensing survey;
- process and submit national data to FRA, including the co-ordination of inputs from different national institutions as well as taking national reporting to other international processes into account;
- act as point of contact for identification of national specialists for the remote sensing survey; when it takes place, and selected special studies which form part of FRA;
- verify and validate national information for FRA before publication;
- disseminate information within their country on the Global Forest Resources Assessment process and related activities;
- contribute to specific regional activities relating to FRA;
- participate in meetings and workshops organized in the context of the Global Forest Resources Assessment Programme.

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

According to the FAO definitions, Forest is defined as: "*land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use*". More specifically:

- Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters.

- It includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.
- It includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.
- It includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.
- It includes abandoned shifting cultivation land with a regeneration of trees that have, or are expected to reach, a canopy cover of at least 10 percent and tree height of at least 5 meters.
- It includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.
- It includes rubber wood, cork oak and Christmas tree plantations.
- It includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.
- It excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations, olive orchards and agroforestry systems when crops are grown under tree cover.
- Note: Some agroforestry systems such as the “Taungya” system where crops are grown only during the first years of the forest rotation should be classified as forest.

Total land area is the total surface area of a country less the area covered by inland waters, like major rivers and lakes.

Remote Sensing is part of the process. A global remote sensing survey was conducted in 2010 with over 200 specialists from about 100 countries. In addition, a close working relationship with the European Commission Joint Research Centre (JRC) has resulted in sharing both technical advances and the workload of global forest change analysis of Landsat data.

Capacity building plans are underway to ensure that opportunities are provided to interest Countries to incorporate Remote Sensing into Country reporting and to extend the value of hard work done by National Correspondents by helping them reach a broader domestic audience. Remote Sensing was used in FRA 2015 - primarily in assessing fire affected areas and estimating the area where forest canopy cover has been reduced.

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Once received, the Country reports undergo a rigorous review process to ensure correct use of definitions and methodology as well as internal consistency. A comparison is made with past assessments and other existing data sources. Regular contacts between National Correspondents and FAO staff by e-mail and regional/sub-regional review workshops form part of this review process.

All Country reports (including those prepared by FAO) are sent to the respective Head of Forestry for validation before finalization and publishing of data. The data are then aggregated at sub-regional, regional and global levels by the FRA team at FAO.

FRA 2015 has been organized to help reduce the forest-related reporting burden countries face. This includes the approach of updating the FRA 2010 country reports rather than starting with blank templates, pre-filling of data for Countries and eliminating some of the more difficult variables. It also introduced the new Collaborative Forest Resources Questionnaire (CFRQ). The CFRQ was built with the premise that data should be collected once and used many times. These data have been shared among the data collection partners so that countries do not need to report the same numbers more than once – and the partners all use the same data in analyses and reporting, facilitating and improving data quality.

In terms of completeness, ultimately data are reported for 234 countries and territories, of which 155 reports come from countries themselves - countries that contain 98.8 percent of the world’s forests. The remaining 79 Countries and territories (covering only 1.2 percent of the world's forest) were reported as desk studies prepared by FAO using existing information from previous assessments and literature search.

The national figures in the database are reported by the countries themselves following standardized format, definitions and reporting years, thus eliminating any discrepancies between global and national figures. The reporting format ensures that countries provide the full reference for original data sources as well as national definitions and terminology. Separate sections in the reporting format (Country reports) deal with:

- the analysis of data, including any assumptions made and the methods used for estimates and projections to the common reporting years)
- calibration of data to the official land area as held by FAO
- reclassification of data to the classes used in FAO’s Global Forest Resources Assessments.

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the “as-is” situation)

Since 1990, FRA complements the information collected through the Country reporting process with global and regional analysis of the world's forest resources using Remote Sensing. With better access to a growing archive of satellite imagery and availability of new tools to facilitate image processing and interpretations, Remote Sensing is becoming an important tool for assessment of status and changes in tree cover and land use.

While the FRA 1990 and 2000 Remote Sensing surveys of forest cover change only covered the pan-tropical region, the FRA 2010 Remote Sensing survey was the first comprehensive global survey on forest land use change dynamics over time, including deforestation, afforestation and natural expansion of forests. The survey was implemented by FAO in collaboration with the EC Joint Research Centre and other partners.

The assessment used a sample-based approach applying a systematic sampling design based on each longitude and latitude intersects with a reduced intensity above 60 degrees north due to the curvature of the Earth. It covered the whole land surface of the Earth and consisted of about 13,500 samples, of which about 9,000 samples are outside deserts and areas with permanent ice. The area covered at each sample site is 10 km x 10 km, providing a sampling intensity of about 1 percent of the global land surface.

For each sample plot, Landsat satellite images, collected around 1990, 2000 and 2005, were interpreted and classified using an automated supervised approach where national experts participated in the final validation. Nearly 7 million polygons were analyzed at each time interval to enable detection of forest area, forest gains and forest losses with size greater than 5 hectares. A detailed description of the methodology applied in the FRA 2010 remote sensing survey was published in the *Journal Remote Sensing, 2016 (8),* and can be downloaded at http://www.mdpi.com/2072-4292/8/8/678 .

As part of FRA 2015, updated forest land-use and change rates (deforestation and afforestation) were calculated at global, regional (continent) and ecological zone scales for 1990, 2000 and 2010.

Today, several organizations are developing global and regional products and datasets about forests. FAO collaborates with many of these organizations in order to provide users with the best possible information on how the world's forests are changing.

Anyway, in general geospatial data, remote sensing in particular, have a limited usage

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

Assessment of forest area is carried out at infrequent intervals in many countries. Access to remote sensing imagery has improved in recent years, but remote sensing techniques have still a limited usage, even if they can provide a continuous mapping of the whole land and in particular of forest area in every Country with low cost and on repetitive basis. A new methodology based on Remote Sensing should rely on workflows with high degree of automation, generating new data or relying on existing thematic layers extracted by satellite data in the framework of consolidated programmes operating on a worldwide basis. In particular, the adoption of a methodology strongly relying on the usage of Remote Sensing data, and supported by other geospatial data layers and proper ground sampling, would allow to cover specific gaps allowing:

- an high disaggregation of data, for example according to administrative unit, also by adopting very detailed units
- the release of the indicator over every Country generated with the same methodology, including those Countries for which no National Correspondents are present
- the improvement of the frequency for the release of the indicator
- a more homogeneous and detailed evaluation of the indicator

The adoption of geospatial information could be based on the processing from scratch of free of charge satellite data or on the usage of already existing geospatial layer based on satellite images and released with a more or less reliable frequency by international agencies.

It has also to be considered that a possible reduction of costs, due to the adoption of free of charge satellite data and geospatial layers, could be achieved with a more relevant usage of geospatial data.

A clear definition of forest and forest area must be clearly stated. In particular, as enhanced by France, "*Total land area is the total surface area of a Country less the area covered by inland waters, like major rivers and lakes*." Since from a legal point of view, internal (sea) waters are considered being part of the country, also coastal waters should also be excluded. From practical point of view, the situation is heterogeneous in Europe: the administrative units stop at coastlines in most European countries but may include some marine areas in other countries. "major rivers and lakes" is subjective and may be interpreted in different ways. Some objective, measurable criteria would be required.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

Global perspective:

This indicator is categorized under Tier I, meaning the indicator is conceptually clear, has an internationally established methodology and standards are available, and data are regularly produced by Countries for at least 50% of Countries and population in every region where the indicator is relevant. The adopted methodology is aimed at the collection of data by single Countries which are supplied through a report generated according to specific and detailed guide. By browsing through the reports of the Countries, geospatial data and remote sensing data in particular are part of the process, but are not used according to a global shared methodology, and their usage is still limited in most of the Countries.

The remote sensing based approach to be adopted should be based on consolidated procedures, relying on highly automated workflow and free of charge data, in order to be applicable in the same way in every Country. At the moment several international projects have released Land Cover data with different level of detail, also at global level, also taking into account, in some cases, a policy for data updating (i.e.: Global Land Cover Datasets at a 30m Resolution - GlobeLand30, the MODIS Land Cover Type product -MCD12Q1, The Global Land Cover by National Mapping Organizations - GLCNMO) . From this land cover data sets can be extracted those classes that better fit the definition of forest area as defined by FAO (and reported in section A*1. Geospatial data analysis and integration* of this document). A possible re-definition of forest area as defined by FAO could be needed in order to fully leverage on the opportunity offered by Remote Sensing. Forest area in this case should be mapped with a good level of detail from a geographic point of view, with geometrical resolution (in terms of size of the minimum mapping unit) depending on the adopted satellite data in the processing. Today, cell size for the generation of Remote Sensing based land cover based on automatic processing of satellite data is generally around and below one sq. km and less, with higher detail for specific datasets or over more limited area. Initiatives are running for targeting a reduction of the cell size, strongly relying on the full availability of time series of free of charge images collected by Sentinel-1 and Sentinel-2 satellite on a global basis. In particular, the initiative of ESA (European Space Agency) in support to the Climate Change Initiative (https://www.esa-landcover-cci.org/) foresees the identification of automatic workflows for the generation of Land Cover with a resolution between 30 and 1000 meter, which could be activated through a dedicated service platform. Actually, higher level of detail over large land cover dataset are only achieved, with a fair thematic accuracy, with a large manual work, but the availability of free of charge satellite time series is going to change quickly the scenario. Once fully available, it will be possible to every Country to generate its own dataset, with the desired frequency. In the meantime, the actual ESA CCI Land Cover (ESA Climate Change Initiative Land Cover) could be considered for the estimation of the 15.1.1 indicator, taking into account that:

- the indicator is updated on a yearly basis
- a workflow with high level of automation is adopted for its generation
- the resolution of the indicator is 250 x 250 meters on a worldwide basis

This would allow:

- to monitor its evolution with a relevant temporal frequency
- the comparison of results across Countries
- a disaggregation of the indicator over very detailed computation unit

It must also be taken into account that the legend adopted by ESA Land Cover is not perfectly fitting the FAO definition of forest.

The ESA Land Cover is one of the possible Land Cover maps produced on a global basis that could support the computation of the indicator. Other Land Cover should be evaluated at this purpose, provided that they offer guarantees at least for the achieved quality and for a regular temporal release. In general, on a global basis, a suggested methodology for a wider usage of geospatial data should be based on a three steps approach:

- to select the proper land cover dataset to be used for forest area detection (as well as for the total land area identification), also considering which kind of post-processing is requested for an homogeneous definition of the forest area
- to use existing land cover at the best resolution for the generation of the indicator
- to adopt new future land cover data sets once available better resolution

This approach will allow the usage of data with the similar characteristics all over the world, thus providing a more sound comparison of data of different Countries and a better aggregation/disaggregation of data.

In the case of the adoption of the ESA CCI Land Cover, a large usage of open source procedures is foreseen, thus guaranteeing the easily re-usage and maintenance of the code for forest class and total land area extraction.

Main geospatial data sets that are involved in the generation of the Land cover from which to extract the indicator as shown before are:

- Satellite data:
  - Modis satellite time series
  - Sentinel-2 satellite time series
  - Sentinel-1 satellite time series
  - Landsat-8 satellite time series

- Data layers:
  - Supporting Land use data sets
  - Administrative borders
  - Geocoded sampling ground points, that are already currently collected by most of the Countries
  - Digital terrain model (SRTM90 or similar)

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

All mentioned geospatial dataset are free of charge, satellite data are updated with a very high collection frequency, depending on the mission.

Data quality requirements: (List in general terms the requirements (for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

As for the current computation strategy of the indicator, when designing an upgraded workflow strongly relying on Remote Sensing and geospatial data, it is mandatory to have a full control on metadata and in particular those related to data quality of every dataset that is included in the workflow. Despite the availability of several datasets of land cover as seen in the previous session, it is important to select the one offering the best performances in terms of quality. At the moment, according to recent achievements (*Land Cover CCI – 1st User Meeting - ESA ESRIN, Frascati - 31 August 2017*), the best datasets in terms of thematic accuracy are the ESA CCI Land Cover (71.9% overall accuracy) and the MCD12Q1 (70.3% overall accuracy). In the evaluation of these thematic accuracies, it must be considered that they are related to a large number of classes; the expected thematic quality achievable for a forestry class obtained by merging several original classes is much higher. It must also be considered that main datasets undergo quality assurance procedures addressing both processing workflow and products. The adoption of data layers built on satellite data with a global coverage will guarantee completeness of the coverage of the indicator, as well as the consistency of the base land cover dataset adopted. In terms of resolution, a gridded level of detail in the order of 1 squared kilometre or less can be achievable and suggested. For the positional accuracy, when relying on recent satellite data, achievable positioning is always within 2 pixels error, therefore with an accuracy that can be below 1 km and that, according to selected dataset, can be improved up to 20-50 meters. With this level of detail, main problems related to positioning accuracy are provided by administrative borders that, depending on the area, can have positioning error much larger than those coming from satellite derived data.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

All considered satellite data sources are fully available, and is foreseen their continuity in the next years. They are all accessible through download without specific limitations for commercial and not-commercial usage. For the land cover dataset, availability and updating policy is depending on the dataset, but in general the main one are continuously maintained updated. In terms of frequency of dissemination, it is possible even to target yearly update. It is foreseen at medium term, anyway, the release of open source software components that could allow an easy generation at any time of new updated geospatial layers starting from free of charge data by each single Country.

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

No specific limitations for data collection can be envisaged by adopting a methodology based on already existing and maintained geospatial dataset. Since all the data that are requested by the indicator (forest area and total land area) can be derived by the same data source, non specific issues related to data integration are foreseen. The only issues to be addressed are: i) the proper identification of the land classes to be considered and/or aggregated for the computation of forest area and total land area. ii) the integration of administrative borders that can generate some bias due to coarse geometric accuracy, but this is really a minor issue that can become important only when a disaggregation over very detailed geographic units is operated.

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - “to-be” situation)

For a proper integration of geospatial data in the workflow for indicator computation, an analysis of the definition of the forest class that can be provided by Remote Sensing vs the definition that is currently provided by custodian agency should be considered. All the procedures for geospatial data exchanging with data provided must be tuned, and proper training sessions on the usage of data should be envisaged. At a second stage, once available more sound and tested open source algorithms for the extraction of forest and total land areas from remote sensing images, there will be a need for training all stakeholders involved in the process of indicator computation at Country level, on how to compute in an autonomous way the indicator.

B. NATIONAL PRACTICE **| Austria (NMCA)**

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

The theme forest has different responsibilities in Austria:

(1) the ministry of environment maintains forest areas from a thematic expert point of view in an autonomous agency (https://bfw.ac.at/) and

(2) the ministry of economy with its federal office of metrology and surveying annually records land use areas (and therefore the forest areas) for all administrative units, derived from the Austrian cadastre (http://www.bev.gv.at).

This assessment focuses on (2) because it provides a precise area calculation (cadastre) of high frequency (yearly).

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

No further disaggregation of this indicator.

Data are available down to cadastral zones.

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

Yearly (reporting the land use for the past year at the reference date 31.12.YYYY)

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

Changes of the forest extend are recorded whenever parcel adaptations will be made. These changes are reported at the reference date.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

The dataset reporting forest areas is included in the product "Regionalinformation Austria", which is a free accessible product at the Austrian Federal Office of Metrology and Surveying: http://www.bev.gv.at/portal/page?_pageid=713,2669356&_dad=portal&_schema=PORTAL

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

Cadastral measurements are used to receive forest areas.

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

The dataset for forest areas requires high temporal accuracy because administrative units may change.

Definitions for forest areas are very important because any calculated area for the forest may change with its demarcation.

The definition given in the metadata concepts

(https://unstats.un.org/sdgs/metadata/files/Metadata-15-01-01.pdf) are a good starting point.

It is still open how to deal with legally defined forest areas that may not be observed in remote sensing - or non-legally defined forest areas (forest observable in OI but legally not defined as forest).

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the "as-is" situation)

At the moment the product regional information describes land use areas within the cadastre. This is a thematic description, which means that no geometric representation exists.

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

The thematic description of forest areas derived from cadastre seems to be sufficient for this indicator.

The main problem is the change of reference units or changes within the thematic classification, which is needed for temporal comparison.

A geometric representation could help for more specific analysis, but also requires a clear comparable structuring of these polygons…maybe an aggregation to statistical grids.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

The actual situation should be sufficient to monitor this indicator.

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

INSPIRE conformance will call for a geometric dimension, which does not exist in this dataset.

Data quality requirements: (List in general terms the requirements for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

The product regional information is available at

http://www.bev.gv.at/pls/portal/docs/PAGE/BEV_PORTAL_CONTENT_ALLGEMEIN/0200_PRODUKTE/UNENTGELTLICHE_PRODUKTE_DES_BEV/Regionalinformation.zip

This dataset is available as download product.

The data are free according to paragraph 2.2.2.e of terms of use

http://www.bev.gv.at/pls/portal/url/ITEM/88AB1D338625A5D0E040010A83211FDB .

The dataset is available yearly at the reference data 31.12.YYYY

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

The data are available as CSV.

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - “to-be” situation)

B. NATIONAL PRACTICE | Finland (NMCA)

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

Natural Resources Institute Finland (Luke): Latokartanonkaari 9, 00790 Helsinki, Finland.

- Luke provides the data for FRA 2015 based on National Forest Inventory (NFI) based on network of NFI field sample plots (http://stat.luke.fi/en/tilasto/6221)

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

Based on network of NFI field sample plots forest area is estimated on municipalities, regions or any geographical area (http://www.metla.fi/ohjelma/vmi/vmi-moni-en.htm). Disaggregation is technically possible for large administrative regions, such as NUTS2 or NUTS3.

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

New data are published annually, using most recent NFI data, usually moving average from 3 latest years.

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

Because data from 3 latest years is applied and there is almost one year delay in processing the data, results are on average 2 years old.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

National Land Survey publishes annually the total land area of Finland (by municipalities) using map data. For total forest area, we use the total land area estimated by National Land Survey and National Forest Inventory (NFI) field sample plots. NFI field observations are used to estimate the proportion of forest from the total land area. Further disaggregation by forest characteristics is possible using several parameters existing in the data (e.g. forest type).

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

In addition to sample plot field measurements, the NFI multi-source inventory method employs remote sensed data and other digital data sources such as land-use maps and elevation models. With the aid of satellite images, the forest characteristics can be estimated for areas lying between the relatively sparse networks of NFI sample plots. The non-parametric k nearest neighbour estimation method is used in the image analysis. Mainly high resolution satellite images, like Landsat TM and SPOT, have been applied. Map data is used to separate forested areas from other land-cover categories, and peat-land maps are used also in stratification. A digital terrain model is used to reduce distortion effects caused by topography. The geometric resolution of both input data and resulted maps is 16 m.

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

National Land Survey map data accuracy is compliant to scale 1:10.000-1:5.000. For total forest area, we use the National Forest Inventory (NFI) field sample plots. Since statistical sampling is applied, the minimum reporting area should not be too small. The results by NUTS2 regions are reliable, results by NUTS3 regions contain larger (relative) variation due to smaller number of sample plots.

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the "as-is" situation)

Satellite imagery like Landsat TM and SPOT, National Forest Inventory (NFI) field sample plots, digital terrain model, National Topographic map.

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

For national results, no changes in the current practice are foreseen. For regional results, we may apply post-stratification techniques using satellite images.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

For regional results, we may apply post-stratification techniques using satellite images.

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

Sentinel-2 satellite data.

Data quality requirements: (List in general terms the requirements for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Sentinel-2 data to improve the resolution (10 meters) and geometrical accuracy (10 meters)

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

Since statistical sampling is applied, the minimum reporting area should not be too small. The results by NUTS2 regions are reliable, results by NUTS3 regions contain larger (relative) variation due to smaller number of sample plots.

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - "to-be" situation)

To improve regional results applying post-stratification techniques using satellite images.

B. NATIONAL PRACTICE | France (NMCA)

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

IGN (French national mapping agency) is the national correspondent of FAO for the FRA (forestry resources assessment) survey. In the framework of this survey, IGN supplies a couple of indicators including 15.1.1.

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

Indicator 15.1.1 is supplied per territory:

- One indicator for metropolitan France;
- One indicator for each oversea department.

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

The FRA survey used to be quinquennial, but since 2015 it is annual, therefore years 2016 to 2020 are currently computed in advance.

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

Indicator 15.1.1 is computed through interpolation between 3 to 5 years, e.g. for 2015: National Forest Inventory data of years 2014 2015 2016 were used to compute a 2015 state.

From 2016, data are extrapolated; a model is adjusted on ancient forest surface increase data. The method still has to be refined.

Indicators 2016 to 2020 have to be supplied to FAO for October 2018.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

The data source is the annual National Forest Inventory survey: https://inventaire-forestier.ign.fr/

The availability of statistical information about forest territories, independent and objective, exhaustive and renewed periodically, is crucial to support public policies. Created in 1958, the national forest inventory belongs since 2017 to public surveys with compulsory character, whose general interest and statistical quality is recognized. Since 2005, IGN realizes every year the permanent and national inventory of the metropolitan French forest resources. The survey produces at the same time an estimation of the woody surface and the volume of the trees which it contains. All the properties, public and private, are inventoried.

The inventory method includes two successive statistical phases:

The first phase of the inventory consists of a punctual photo-interpretation. From the departmental reference orthoimage (BD Ortho), information relative to the cover of the ground and to its use is noted on small places with a radius of 25 meters surrounding the inventory points. The interpretation concerns every year a 80 000 points systematic sample. IGN determines for every point of the sample the nature of the cover of the ground (forest, moor, artificial grounds, etc.). Since 2005, the IGN adopted the FAO definition of the forest: "The forest is a territory occupying a surface of at least 50 ares with trees which can reach a height superior to 5 m in in-situ maturity, a wooded coverage setting of more than 10% and a width average of at least 20 meters. It does not include the grounds the dominant use of which is agricultural or urban." Coverage afforested with a dominant agricultural or urban use are not considered as forest. This information contributes to a first estimation of the surface of the territory according to the cover and the use of the ground.

The second phase of the inventory consists in visiting on the ground a sub-population of points photo-interpreted during the first phase to confirm the cover of the territory (forest or not) and, if it is well a forest, to collect a large number of data describing the populating, the trees, the environment, the flora, etc.

Thanks to this tool, the national forest surface is estimated with a 0.3 % standard deviation.

Access conditions of the National Forest Inventory:

- Raw data (what is surveyed in the field): openly accessible;
- Precise coordinates of the sample plots: disseminated in a degraded way (to protect personal data, legal obligation);
- Sampling plan: not disseminated because subject to statistical secret (legal obligation).

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

The National Forest Inventory is a statistical exploitation of field measurements. It is a statistical survey which is localized in space.

The National Forest Inventory uses a geospatial reference layer to know the total surface and to know where to apply the inventory grid in space.

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

For the National Forest Inventory:

- Documentation is accessible and validated by the National Council for Statistical Information;
- There is an internal quality procedure with field control teams, which blind re-measure inventory points;
- Collectors are coordinated.

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the "as-is" situation)

The National Forest Inventory is a statistical exploitation of field measurements.

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

The National Forest Inventory was designed to supply indicators about afforestation rates in the country. No gap is identified for the metropolitan territory, but there are gaps in oversea departments, where there is no system for producing periodic information about forest coverage.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

See section above.

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

Following an order from the ministry of agriculture, IGN is currently producing a forest map over oversea departments, in order to compute Indicator 15.1.1.

Data quality requirements: (List in general terms the requirements(for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Oversea departments, the forest maps which are currently being produced will contain at last two envelopes:

- Envelopes of forest according to the FAO definition (minimum surface: 0.5 ha; and minimum afforestation rate: 10%);
- Envelopes of other forested lands (minimum surface 0.5 ha, and minimum afforestation rate between 5 and 10%) and other lands covered by trees (agricultural or urban land, e.g. agroforestry areas, orchards).

Over Guadeloupe and Martinique, there will be more information, richer nomenclature, e.g. forest types will be distinguished.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - “to-be” situation)

When available, national forest inventory data is better than forest maps to compute indicators, because forest maps cannot supply information about wood volumes, while national forest inventory data supply information about both wood surface and wood volume. National forest inventory data enables to compute several indicators in a consistent way.

B. NATIONAL PRACTICE | Germany (NMCA)

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

The Federal Statistical Office of Germany (Statistisches Bundesamt - STBA) is the responsible institution for the authoritative area statistics. The STBA collects the statistical data from the federal states (Länder).

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

A disaggregation of this indicator is not applicable, the indicator figure is provided for the whole territory of Germany.

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

Figures on the official area statistics are published every year, based on a yearly cycle.

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

The area statistics is published on a yearly basis (3rd quarter), with reference on the date 31st December of the previous year. The indicator 15.1.1 is calculated based on those figures of area statistics.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

The data source for the area statistics – and through that for the indicator 15.1.1 – are the cadastral data of the land surveying authorities (http://www.adv-online.de/Products/Real-Estate-Cadastre/). The cadastral data cover 100% of the German territory. The data on area statistics is transferred from the cadastral institutions to the Federal Statistical Office through the statistical offices of the Länder. Each parcel object within the cadastral data system contains a land use type, such as “forest”. All cadastral parcels with the use type “forest” are summed up to the entire forest area in Germany. The data collection itself is based on analysis of areal orthophotos and in-situ measurements.

The cadastral data is updated either on a cyclic basis, or occasion-based, e.g. when a parcel is divided or other cadastral surveying is accomplished.

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

See above under "data sources".

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the "as-is" situation)

The indicator 15.1.1 is calculated based on official area statistics. Spatial data is used in form of the geometries of cadastral parcels, which are the source for the statistical data in form of tables.

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

Currently, the indicator 15.1.1 is calculated based on the official area statistics, which rely on cadastral data and represent a total capture of all forest areas. Another data source for forest areas in Germany is the national forest inventory ("Bundeswaldinventur - BWI"), which give forest area estimates based on field sample points with a varying density between 2x2 and 4x4 km. The survey is executed every 10 years. The BWI overestimates the size of the total forest area compared to the area statistics with many additional information like tree diversity, structure, timber stock and wood utilization. A proposal could be to assess the deviations of the two data sources by a spatial analysis by integrating the BWI sample points with the cadastral parcels. Coordinates of the BWI sample point are needed to do so.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

As the area statistics is based on cadastral data, which cover 100% of the territory. No more spatial data is needed.

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

Data quality requirements: (List in general terms the requirements(for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - “to-be” situation)

B. NATIONAL PRACTICE | Italy (e-GEOS)

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

Under ISTAT (Italian National Institute of Statistics) coordination, source of the indicator is ISPRA (Italian Institute for Environmental Protection and Research), providing processing of the total forest area using data generated by CFS (Corpo Forestale dello Stato) for the contribution to the Global Forest Resources Assessment 2015 - Country Report

Italy (http://annuario.isprambiente.it/entityada/basic/6117). The content and the structure are in accordance with the recommendations and guidelines given by

FAO in the document Guide for country reporting for FRA 2015 (http://www.fao.org/3/a-au190e.pdf) (source: http://www.istat.it/it/files/2016/12/2017_SDG_15_Italy.pdf).

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

It is not foreseen the disaggregation of the indicator according to UN SDG metadata. Anyway it can be disaggregated according to geographic location, which is according to the official region or province borders. Additional disaggregation could be done according to ISTAT census data, but could be meaningless

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

Actually 10 years, based on the National Forestry Inventory updating frequency. Interpolation can be used for other frequencies

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

The generation of the layer is based on the integration of photointepretation of remote sensing with ground surveys. The whole workflow, including validation, can take several years for indicator availability.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

For total forestry area, data sources are provisional results of photointerpretation from first phase of the National Forestry Inventory 2015 operated by Corpo Forestale dello Stato (CFS). No ground truth used yet.

Not known how total country area (as foreseen by the indicator) is actually computed. The easiest way is to use is using data from official borders at Commune level for the global surface.

Main rivers and lakes area (to be subtracted to the global area) can be computed:

- from CORINE Land Cover water classes, considering that only main rivers are treated as a polygon (that is: they have an area)

- From Copernicus HRL water bodies

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

Forest area is computed based on the integrated usage of aerial and satellite data, which are phointerpreted, and ground truth survey, based on sampling strategy. Absolute sampling points location is not public available, therefore statistics at national level can be provided only by CFS.

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Resolution of Italian available aerial ortoimages is actually 20 cm (was 1 meter / 50 cm in the past), with accuracy compliant with 1:10,000 - 1:5.000 scale. Data are collected on each administrative region every three years.

Data from ground surveys are mandatory for a proper estimation of the forest surface.

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the "as-is" situation)

Usage of ortophoto from aerial or satellite data

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

The adopted methodology can be applied every 10 years, and fully relies on geospatial data. An improvement could be achieved by increasing the indicator measuring frequency in comparison to the actual. For this improvement should be evaluated the usage of additional data sources, or a more intensive usage of existing ones, as well as the usage of a lighter workflow focused of the forest coverage computation only, and not on a national forestry inventory

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

Gap to be filled could be increasing the frequency in the provision of the indicator and in more focused workflow for its computation. This goal could be achieved basically in three ways:

- increasing the releases of the National Forestry Inventory, maybe in a simplified format only dealing with the periodic assessment of forestry area

- By using alternative methods based on low/no cost satellite data for forestry area detection

- Adopting datasets collected and validated at EU level for forestry area estimation (and for permanent water bodies extension

In general, the adoption of additional data must be analyzed in terms of compliance with FAO definition of "forest area". Depending on adopted alternative strategy, costs maybe highly different

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

In the actual situation, indicator needs area already satisfied for a 10 years frequency. Additional data that could be added for improving frequency or support higher quality are:

Geospatial themes:

- CORINE Land Cover

- Copernicus HRL forest type layer

- Copernicus HRL water bodies

Geospatial data sources:

- Sentinel-1 satellite data

- Sentinel-2 satellite data

- National aerial ortoimages

Data quality requirements: (List in general terms the requirements for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Geospatial themes:

- CORINE Land Cover (CLC), the forest layer can be derived by properly assembling second and third level classes of the first level forest class. Minimum mapping unit is 25 ha, revisit frequency is 6 years, geometric accuracy < 25 m. The CLC multilevel legend is a consolidated international standard that can be locally adjusted with additional classes or by increasing the number of level from 3 to 4 or 5.

- Copernicus HRL forest type layer, resolution is 20x20 meters with geometric accuracy better than 100 m. The definition of this layer is very close to the FAO definition, since it considers forest area > 0.5 ha. Layer has been collected for 2012, updating frequency of 4 years, responsible organization EEA (European Environment Agency).

- Copernicus HRL permanent water bodies layer, resolution is 20x20 meters with geometric accuracy better than 100 m. Also very small water bodies are mapped, river are mapped only when of relevant width. Layer has been collected for 2012, updating frequency of 4 years, responsible organization EEA.

Geospatial Data Sources

- Sentinel-1 data: resolution 20 meters, achievable geometrical accuracy 20 meters, revisit 6 days

- Sentinel-2 data: resolution 10 meters, geometrical accuracy 10 meters, revisit 5 days

- National aerial ortoimages (3 years updating frequency) have 1:5.000-1:10.000 reference scale and 20 cm resolution in four spectral bands (visible + near infrared)

All mentioned geospatial themes and data sources are subject to data quality validation procedures.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

- CORINE Land Cover:

EU39 coverage, methodology exportable global. Accessible through download. No limitations . Six years refresh.

- Copernicus HRL forest type layer:

EU39 coverage, methodology exportable worldwide. Accessible through download. No limitations. Production every four years.

- Copernicus HRL water bodies

EU39 coverage, methodology exportable worldwide. Accessible through download. No limitations. Production every four years.

- Sentinel-1 satellite data

Global coverage. Accessible through download. No usage limitations. Available every 6 days in Europe, lower frequency, progressively increasing worldwide.

- Sentinel-2 satellite data

Global coverage. Accessible through download. No usage limitations. Available every 5 days in Europe, lower frequency, progressively increasing worldwide.

- National ortophoto:

National Italian coverage. Similar datasets collected over several countries in Europe, mainly with lower (50cm) resolution. Data collected in support to Common Agriculture Policy, often accessible also by Local Public Administration. Usage limited to Public Administration. Available every 3 years in Italy, similar or lower frequency in other EU countries.

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

When using Geospatial Themes, data are ready to be used. When using Geospatial Data Sources (for Countries outside EU, some technology transfer activities must be carried out for the extraction of needed Geospatial Themes from the images (normally through semiautomatic processing of satellite data followed by a manual interpretation and refinement). No specific problems for data availability and usage

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - “to-be” situation)

For the operational adoption of Geospatial Themes, some review in the definition of "forest area", should be considered. When starting from Geospatial Data Sources, the adoption still requires some review of "forest area" definition, as well the definition of operational workflow for information extraction

B. NATIONAL PRACTICE | **Spain (NMCA)**

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

- Directorate General for Rural Development and Forestry Policy of Ministry of Agriculture and Fisheries, Food and Environment responsible for forest data set: G7

- The National Geographic Institute of Spain (IGN) is the National Reference Centre in Land Cover and Land Use & Spatial Planning (EIONET´s National Reference Centre, by mandate of the National Focal Point, the Ministry of Agriculture and Fisheries, Food and Environment). IGN must coordinate the information in Spain related to Land Cover and Land Use. Among the NRC responsibilities IGN coordinates the project called SIOSE: The Information System on Land Cover and Use of Spain. H7

Currently, land cover and land use data sets are INSPIRE compliant. All of them have metadata and view and download service INSPIRE compliant.

- CORINE Land Cover (Spain):

http://www.idee.es/csw-codsi-idee/srv/spa/catalog.search#/metadata/spaignCLC

- Information System on Land Cover and Use of Spain (SIOSE) http://www.idee.es/csw-codsi-idee/srv/spa/catalog.search#/metadata/spaignsiose2011

All actions related with the management of the environmental information must be governed by the following European Directives: Directives 2003/4/CE, 2003/35/CE for the public access to environment information and Directive 2003/98/CE for the re-use of public sector information. NMCA.

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

15.3.1 (C150401) Proportion of land that is degraded over total land area: The continuous measurement of indicator 15.1.1 for years allows being identified land cover changes.

https://unstats.un.org/sdgs/indicators/Official%20Revised%20List%20of%20global%20SDG%20indicators.pdf

The available national data set facilitate the disaggregation of statistics in territorial lower-level units the country (Municipalities and Provinces)

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

MFE and IFN have long term frequency for update due to their thematic accuracy requirements. Updates periods and actualization campaigns can embrace 10 years.

The Information System on Land Cover and Use of Spain (SIOSE) is part of the National Land Monitoring Plan (PNOT), managed and coordinated by the IGN, which offers a multidisciplinary spatial data infrastructure, periodically updated, for the Spanish national and regional administrations.

Currently, 4 versions of SIOSE have been produced: SIOSE 2005, 2009, 2011 and 2014. Nowadays the nominal frequency for update of SIOSE is 3 years. These SIOSE versions make it possible to finally address the generation of CORINE 2012 via semiautomatic processes. From the last versions of SIOSE, SIOSE and MFE are coordinated in many regions and it is feasible to obtain aligned statistics in general terms of land cover.

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

The average production time of SIOSE is decreasing. Once created the database, the service WMS, WFS and ATOM are created. Its production time is 3-5 months.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

At national level for forest areas of Spain:

National Forestry Inventory (IFN):

http://www.mapama.gob.es/es/desarrollo-rural/temas/politica-forestal/inventario-cartografia/inventario-forestal-nacional/default.aspx

National Forest Map (MFE):

- Spatial data set has conformant metadata, and it is accessible through WMS and ATOM, but the spatial data set doesn't INSPIRE compliant yet.

- View service: http://wms.mapama.es/sig/Biodiversidad/MFE/wms.aspx

- ATOM (shapefile format):

http://www.mapama.gob.es/ide/inspire/atom/MapaForestaldeEspaaMFE.xml

- URL Metadata: http://www.idee.es/csw-codsi-idee/srv/spa/catalog.search#/metadata/ac11b891-6c6c-4458-b89c-2b73f593d019

- Official information: (Spanish) http://www.mapama.gob.es/es/desarrollo-rural/temas/politica-forestal/inventario-cartografia/mapa-forestal-espana/default.aspx

- https://www.europeandataportal.eu/data/en/dataset/ac11b891-6c6c-4458-b89c-2b73f593d019

The Information System on Land Cover and Use of Spain (SIOSE), which defines urban, agricultural, forest, natural and wet areas of Spain with precision and homogeneity. SIOSE is able to integrate different data of regional and national administrations. SIOSE is part of the National Land Monitoring Plan (PNOT), managed and coordinated by the IGN, offering a multidisciplinary spatial data infrastructure, periodically updated, for the Spanish national and regional administrations. This projects has been designed according to the main INSPIRE principles, and ISO TC/211 standards, moving from previous hierarchical land cover databases towards a land cover feature data model, able to describe the different land cover classes in the territory, but also their environmental parameters. This complex and strong description of each land cover occurrence will allow obtaining environmental key indicator from SIOSE data. From the last versions of SIOSE, SIOSE and MFE are coordinated in many regions and it is feasible to obtain aligned statistics in general terms of land cover

SIOSE main data sources are:

- Reference image for the complete territory: SPOT (2.5 m GSD) and orthophotos (50-25 cm GSD) from the National Plan of Aerial Orthophotography (PNOA)

- Reference topographic vector data: National Topographic Maps (hydrography, roads, railway network), and Cadastre (urban limits, street axes)

- Agricultural (National Crop Map - MCA) and Forest (National Forest Map - MFE) thematic reference data

- Regional thematic Copernicus land cover land use (LC/LU) databases in the Spanish Regions

SIOSE is in conformity with INSPIRE Implementing Rules on interoperability of spatial data sets and services. Its metadata is in conformity with INSPIRE Metadata Regulation

The SIOSE is accessible through view and/or download services and is conformity with INSPIRE Implementing Rules for Network Services

- Land cover and use view service: http://www.idee.es/wms-inspire/ocupacion-suelo.

This service has 2 layers: LU.ExistingLandUse, LC.LandCoverSurfaces.

- Land cover download services: http://www.idee.es/wfs-inspire/ocupacion-suelo

- Land use download service http://www.idee.es/wfs-inspire/uso-suelo

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

National Forest Map (MFE) offers a complete vision of forestry information for the entire country with a temporal truthfulness based in long term periods. Nevertheless there are intermediate products, called MFE – Fojo Fija, available to generate yearly statistics but with temporal latency in several areas. Reference scale is from 1:50.000-1:25.000 with minimum mapping units between 0.5

and 2 ha depending on the elements to be mapped. In thematically terms, MFE offers information about general land cover classes, structural type of vegetation, tree canopy, forest type, forest distribution, tree state and vegetal species.

Data access:

http://www.mapama.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/index_mapa_forestal.aspx

Data model and data dictionary of MFE:

http://www.mapama.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/mfe25_informacion_disp.aspx

Processing:

In order to obtain an estimation of the required indicator with MFE, it would be advisable to proceed with MFE intermediate product Fojo Fija with reference year 2012. It is remembered that not all data has updateness of 2012, Foto Fija combines MFE data from different dates from 2012 to the past. MFE or MFE Foto Fija offers information about size and tree canopy on forest patches, but does not have direct information about tree height. The process can consist on the:

a) Selection of forest polygons according the value of 'structural type'

b) Aggregation / disaggregation of the tree canopy depending of the 'forest types' required

c) Filtering forest polygons depending size and tree canopy

d) Calculate the indicator by accumulation of selected forest polygons

Based on SIOSE, the last version accessible via web is the version of 2011 that means a homogeneous complete vision of LC/LU for entire country at this reference date. The SIOSE reference scale is 1:25,000, and, therefore, constitutes the first continuous LC/LU layer for the whole Spain at that level of detail. It uses a object oriented data model that can integrate existing diverse presence of LC/LU classes by percentage per each polygon (e.g. a polygon can be described by composition of different percentages: 45 trees + 45 crops + 10 buildings). It is represent an important revolution in the management of LC/LU information because reduces efforts and cost production integrating more information in the system. This object oriented data model philosophy have been exported to international LC/LU initiative such us: INSPIRE data specifications on Land Cover and Land Use, EIONET Action Group on Land monitoring in Europe (EAGLE group of experts) and explored for new versions scheduled for Copernicus CORINE Land Cover. Moreover since SIOSE 2011 version, SIOSE and MFE are coordinated in many regions and it is feasible to obtain aligned statistics in general terms of land cover.

The minimum area of between 0.5 and 2 ha depending on the elements to be mapped (the minimum mapping unit is 2 ha for agrarian, forest, and natural areas, and the minimum width of linear elements is 15 m).

SIOSE has 85 classes feasible to be managed by composition between them to describe accurately each polygon,. Some of them are about forest like coniferous, deciduous broad-leaved or evergreen broad-leaved, and there are several forestry attributes such us plantation nature, riparian aspect, firebreak function and clear cuts. .

http://www.idee.es/register-inspire/LandCover/SIOSEValue/SIOSEValue.rdf

In order to obtain an estimation of the required indicator with SIOSE, it would be advisable to proceed with version 2011. SIOSE offers information about size and tree canopy on forest patches, but does not have information about tree height. The process can consist on:

a) Selection of forestry land cover presences and/or attributes

b) Aggregation / disaggregation of the tree canopy depending of the forestry land cover classes

c) Transmission of tree canopy values from land covers to polygons (locate geographical the forest information)

d) Calculate the indicator by accumulation of selected forest polygons

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

The MFE's database:

- The database integrates different data of regional and national administrations
- Geodetic Reference System: ETRS89.
- Cartographic Projection: Universal Transversal Mercator (UTM), zones 28, 29, 30 y 31
- Different surface minimum unit, according to the cover class in the land.
- Urban Fabric and Water bodies: 1 ha.
- Agricultural land and greenhouses: 2 ha.
- Forest and Natural Areas: 1 ha.
- Wetlands, Beaches, riverside vegetation: 0.5 ha.
- Resolution: 1:50.000 - 1:25.000
- Positional accuracy: quadratic mean error (X,Y) ≤ 10-5 m

http://www.mapama.gob.es/es/desarrollo-rural/temas/politica-forestal/inventario-cartografia/mapa-forestal-espana/default.aspx

The SIOSE's database:

- The database integrates different data of regional and national administrations
- Geodetic Reference System: ETRS89.
- Cartographic Projection: Universal Transversal Mercator (UTM), zones 28, 29, 30 y 31

- Different surface minimum unit, according to the cover class in the land.
- -Urban Fabric and Water bodies: 1 ha.
- - Agricultural land: 2 ha.
- - Forest and Natural Areas: 2 ha.
- -Wetlands, Beaches, greenhouses, riverside vegetation: 0.5 ha.
- Resolution: 1:25.000
- Positional accuracy: quadratic mean error (X,Y) ≤ 5 m. Screen resolution: ≈ 90 pixels/inch
- Thematic accuracy: > 95%
- Completeness: 100%
- Logical consistency: Complete
- Nomenclature with 85 values: http://www.idee.es/register-inspire/LandCover/SIOSEValue/SIOSEValue.rdf
- The spatial data set is in conformity with INSPIRE Implementing Rules on interoperability of spatial data sets and services on data specifications
- Its metadata is in conformity with INSPIRE Metadata Regulation

Current use of geospatial data for the indicator: (Describe the current use of geospatial data, as suggested by the existing metadata – the "as-is" situation)

National Forestry Inventory (IFN), Forest Map of Spain (MFE) and SIOSE are data set widely used for analysing of forest and non-forest territory at the national level.

There are some view services about MFE and SIOSE to retrieve information about features and coverages displayed in a map. And there are some download service to select of features from the data sources including geometry and attribute values.

Example of GetFeature Request:

http://www.ign.es/wfs-inspire/ocupacion-suelo?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&TYPENAME=lcv:LandCoverUnit&FILTER=<Filterxmlns:lcv="http://inspire.ec.europa.eu/schemas/lcv/4.0" xmlns:lcn="http://inspire.ec.europa.eu/schemas/lcn/4.0" xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:base="http://inspire.ec.europa.eu/schemas/base/3.3"><PropertyIsNotEqualTo><ValueReference>lcv:landCoverObservation/lcv:LandCoverObservation/lcv:class/@xlink:href</ValueReference><Literal>Bosques de frondosas</Literal></PropertyIsNotEqualTo></Filter>&COUNT=50

The users are technicians, researchers and general public. The temporally databases able to identify main land cover changes in Spain in an homogeneous way, with several reference dates (1990, 2000, 2006, 2012) and in the future high resolution SIOSE.

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

The applied methods:

- The forest and no-forest areas requirements need to be very clearly defined. Need for an agreement between responsible organization in Forestry and Agricultural activities.
- To need to establish methodologies makes comparison between sources and the possibility of establishing precise data of forest area.
- To apply methodology for production of high resolution land cover and land use data. Next version of SIOSE, reference date 2017 are becoming in an integration platform of different sources of high resolution LC/LU date. With the objective to obtain in a semiautomatic process LC/LU data at 1:1.000 – 1:5.000 scale. Data source involved in the project: Cadastre, Land Parcel Information System, LIDAR (light detection and ranging) data, MFE, reference information system on hydrography, transports and settlements
- To create ATOM service according to INSPIRE Implementing Rules for Network Services.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

The coordination is improved with the producers of the spatial data sets (MFE, SIOSE and cadastral parcels.) which guarantee the principles of dissemination, technical rigor, coherence and interoperability, which include the application of the environmental Directives.

To implement support tools with the objective of improving the quality of the data and of their metadata.

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

It is always needed to have updated official forest information, and if it is not available, official information on land cover and land use will be used. In addition, if the forestry variables are georreferenced on cadastral terms, they must also be used.

Relation with INSPIRE themes are: II.2 Land Cover, III.3 Land Use, I.6 Cadastral Parcels.

SIOSE geospatial data sources:

- Reference topographic data: hydrography, roads, railway network;
- Cadastre: urban limits, street axes;
- Agricultural (National Crop Map -MCA) and Forest (National Forest Map - MFE) thematic reference data;
- Thematic LC/LU databases in the Spanish Autonomous Communities.

Data quality requirements: (List in general terms the requirements for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Coordination requirements between forestry initiatives, land cover, land use and cadastral. Geometric requirements inherited from the cadastral geometry, but thematic and temporary adapted to the forest requirements. ISO Geographic Information Standards TC-19100 should be applied.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

MFE and SIOSE are available under the expressed data availability:

1) Geographically: national/regional/global

2) Source: Accessible through view (WMS – Web Map Service and WMTS – Web Map Tile Service) and download (WFS – Web Feature Service and ATOM - Animation Transfer Object Model)

3) Commercial/legally: SIOSE has commercial and non-commercial use, reuse, redistribution, modification, whose main aim is to foster data reuse and the creation of value-added products or information services based on these data.

4) Timeliness: SIOSE provides more updated periods.

5) Frequency of dissemination

Currently the high resolution SIOSE is in development phase and is not available. But the perspective is that it can achieve all the aspects indicated in 1) 2) and 3), free charge and restriction, and be available with the most temporal frequency.

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

The data sets used for the generation of the indicator should be produced by integration of available data and automatic procedures for extracting information from earth observation techniques. Only manual editing will be used in an exceptional case and to solve lacks of automatic data. The production of all official geospatial data must be coordinated between public administrations to enforce Directives 2003/4 / EC, 2003/35 / EC for the public access to environment information and Directive 2003/98 / EC for the re-use of public Sector information.

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - "to-be" situation)

In addition to the specific requirements already mentioned above (https://unstats.un.org/sdgs/metadata/files/Metadata-15-01-01.pdf), the focus on cadastral parcels will require the coordination of responsible agents at the national level in the official forest information, land cover, land use and cadastral, as well as a high massive computation due to its high level of detail.

C. EU SDG 15.11 - Forest area as a proportion of total land area | Eurostat

1. Current reporting situation

Responsibility: (Identify the agency responsible for the indicator and the situation regarding the ESS and NSS projects (including dissemination) and /or INSPIRE conformance)

For LUCAS data, Eurostat.

For forest area (for_area), Eurostat dissemination but data come from FAO and JRC.

Indicator disaggregation: (List the indicator disaggregation by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts to support the monitoring of the implementation of the SDGs)

Two data sources: for_area and lan_lcv_ovw under LUCAS. LUCAS goes down to NUTS2 while for_area is available only at national level.

Frequency of dissemination: (Describe the time interval at which information is disseminated over a given time period)

LUCAS Every three years i.e. 2009, 2012, 2015, 2018.

In the case of for_area every five years 2010, 2015.

Timeliness: (Length of time between data availability and the event or phenomenon they describe. Describe the average production time for each release of data)

LUCAS X+ 2 years.

Not specified for for_area but 2015 already available.

Data sources: (List the data sources and themes or variables in use, including conditions of access situation, resolution, positional accuracy, frequency and timeliness regarding the ESS and NSS projects and /or INSPIRE conformance).

LUCAS survey, FAO, JRC data for for_area.

Geospatial data analysis and integration: (Describe spatial analysis methods, procedures and computations, including regarding data integration)

LUCAS methodology. Not available for for_area.

In general data are not the result of geospatial data analysis and integration. LUCAS data are computed based on sample survey.

Data quality requirements: (List in general terms the requirements for the sources and themes in use with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards are being followed, including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

LUCAS has a detailed methodology describing all quality aspects. Not available for for_area.

The VHRL of Copernicus could probably meet many requirements but its production characteristics need to be understood better, e.g. timeliness, currency. This will be investigated in a joint European Commission and EEA task team as of 2017.

General comments: (Please provide any additional information or comments)

Copernicus information using a VHRL layer is a potential alternative.

There is a Commission task team to understand if Copernicus information could complement statistical data with the goal to improve coverage, timeliness and resolution.

2. Suggested Methodology

GAP analysis: (Describe what changes in use of **applied methods** are needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

Depends on recommendation from Commission task team on the use of Copernicus VHRL.

3. Suggested geospatial data integration

GAP analysis: (Describe what changes in use of **data** needed to go from the suggested/current procedure for monitoring the indicator, to a future procedure which better fulfils the reporting requirements - going from the "as-is" situation in the present metadata proposal to a "to-be" situation)

Depends on recommendation from Commission task team on the use of Copernicus VHRL.

List required geospatial data: (Develop a list from the GAP analysis, which lists the geospatial data sources and themes which are required to support the to-be situation, including INSPIRE conformance)

Depends on recommendation from Commission task team on the use of Copernicus VHRL.

Data quality requirements: (List in general terms the requirements for the suggested sources and themes with relevant parameters: Resolution, completeness, logical consistency, positional accuracy, temporal accuracy etc. List if certain international standards should be followed including classifications/nomenclatures. Data quality should allow computing results to the needed level of resolution and disaggregation). Please take into account the EURO-SDMX Metadata Structure (ESMS) 2.0.

Depends on recommendation from Commission task team on the use of Copernicus VHRL.

Data availability: (List the data availability for the suggested sources and themes or variables: 1) Geographically: national/regional/global (as well as comparability across countries), 2) Source: Accessible through services or download, 3) Commercial/legally: license conditions - are data free or are there restriction on use; 4) Timeliness; 5) Frequency of dissemination)

Depends on recommendation from Commission task team on the use of Copernicus VHRL.

Data collection: (Describe how the geospatial data for the indicator can be collected/made available, and issues to overcome – are there many sources to collect from, do they need to be integrated and normalized etc.)

Depends on recommendation from Commission task team on the use of Copernicus VHRL.

Geospatial data analysis and integration: (Describe which analysis, procedures and computations are needed to provide the results needed to support the reporting requirements - “to-be” situation)

Depends on recommendation from Commission task team on the use of Copernicus VHRL.