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# LUCAS 2015
## (Land Use / Cover Area Frame Survey)

## Technical reference document C4
## Quality Control Procedures

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# 1 Scope

This document is part of a series of reference documents defining the framework of the Land Use / Cover Area frame statistical Survey (LUCAS). The LUCAS reference documents are continuously improved and adapted taking into account the lessons learnt from the implemented surveys and the requirements of the LUCAS data and users.

This document addresses one of the most important topics within LUCAS: data quality control. Below detailed information and descriptions are given on which data and the way how data will be controlled, and by whom.

# 2 Actors and roles

## 2.1 Role of the surveyor (SU)

The surveyor's task is to carry out the field survey according to the LUCAS instructions. He is in charge to fill in the field form and keep it until the end of the survey respectively to hand it over to the regional/central office. Hereby, the surveyor needs to respect the instructions given during the surveyor training and those provided in the LUCAS documentation.

The surveyor has to enter the data in the Data Management Tool (DMT), to control the data, to export the data and to forward the data to the responsible regional or central office of the field work contractor. The surveyor controls all data regarding completeness, correctness and consistency during data collection at the point and during data entry, including GPS points and tracks, topsoil samples and the anonymization of the photos. The built-in controls of the DMT support the surveyor in this task. Any problem or inconsistency identified during data entry or data export needs to be verified with the original field form and other means at hand and corrected immediately.

If there is a feedback from the regional/central office, the surveyor corrects or completes the data. If necessary to do so, the surveyor has to go back to the field and to survey the point again.

## 2.2 Role of the regional / central offices (RO/CO)

The regional/central office receives the data from the surveyor, including photos and GPS points and tracks. The RO/CO imports the data into the DMT and initiates the quality control. Since there are many built-in error correction features integrated in the DMT, data should be formally correct, complete and free of formal errors when received from the surveyor. This means that RO/CO shall concentrate on the trueness or accuracy of the data content (e.g. LC corresponds to the reality shown on the crop photo etc.).

By use of the LUCAS DMT 2015 and of any additional suitable software, additional available data and GIS tools, the contractor is requested to apply a systematic internal quality check of **all** surveyed points and to correct them when necessary. This check should be done in the regional and/or central office(s). The following aspects of the data need to be checked and properly reported by the quality controllers, and sent to the surveyor for correction in case of need:

- Identification of the exact location
- Logical consistency of the data (including change analysis)

- Land cover, land use, transect and agro-environmental data on basis of the photos taken by the surveyors
- Inaccessibility of the points in case of the photo-interpretation in the field.
- Itinerary of the surveyors (using the GPS tracks)
- Photo quality
- Photo anonymization
- Place of collection of topsoil samples.

If any error is identified, RO/CO corrects the data directly if possible or returns the data to the surveyor requesting correction and/or clarification. The RO/CO shall give advice and guidance to the surveyors on how to avoid in the future the type of identified errors.

In the case of any formal or content error which cannot be corrected, it is mandatory to add a remark clarifying the circumstances. If such remarks are missing, data will not pass the QC carried out the external quality controller.

# 2.3 Role of the external quality controler

## 2.3.1 Data control

The external quality controler (XQC) will have a similar role to play as the RO/CO: it anticipates formal correctness of data and assumes that data already went through RO/CO quality control. Almost identical cross checks are done as those specified for the RO/CO.

**Check all in situ photo-interpreted points**

All points photointerpreted in the field (observation type 3) will be checked by the XQC contractor. On this set of points, the contractor will do a full quality control, focusing especially on the reasons why the point has not been reached in the field. If the reasons don't comply with the Commission instructions and rules, these points will be refused and sent back to the FW contractors for correction or re-visit. The FW contractor shall provide correction or further justification within 15 days. XQC contractor re-checks these points for approval or rejection. In case of a second rejection, the point will be classified as “double rejected”.

**Check 90,000 points that have been visited in the field**

During the first weeks of the survey the contractor has to perform full quality checks on all points visited on the field by all the surveyors. This applies to points that were visited on the field (observation type 1 or 2) and that have passed DMT in-built checks and were validated by the CO. This verification of all visited points of each surveyor goes on until the first 20% of points coming from each surveyor have been checked. The number of points per surveyor in this first draw is determined by using the first assignment list provided by the FW contractors before the starting of the field work. The remaining 80% of the points for this component of the quality control will be flagged by the Commission. The XQC contractor will perform the full quality checks as soon as those points are released by the Commission.

If any error in the submitted LUCAS data is detected by XQC, data are sent back once to the RO/CO for correction. The XQC accepts only one re-submission of data. After that correction round, the data sets are directly forwarded to the Commission with a status indicating that the data contains errors.

### 2.3.2 Photo control

Photos will be checked by the contractor to assess whether:

- all mandatory pictures have been taken (e.g. landscape, point, crop/coverage, transect, irrigation, soil – if any)
- the quality of photos is good
- the photo size is within the requested range and the proportions are correct
- the photo is taken in landscape mode
- whether any anonymization is necessary

Under the framework of LUCAS, anonymization is a procedure where individual recognizable elements (persons and/or vehicle identification plates) are identified and blurred in such a way that they are not any more recognizable. Photos containing any recognizable elements are not accepted. The FW contractors take strickly the responsibility that such recognizable elements are blurred before transmission to the Commission. As breaking this is considered a serious breach of the contract, the XQC contractor has to inform the Commission immediately when such a case is identified. If one of these features are found on the photos, the point is rejected and sent back to the FW contractor for blurring.

**Additional checks for picture anonymization**

In addition to the checks that have to be performed to the pictures belonging to the points included in the quality control sample, an additional check to 20.000 point and landscape photos selected by the Commission will be performed by the XQC contractor, since all eventual personal information on the photos needs to be blurred before transmission to Commission. The FW contractor is responsible for anonymizing all images. The XQC contractor will check the above mentioned images to verify if all features (faces and vehicle identification plates) are properly anonymized. In case at least one non anonymized picture is identified, the FW contractor will be requested to perform a complete verification and correction of all images. Non-compliance with the anonymization of all pictures is considered a breach of contract.

### 2.3.3 GPS tracks

The contractor will use the GPS tracks, recorded by the surveyor when he/she was in the field, to overlay with the available orthophotos (provided by the FW contractors) and other relevant map products to control the following issues:

- completeness of tracks (track from each working day available)
- compliance with declarations of surveyors
- if the point and the end of transect have been reached
- compliance with general remarks

### 2.3.4 Panel points

Panel points are points that have been visited in two different LUCAS campaigns. Checks will incide on points with plausible changes, on points with unplausible changes and on points where no changes were identified. For example, a point where no change has occoured in the terrain should not be classified in a way that a change in land cover or land use is identified. Likewise a point where a change has occoured should be adequately classified in both campaigns.

### 2.3.5 Follow-up missions

In addition to the data control, experienced experts in land cover / use information & statistics will visit the field work contractors (FWC) to supervise and assess the sound application of proposed quality assurance measures. These so-called "follow-up missions" of 3-days duration will be organised in the early stage of the survey implementation to enable detection of possible systematic errors due to misunderstanding of instructions or any other reasons whatsoever. The expert will check the "office" phase as well as the survey implementation in the field. During the office phase of the mission, the set-up and the organisation of the survey at the central (or a regional) office of the relevant country will be subject of the assessment. A specified checklist will be executed. The field survey implementation will be assessed based on a field trip accompanying a surveyor on a sample of points selected. The FW contractor is requested to provide any assistance the expert might need to carry out his task, including putting relevant documentation at disposal of the expert timely in advance of the visit. The report of the expert serves the Commission as input to their quality assessment of the survey implementation. In case it deems necessary, the Commission will request the FW contractor to assist to a second ad-hoc visit of the expert of duration of one day.

## 2.4 Role of the Commission

Eurostat, on behalf of the Commission, supervises the whole quality control process and intervenes if systematic errors are detected at any step.

Eurostat also makes random checks to the data received from the XQC.

# 3 Controls prior to the iniciation of the survey

## 3.1 Ground documents

### 3.1.1 Preparation of ground documents

While preparing the ground documents, special care has to be taken in coordinate conversions and the application of national projections to the images.

The panel approach of LUCAS, in which a large number of points are visited in different campaigns to assess changes in land cover and land use, depends heavily on the fact that the surveyor correctly identifies the location of a point on the orthorectified imagery. Any shifts that may occur in the apparent location of the point on the images from one campaign to the next will heavily impact the quality of the final results.

It is advisible to define a minimum scale for the orthophoto overview of 1:5000 with an area size coverage of at least 49 ha (700 m x 700 m).

### 3.1.2 Checking for shifts in ground documents

| Role | Check |
|---|---|
| QC RO/CO | Compare a sample of ground documents of points that have been visited in previous campaigns with the documents prepared for 2015, so that an assessment of any existing shifts can be made and any possible corrective measures are taken before the final ground documents are printed. The Commission's approval of the ground document is dependent on the result of this assessment. |

# 4 Data control procedures

Quality checks to be performed include, but are not restricted to, correctness of location, land cover and land use data and associated agro-environmental parameters, in the current year and in confront with previous campaign data, correctness of the transect data, existence of mandatory photos, evaluation of photo quality, cross check position with GPS tracks. Mistakes and problems found during this control will be duly reported in the appropriate fields of LUCAS DMT 2015.

See below more details on control procedures being applied. Please note that this is not an exhaustive list and other additional checks can and will be carried out.

## 4.1 Identification

### 4.1.1 Surveyor ID (field A)

To be defined by central offices. For each surveyor an individual ID should be assigned to enable tracing the surveyor and respective data.

### 4.1.2 Point_ID (field B)

Fixed through the sample design. Correctness is checked automatically by means of the GPS geographical coordinates and the "observation distance" entered by the surveyor.

## 4.2 Access to point

### 4.2.1 Date (field 1)

| Role | Check |
|---|---|
| QC SU | Check correctness |
| QC RO/CO | Cross check with photo shooting (creation date of photo file) if questionable |
| QC XQC | Cross check with photo shooting (creation date of photo file) if questionable |

### 4.2.2 Start time and End time (fields 2, 3)

| Role | Check |
|---|---|
| QC SU | Check that the survey time is more than 15 min and less than 1 h 15 minutes. Give reasons for a shorter or longer time in the remarks (Field 15). |
| QC RO/CO | Duration of survey/point < 15 min: check remarks and field documents and have a close look to the data, particularly the transect. |
| QC XQC | Duration of survey/point < 15 min: check remarks and field documents and have a close look to the data, particularly the transect. Add surveyor to the watch list in case of problems. |

### 4.2.3 Car park latitude/longitude (fields 4, 5, 6)

| Role | Check |
|---|---|
| QC SU | Check whether lat/long is given in decimal degrees, with six decimals. |
| QC RO/CO | Check whether lat/long is given in decimal degrees, with six decimals.<br>Check with GPS tracks/waypoints on orthophotos.<br>Add comments if needed. |
| QC XQC | Check whether lat/long is given in decimal degrees, with six decimals.<br>Check with GPS tracks/waypoints on orthophotos. |

| | |
|---|---|
| | Add comments if needed. |

### 4.2.4 Type of Observation (field 7), GPS coordinate system (field 8), Latitude/Longitude (fields 9, 10, 11), Elevation (field 12), Precision (field 13), Distance to the point (field 14)

| Role | Check |
|---|---|
| QC SU | Check whether lat/long is given in decimal degrees, with six decimals.<br><br>Check together with pointID and precision (field 13) if distance to the point, lat/ long, W/E are correct.<br><br>If Type of observation is 2, 3 or 4, add a comment. |
| QC RO/CO | Check whether lat/long is given in decimal degrees, with six decimals.<br><br>Check whether observation position/location is reasonable in the given context: cross-check with distance to the point (field 14), precision (field 13), as well as with the field documents and orthophotos.<br><br>In case, check if photointerpretation is justified.<br><br>Check with GPS tracks/waypoints and orthophotos.<br><br>Check with previous LUCAS survey data.<br><br>Check if needed comments exist. Add any comment if needed. |
| QC XQC | Check whether lat/long is given in decimal degrees, with six decimals.<br><br>Checks whether observation position/location is reasonable in the given context, together with distance to the point (field 14), precision (field 13) as well as with the field documents and orthophotos.<br><br>In case, check if photointerpretation is justified.<br><br>Check with GPS tracks/waypoints and orthophotos.<br><br>Check with previous LUCAS survey data.<br><br>Add any comments if needed. |

## 4.3 Comments

### 4.3.1 Description of the way to the point (field C)

Pre-filled field, with information relative to the description of the way to the point in a past campaign.

### 4.3.2 Description of the way to the point (field 15)

| Role | Check |
|---|---|

| | |
|---|---|
| QC SU | Check that the comments are reasonable. Preference should be given to the use of standardised comments. If free text is used, English is mandatory. Special characters should be avoided. SU shall make sure that the comments are clearly understandable. |
| QC RO/CO | Check if free text can be transformed in standardised comments and do so. |
| QC XQC | Check whether comments are reasonable.<br>Add comments if needed. |

# 4.4 Point observation

### 4.4.1 Remarks about point observation (field 16)

| Role | Check |
|---|---|
| QC SU | Check that the comments are reasonable, understandable and pin-pointing the encountered situation. Preference should be given to the use of standardised comments. If free text is used, English is mandatory. Special characters should be avoided. SU shall make sure that the comments are clearly understandable. |
| QC RO/CO | Check if free text can be transformed in standardised comments and do so. |
| QC XQC | Check whether comments are needed, useful and understandable.<br>Add comments if needed. |

# 4.5 Land cover and land use

### 4.5.1 Direction (field 17), Radius (field18) and Plot area (field 19)

| Role | Check |
|---|---|
| QC SU | Check adequacy against the ground document. Check with the landscape photos.<br>Add remark, if orthophoto differs from reality (e.g. outdated), or if the decision on direction of observation is different than in a previous campaign. |
| QC RO/CO | Check with the landscape photos, ground document and remarks. |
| QC XQC | Check with the landscape photos, ground document and remarks. |

### 4.5.2 LC1 (field 20), LC2 (field 23), plant species (fields 21, 24), LU1 (field 29), LU2 (field 32), land use type (fields 30, 33)

| Role | Check |
|---|---|
| QC SU | Check LC1 and LC2 combination for consistency. |

| | |
|---|---|
| | Check LU and LC combination for consistency.<br>Check if plant species and land use types are used when needed.<br>Cross-check with LC/LU from the previous survey (if available) for consistency.<br>Add a remark if necessary (e.g. different decision, real change). |
| QC RO/CO | Check all LC and LU against photos and ground document for accuracy.<br>Check combinations of LC1xLC2 and LCxLU for consistency.<br>Check consistency with previous data (if available), and justification if different decision or change exist.<br>Add a remark if necessary. |
| QC XQC | Check all LC and LU against photos and ground document for accuracy.<br>Check combinations of LC1xLC2 and LCxLU for consistency.<br>Check consistency with previous data (if available), and justification if different decision or change exist.<br>Add a remark if necessary. |

### 4.5.3 Height of trees at the moment of survey (field 26)

| Role | Check |
|---|---|
| QC SU | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against the photos and ground document. |
| QC RO/CO | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against the photos and ground document. |
| QC XQC | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against the photos and ground document. |

### 4.5.4 Height of trees at maturity (field 27)

| Role | Check |
|---|---|
| QC SU | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against the photos and ground document. |
| QC RO/CO | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against the photos and orthophotos. |
| QC XQC | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha) |

| | |
|---|---|
| | Check against the photos and orthophotos. |

### 4.5.5 Width of feature (field 22)

| Role | Check |
|---|---|
| QC SU | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against the ground document.<br>Add remark, if orthophoto differs from reality. |
| QC RO/CO | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against ground document, photos and remarks.<br>Check if remark exists, if orthophoto differs from reality. Add remark if needed |
| QC XQC | Check that it is filled in case needed (LC=CXX or D10 or E10 and Plot area >= 0.5ha)<br>Check against ground document, photos and remarks.<br>Check if remark exists, if orthophoto differs from reality. Add remark if needed. |

### 4.5.6 Percentage of land coverage LC1, LC2, LU1 and LU2 (fields 22, 25, 31, 34)

| Role | Check |
|---|---|
| QC SU | Check with the ground documents, landscape photos and crop/cover photo. |
| QC RO/CO | Check with the geound documents, landscape photos and crop/cover photo. |
| QC XQC | Check with the ground documents, landscape photos and crop/cover photo. |

### 4.5.7 Land management (field 35)

| Role | Check |
|---|---|
| QC SU | Check with crop/cover photo and landscape photos. If needed add also additional photo. |
| QC RO | Check with crop/cover photo and landscape photos. Also with additional photos if existing. |
| QC XQC | Check with crop/cover photo and landscape photos. Also with additional photos if existing. |

### 4.5.8 Special status (field 36)

| Role | Check |
|---|---|
| QC SU | If applicable add additional photo. |

| | |
|---|---|
| QC RO | If applicable check additional photo. |
| QC XQC | If applicable check additional photo. |

### 4.5.9 Special remark on land cover/use (field 37)

| Role | Check |
|---|---|
| QC SU | Check with crop/cover photo and landscape photos. If needed add also additional photo. |
| QC RO | Check with crop/cover photo and landscape photos. Also with additional photos if existing. |
| QC XQC | Check with crop/cover photo and landscape photos. Also with additional photos if existing. |

## 4.6 PLCC

### 4.6.1 INSPIRE pure land cover classes (fields 38 to 45)

| Role | Check |
|---|---|
| QC SU | Check if filled for points where LC1=CXX,DXX,EXX or FXX.<br>Check if LC1, LC2 and respective percent land cover are compatible with the values entered. |
| QC RO | Check if filled for points where LC1=CXX,DXX,EXX or FXX.<br>Check if LC1 and percent land cover are compatible with the values entered.<br>Add remark if needed. |
| QC XQC | Check if filled for points where LC1=CXX,DXX,EXX or FXX.<br>Check if LC1 and percent land cover are compatible with the values entered.<br>Add remark if needed. |

## 4.7 Water management

### 4.7.1 Presence of water management (field 46)

| Role | Check |
|---|---|
| QC SU | Checked if filled when needed (LU=U111 or U112)<br>Check that the irrigation photo has been taken, if needed. |
| QC RO | If relevant, check whether irrigation photo taken and water management is visible |

| | |
|---|---|
| | on the photo. Check if the code coincides with feature on the photo. |
| QC XQC | Ifrelevant, check whether irrigation photo taken and water management is visible on the photo. Check if the code coincides with the feature on photo. |

### 4.7.2 Type of irrigation (field 47), source (field 48) and delivery system (field 49)

| Role | Check |
|---|---|
| QC SU | If applicable, check that the irrigation photo has been taken. If relevant add additional photo. |
| QC RO | Check photos if relevant |
| QC XQC | Check photos if relevant |

## 4.8 Soil

### 4.8.1 Soil belongs to a triplet (field D)

Pre-filled field, used to indicate whether a point is part of the soil sample and therefore has to be considered for collection of topsoil.

### 4.8.2 Soil sample taken (field 50), soil label (field 51), signs of ploughing (field 52), percent residuals (field 53), percent stones (field 54) and remarks on soil (field 55)

| Role | Check |
|---|---|
| QC SU | Check if filled appropriately. Cross-check label number with the label on the sample.<br><br>If applicable, check that the soil photo has been taken. If relevant add additional photo.<br><br>If sample not collected on a triplet point, remark is needed. |
| QC RO | Check physical soil sample for label number.<br><br>Check photos (soil and additional) if relevant. Check for remarks. |
| QC XQC | Check photos if relevant. Check for remarks. |

## 4.9 Transect

### 4.9.1 Previous campaign transect (field E)

Pre-filled field. Useful to check if transitions are appropriate.

### 4.9.2 Transect (field 56)

| Role | Check |
|---|---|

| | |
|---|---|
| QC SU | Check codes against the ground document and the transect photo. Check if rules were correctly applied. Add additional photo if relevant.<br><br>Crosscheck with orthophoto for completeness if necessary.<br><br>Add a remark if orthophoto differs from reality. |
| QC RO/CO | Check with orthophoto, ground document, landscape photos and GPS track for fundamental mistakes and incompleteness.<br><br>Check if the first element coincides with rules (if transect starts with linear feature, look to North rule applied, etc).<br><br>Check whether visible structural elements in E direction appear in the East photo and in transect.<br><br>Check that eventual photointerpretation has been marked. |
| QC XQC | Check with orthophoto, ground document, landscape photos and GPS track for fundamental mistakes and incompleteness.<br><br>Check if the first element coincides with rules (if transect starts with linear feature, look to North rule applied, etc).<br><br>Check whether visible structural elements in E direction appear in East photo and in transect photo.<br><br>Check that eventual photointerpretation has been marked. |

### 4.9.3 Remarks to the transect (field 57)

| Role | Check |
|---|---|
| QC SU | Check that comments are understandable and pin-pointing the specific situation, use standardized remarks whenever possible. For free text comments use English.Avoid special characters. |
| QC RO/CO | Check that comments are understandable.<br><br>If free text is used check whether they can be converted into standardized remarks. |
| QC XQC | Check if potential problems have been commented. |

# 4.10 Photos

### 4.10.1 Photos (fields 58 - 66), additional photos (field 67) and remarks on photos (field 68)

| Role | Check |
|---|---|
| QC SU | Check that all required photos are taken and of good quality. Rename the photos and take care that the photos are correctly assigned. |

| | |
|---|---|
| | Check whether photos need to be to be anonymised, and do so if necessary.<br><br>Check the physical size of the photo and compress if necessary. |
| QC RO/CO | Check completeness of photos, whether taken/not taken coincides with photos available.<br><br>Check that the quality of the photos is good.<br><br>Check whether photos have been correctly assigned to each category.<br><br>Check whether not relevant fields are correctly ticked or whether photo should have been taken.<br><br>Check whether photos are in correct format.<br><br>Check the physical size of the photo and compress if necessary.<br><br>Check whether photos have been multiplied/copied. It is not allowed to use the same photo in two different fields.<br><br>Check whether photos that need to be anonymized have been checked and anonymized. Check for photos that were not anonymized, but should have been. |
| QC XQC | Check completeness of photos, whether taken/not taken coincides with photos available.<br><br>Check that the quality of the photos is good (focused, light conditions OK etc.).<br><br>Check whether photos have been correctly assigned to each category (e.g. irrigation photo not marked as W landscape photo).<br><br>Check whether not relevant fields are correctly ticked or if photo should have been taken.<br><br>Check whether photos are in correct format.<br><br>Check whether photos have been multiplied/copied.<br><br>Check whether photos that need to be anonymized, have been checked and anonymized. Check for photos that were not anonymized, but should have been. |