

## Annex B

### (informative)

### Use cases

It would be unrealistic to expect to identify exhaustively all existing use cases for the INSPIRE *Orthoimagery* theme. As reference data, orthoimagery is handled by many actors in various ways, at different scales and for different purposes.

Therefore, this annex presents a selection of use cases representative of the range of level of details, from the European level to the Regional level.

These use cases that have been used as a basis for the development of this data specification are:

1. Acces to orthorectified imagery for Global Monitoring for Environment and Security
2. Access to orthorectified imagery via WCS
3. Use of orthoimagery in the frame of the Integrated Administrative Control System for managing the EU CAP funds
4. Updating Geographic Database at 25K from PNOA orthoimages in the National Geographic Institute of Spain
5. Agriculture water needs estimation for achieving an efficient and sustainable use of water

#### **Use Case 1: Access to Orthorectified Imagery for Global Monitoring for Environment and Security**

GMES (*Global Monitoring for Environment and Security*) is a joint initiative of the European Commission (EC) and the European Space Agency (ESA) with the aim to develop a range of services in the field of Earth Observation (EO) by using mainly Space data from a constellation of the Sentinel missions, developed by the ESA and other third party missions under specific arrangements. Amongst other, access to orthoimagery is required by various services. The GMES requirements today for orthoimagery come from the GMES Services representatives, including the core services Geoland-2 and SAFER, the GMES Service Element (GSE) funded projects like Land and Forest Monitoring as well as the EC-funded Urban Atlas Project. Before the Sentinels are launched, data will be provided from missions identified as GMES Contributing Missions (GCMs). Missions of interest today for orthoimagery include for example ALOS, SPOT-4/-5, IRS-P6, Landsat-5, EROS-A/-B, MERIS and MODIS. GMES Services requirements for orthoimagery refer to:

- Area of interest
- Geo-location accuracy
- Map scale
- Optical bands (e.g., VNIR/SWIR)
- Optical resolution (e.g., HR/MR Resolution – 10m – 300m)
- Optical processing level

The latter corresponds with the level corresponding with the orthorectified product. On top of this information, as well references to the following information is included:

- Reference year
- Reference for orthorectification
- Digital Elevation Model (e.g., use of one specific DEM < 60 deg and national DEMs > 60 deg)
- Projections used (e.g., data supplied in European and national projection)
- Data Product Format
- File naming and organisation requirements

Users as well often put constraints on the cloud coverage (e.g., < 5%), sun illumination (e.g., sun elevation angle has to be higher than 23 degree) and incident angle (e.g., instrument incidence angle has to be less than 25 degree). Other requirements relate to haze (e.g., without) and snow coverage (e.g., only glaciers and perennial snow).

Use Case Description	
Name	Access to Orthorectified Imagery for Global Monitoring for Environment and Security

Use Case Description	
Priority	high
Description	The user, an eligible GMES Service, requires access to orthorectified via the GMES Space Component (GSC).
Pre-condition	User is an eligible GMES Service authorised to access data from the GMES Space Component,
Flow of Events – Basic Path	
• Step 1.	Consolidated GMES Services' requirements, in particular for orthoimagery are provided.
• Step 2.	Data offer is defined in response to the requirements and agreed with GMES Contributing Missions (GCMs).
• Step 3.	Datasets are implemented by GCMs, i.e. action is taken to prepare for data delivery to users.
• Step 4.	Once implemented, orthorectified products are made available to the GMES Services by the GCM(s) or Coordinated Data Access System. Orthorectification can be done by the GCM itself, or by a third party.
• Step 5	GMES Service accesses the data.
Post-condition	
Data source: INSPIRE-Conformant Orthoimagery Provided by Member States	
• Description	Orthorectified data from satellite sensors (in some cases this is called Level 3 data, in other Level 1C).
• Data provider	GMES Contributing Missions
Geographic scope	World wide, although smaller areas may be selected.
Thematic scope	INSPIRE Annex II. <i>Orthoimagery</i> .
Scale, resolution	From LR (>300m) to VHR (<= 1m)
Delivery	Normal delivery. Data supplied in European and National Projection.
Documentation	INSPIRE <i>Orthoimagery</i> Data Product Specification

### **Use Case 2: Access to orthorectified imagery via WCS**

In the frame of the ESA Research and Service Support, online access to satellite products is going to be provided through a system integrating EO-WCS 2.0 (Earth Observation application profile of WCS, see OGC 10-140) and WMS. At the moment of writing a pilot project under finalization will grant access to ortho-rectified images from the IMAGE 2009 European cloud free coverage and to an orthorectified mosaic with IKONOS images collected in the last three years. The same use case is applicable to all satellite orthorectified images distributed by WCS.

Use Case Description	
Name	Ortho-rectified Imagery access via WCS
Priority	High
Description	The user access to orthorectified satellite images using a WCS
Pre-condition	User is eligible. Metadata are provided using Earth Observation application profile of Observation and Measurement (OGC 10-157r3).
Post-condition	The user downloads the product
Flow of Events – Basic Path	
• Step 1	User logs into the WCS
• Step 2	User invokes <i>getCapabilities</i> operation to obtain the list of Dataset, Dataset Series and Stiche Mosaics provided by the WCS
• Step 3	User invokes <i>describeEOCoverageSet</i> operation specifying a spatio-temporal interval on a set of Dataset, DatasetSeries or Stiche Mosaic.
• Step 4	The WCS returns a description of the Dataset, Dataset Series or Stiche mosaic in the spatio-temporal interval. The description is made by the Earth Observation application profile of Observation and Measurement metadata
• Step 5	User invokes <i>getCoverage</i> operation on a Dataset or a Stiche Mosaic optionally specifying trimming information
• Step 6	The WCS returns the item requested suitably trimmed.
Data sources: INSPIRE-Conformant Orthoimagery Provided by Member States	
• Description	Ortho-rectified data from satellite sensors (in some cases this is called Level 3 data, in other Level 1C).
• Data provider	Member states or international space agencies
Geographic scope	Worldwide, although smaller areas may be selected.
Thematic scope	INSPIRE Annex II. <i>Orthoimagery</i> .
Scale, resolution	from HR (4m) to MR (300m)
Delivery	WCS
Documentation	INSPIRE <i>Orthoimagery</i> Data Product Specification, OGC 10-140

### Use Case 3: Use of orthoimagery in the frame of the Integrated Administrative Control System for managing the EU CAP funds

The use of orthoimage is a fundamental (and soon required) element in the framework of the implementation of the EU Common Agriculture Policy. Orthoimagery drives various core administrative processes and services, such as:

- Basis for the establishment of reference Land Parcels data (LPIS) for the administration and automated controls of aid, and for the upkeep of these references.
- Up to date source for the inspection of the above reference data (LPIS Quality Assessment)
- Provision of the up-to-date source data to the farmers during the aid application phase
- Tool for the measurement of agriculture parcel area by the inspectors during the on-the-spot controls (OTSC)
- Provision of source data for the verification of the cross-compliance related issues (good agriculture and environmental conditions) at farm level, in particular the verification of the retention of landscape features; CC inspections may be delegated to specialized agencies.
- Data source for the auditing of OTSC and LPISQA inspection records
- In near future: Provision of detailed information on the environmental status of rural area in the EU and to check the 'greening' measures of the new CAP.

The use cases from these IACS activities could be considered in the scope of INSPIRE due to the following reasons.

- It deals with environmental data and refers to environment-related queries and analysis (for example the cross-compliance checks), and this will be reinforced with the entry of the new "green" CAP after 2013
- It involves national datasets and relies on the role of the MS Administration, due to fine scale of the data (1:5 000) and high update frequencies; cost-sharing partnerships between public stakeholders are frequent
- It applies indeed at a Pan-European dimension.

As an example, is given hereafter the use case of data extraction for managing the LPIS.

Use Case Description	
Name	Managing the Land Parcel Identification Systems (LPIS)
Primary actor	EU Member State Administration (LPIS custodians)
Goal	Member States have to systematically update the LPIS on the entire territory in order to reflect the actual situation on the ground. To benefit from reduced control rates, this must be done within a period of maximum three years and covering yearly at least 25% of the hectares eligible for CAP direct aid, with imagery not older than 15 months.
System under consideration	Land Parcel Identification System (LPIS)
Importance	High
Description	The inspector checks the correctness of the LPIS reference parcel and updates, if necessary, the associated spatial and alphanumeric information (on the base of up-to-date information derived from orthoimagery of very-high resolution (VHR)).
Pre-condition	Availability and completeness of up-to-date orthoimagery on the area under update. The orthoimages used for the update shall not be older than 15 months from the date of inspection.
Post-condition	Set of reference parcels that are updated and corrected before making them available to the farmers for the preparation of their annual aid applications.
Flow of Events – Basic Path	
• Step 1	Collect and display the newly acquired and processed orthoimagery for the area of interest
• Step 2	Import the LPIS data and the orthoimage datasets (vector, raster and alphanumeric data) into a pre-defined GIS environment

Use Case Description	
• Step 3	Check for spatial consistency and completeness
• Step 4	Perform visual inspection of the reference parcels under update using the information delivered from the orthoimage data. If needed, perform visits on the field to further verify the computer assisted photointerpretation (CAPI) made in the office.
• Step 5	If necessary, perform an update of the reference parcel on the base of the observations made, using a pre-designed validated update procedure.
• Step 6	Check the consistency and topology of the updated LPIS dataset, and approve the new version
• Step 7	Generate an final report with relevant findings and statistics
Data set: Orthorectified imagery	
• Description	Newly acquired airborne or spaceborne orthoimagery (often being part of a 3 year orthophoto update cycle established for the entire country)
• Type	input
• Data provider	MS Administration (LPIS custodian, Paying Agency or third party)
Geographic scope	Country extent (National boundaries)
Thematic scope	Natural colour and/or colour infrared orthoimagery of spatial resolution ranging from 0.25 to 0.8 meters, radiometric resolution of 8 bits at minimum and positional accuracy of 2.5 meters (RMSE1-d)
Scale, resolution	1:5 000 (Preferably spatial resolution of 50 cm)
Delivery	INSPIRE compliant WMS
Documentation	<a href="http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Orthoimage_technical_specifications_for_the_purpose_of_LPIS">http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Orthoimage_technical_specifications_for_the_purpose_of_LPIS</a>
Data set: Observations from the update process	
• Description	Raw observations (mapped features, measurements and observed values) for all defined quality measures per inspected reference parcel
• Type	intermediate
• Data provider	MS Administration (LPIS custodian)
Geographic scope	Country extent (National boundaries)
Thematic scope	Structured XML and GML files containing all observations collected per inspected reference parcel
Scale, resolution	1:5 000 – 1: 10 000
Delivery	Online
Documentation	<a href="http://marswiki.jrc.ec.europa.eu/wikicap/index.php/LPISQA2011_2.c">http://marswiki.jrc.ec.europa.eu/wikicap/index.php/LPISQA2011_2.c</a>

**Use Case 4: Updating Geographic Database at 25K from PNOA orthoimages in the National Geographic Institute of Spain**

The Spanish National Program of Aerial Orthophotography (PNOA) provides Orthophotos between 25 and 50 cm of spatial resolution of all Spain. According to INSPIRE, data are collected once and shared between all Spanish users. These images are used, among other things, to keep update the Spanish Geodata Base at 25K scale, called BTN25. That is the most accurate scale and BTN25 it's used to produce maps, support the Spanish SDI or to explore with GIS tools.

Use Case Description	
Name	BTN25: Geographic Database at 25K updated from PNOA orthoimages
Priority	High
Description	The user, to update the geodatabase BTN25, uses orthoimages from PNOA. With GIS tools compares the vector information store in the data base with the raster image.
Pre-condition	<p>Quality controlled geodata base is available to the user in line with INSPIRE. The database BTN25 has a schema composed of themes: hydrography, buildings, transport network, supplies and facilities. Transport network and hydrography according to INSPIRE specifications (transport network). The images used to generate the orthoimagery must have been acquired during a period consistent for the updating task, at least every two years and a date of acquisition no more than four months ago.</p> <p>Another orthoimage requirements:</p> <ul style="list-style-type: none"> <li>• Orthoimages with Red, Green, Blue and near infrared.</li> <li>• Orthoimages must be free of clouds, snow, fog, smoke, flooded zones or any artefact.</li> <li>• Solar elevation <math>\geq 40^\circ</math>.</li> <li>• Ground Sample Distance (GSD) at least 0.5 m.</li> <li>• Radiometric resolution at least 8 bits per band.</li> <li>• Geodetic Reference System in ETRS89.</li> <li>• Cartographic projection UTM in the corresponding UTM zone.</li> <li>• Positional accuracy, <math>RMSE \leq GSD</math></li> <li>• Maximum error at any point <math>\leq 2 \times GSD</math> in 95% of the cases.</li> <li>• Orthoimages will be available at least in tiff and Jpeg 2000 format (with compression of 1:10).</li> <li>• Pixels at different resolutions must be aligned (It is recommended to use the WMTS standard)</li> </ul>
Flow of Events – Basic Path	
• Step 1.	The updater may connect with the PNOA raster store using GIS soft, SDI's, etc.
• Step 2.	The updater may connect with the BTN25 vector database using GIS soft.
• Step 3.	The updater selects the theme to update (transport network or building) entering the legends in the GIS map.
• Step 4.	The updater may enter in the legend the orthoimage that covers the same area of the vector information to update.
• Step 5	The updater detects the differences between the vector data and the image. Also may change manually the differences detected: deleting, modifying or inserting features.
Post-condition	The metadata of the database must be also updated indicating the date of update.
Data source: INSPIRE-Conformant Geodata base updated at 25K and orthoimages Provided by Member State (PNOA)	
• Description	Orthoimages used and Geodatabase updated is available to extract information to be incorporated into other European databases on the same scale or smaller.

Use Case Description	
• Data provider	Each member state.
Geographic scope	Europe wide, although a smaller area may be selected.
Thematic scope	INSPIRE Annex II. <i>Orthoimagery</i> .
Scale, resolution	1:25.000 (resolution of 5 m) or smaller with generalization
Delivery	<p>Geometry information and orthoimage mosaics with the next requirements:</p> <ul style="list-style-type: none"> <li>• Geodetic Reference System in ETRS89.</li> <li>• Cartographic projection UTM in the corresponding UTM zone.</li> <li>• Mosaics will be available at least in tiff and Jpeg 2000 format (with compression of 1:10).</li> <li>• Polygons defining the area each Orthoimage contributes to the final mosaic.</li> </ul>
Documentation	INSPIRE <i>Orthoimagery</i> Data Product Specification

**Use Case 5: Agriculture water needs estimation for achieving an efficient and sustainable use of water.**

The scenario for the Agriculture water needs estimation for achieving an efficient and sustainable use of water is that different regional persons in charge could have necessary information about water needs in their influence areas in order to improve the irrigation procedure, improve natural resources management, make better and quickly decisions and reduce environmental impacts. The Spanish National Program of Remote Sensing (PNT) provides satellite imagery of all Spain between 2 and 30 meters of resolutions, these images are used, among other things, to water needs estimation.

Use Case Description	
Name	Agriculture water needs estimation for achieving an efficient and sustainable use of water.
Priority	High
Description	The user unload different satellite images from National Program of Remote Sensing (PNT) in order to obtain some information about types of crops and their evolution in time to calculate water needs for his influence areas.
Pre-condition	<p>Quality-controlled orthoimagery and agricultural data, are available to the user according to INSPIRE provides all the necessary information for standardised access to data. The images used to generate the orthoimagery must have been acquired during a period consistent for this task, weekly or be-weekly at least and a date of acquisition no more than two days ago.</p> <p>Another orthoimage requirements:</p> <ul style="list-style-type: none"> <li>• Orthoimages with Green, Blue and near infrared at least.</li> <li>• With clouds, snow, fog, smoke under 10%.</li> <li>• Tilt Angle under 30 degrees.</li> <li>• Ground Sample Distance (GSD) 30 m at least.</li> <li>• Radiometric resolution at least 8 bits per band.</li> <li>• Geodetic Reference System in ETRS89.</li> <li>• Cartographic projection UTM in the corresponding UTM zone</li> <li>• Positional accuracy, RMSE <math>\leq</math> GSD</li> <li>• Maximum error at any point <math>\leq 2 \times</math> GSD in 95% of the cases.</li> <li>• Digital Terrain Model used with a distance between points similar to GSD.</li> <li>• Bicubic interpolation at least.</li> <li>• Orthoimages will be available at least in tiff and Jpeg 2000 format (with compression of 1:10).</li> <li>• Pixels at different resolutions must be aligned (It is recommended to use the WMTS standard)</li> </ul>
Flow of Events – Basic Path	
• Step 1.	IGN provide by FTP Spanish Public Administration with orthoimagery and other derivative products. (It is recommended to obtain cloudless composites weekly, in Spain is being developed this process).
• Step 2.	The user may calculate crops areas and display their boundaries over the most recent available orthoimages with enough resolution for the application purposes.
• Step 3.	User has estimated each crop evolution from multi-temporal imagery of the same place.
• Step 4.	From information obtained in steps two and three, user identifies the irrigated crops and the amount of water the land have.
• Step 5	Combining imagery information obtained with other data set, the user can obtain environmental variables to calculate cubic meters of water needed for crops.
Post-condition	The information obtained can help user to make decisions.



Use Case Description	
Data source: INSPIRE-Conformant Orthoimagery Provided by National Program of Remote Sensing (PNT) and water need parameters by Member State	
• Description	User can access orthoimagery, in official map projection ETRS-89, by File Transfer Protocol (FTP). Report data generated for agriculture water needs to provide summary details across Europe.
• Data provider	Each member state or other national, regional or local providers.
Geographic scope	Europe wide, although a smaller area may be selected.
Thematic scope	INSPIRE Annex II. <i>Orthoimagery</i> .
Scale, resolution	A Minimum resolution threshold is required, which crops areas can be defined. About 30 metres of pixel size at least.
Delivery	Data set, water need parameters and textual reports.
Documentation	INSPIRE <i>Orthoimagery</i> Data Product Specification