European Commission
Joint Research Centre
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European Commission > Joint Research Centre > IPSC > MARS Unit > WikiCAP

Category art 34 content

From Wikicap

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1. Agricultural parcel
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Contents

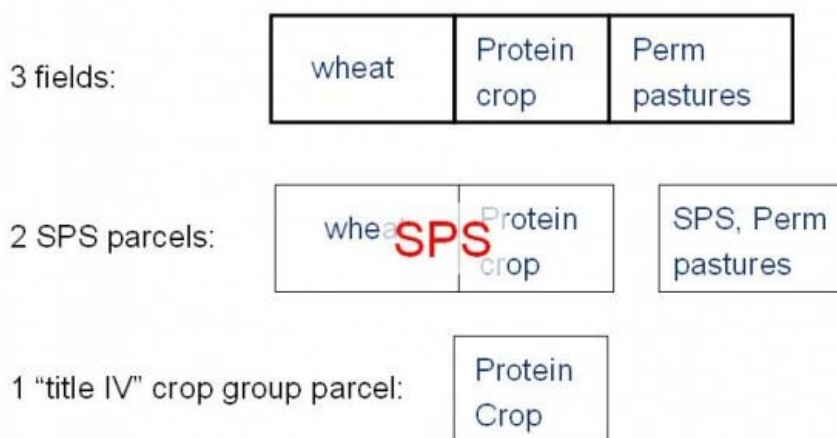## 1.1. Definition of the agricultural parcel

As from 2010, Art 2(1) of Reg 1122/2009 defines the agricultural parcel in the following way:

- *"agricultural parcel" means a continuous area of land, declared by one farmer, which does not cover more than one single crop group[1]; however, where a separate declaration of the use of an area within a crop group is required in the context of this Regulation, that specific use shall if necessary further limit the agricultural parcel; Member States may lay down additional criteria for further delimitation of an agricultural parcel;*

The uses needing a separate declaration within the SPS (or SAPS) crop group are permanent pastures (art 13(8) of Reg 1122/2009) and hemp (for the tetrahydrocannabinol content check, see art 39 of Reg 79/2003).

When a MS opts for further limitation of the agricultural parcel, the same definition should be applied systematically and in the whole of the procedure.

Art 2(1) of Reg 1122/2009 offers to Member States the possibility to choose the most appropriate definition of the agricultural parcel for their context: it could for instance be the **single crop parcel** or the **"crop group" parcel** as shown in the example below:

The example above illustrates the case where the Member States opts for the "crop group" parcel definition: the three fields make up two SPS parcels and one protein crop parcel.

In the figure below, the Member State defines the single crop parcel as the agricultural parcel. The three fields therefore correspond to three

agricultural parcels (one of these, the protein crop field, being also claimed for Title IV).

Where the crop or cover type is not explicitly required by the regulation, declaring "crop group" parcels instead of single crop parcels allows declaring parcels that otherwise might be below the minimum parcel size defined by the Member State. It may also simplify the farmer's declaration and the control, in particular when the "crop group" parcel matches a reference parcel.

Notes:

1. ↑ Cf. art. 56(1) of Commission Regulation (EC) No. 1122/2009 for the definition of crop groups

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1.2. Definition of the area to be measured
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The total area of the agricultural parcel, in accordance with Art.34(2) and 34(3) of R.1122/2009, should be measured. However, areas not taken up by agricultural activities such as buildings, woods, ponds and paths are to be excluded from this area (Art.34 of R.73/2009).

Art.34(4) of R.1122/2009 states that, without prejudice to Art.34(2) of R.73/2009 (parcels with permanent crop trees or parcels afforested under a 2nd pillar scheme), "an agricultural parcel that contains trees shall be considered as eligible area for the purposes of the area-related aid schemes provided that agricultural activities or, where applicable, the production envisaged can be carried out in a similar way as on parcels without trees in the same area".

In this **context**, the Commission services view is that **Woods** (in parcels not declared as short rotation coppice) should be interpreted as areas within an agricultural parcel with tree-cover (including bushes etc.) preventing growth of vegetative under-storey suitable for grazing.

- With regard to **parcels containing trees**, the commission services are of the view that, as a result, areas of trees inside an agricultural parcel with density **of more than 50 trees/ha** should, as a general rule, be considered as ineligible. Exceptions, justified beforehand by the Member States, may be envisaged for tree classes of mixed-cropping such as for orchards and for ecological/environmental reasons.
- With regards to **shrubs, rocks** etc, the conditions under which these elements can be considered as part of the agricultural parcel should be defined on the basis of the customary standards of the Member State or region concerned (e.g. land cover type, maximum area percentage).

To assess the eligibility of / eligible area within an agricultural parcel of (permanent) pasture, Member States can use a **reduction coefficient**, which can take the following forms:

- a *pro rata* system whereby the eligible area taken into account is determined according to different thresholds applied at the level of each parcel. For instance, if the crown cover determined on the ortho-imagery and recorded as such in the LPIS-GIS ranges between 25% and 75%, the parcel is considered as 50% eligible.

– a percentage reduction applied at agricultural parcel level based on an assessment of the parcel using scorecards differentiating the reduction to be applied according to the type of ineligible feature, its predominance within the parcel etc.
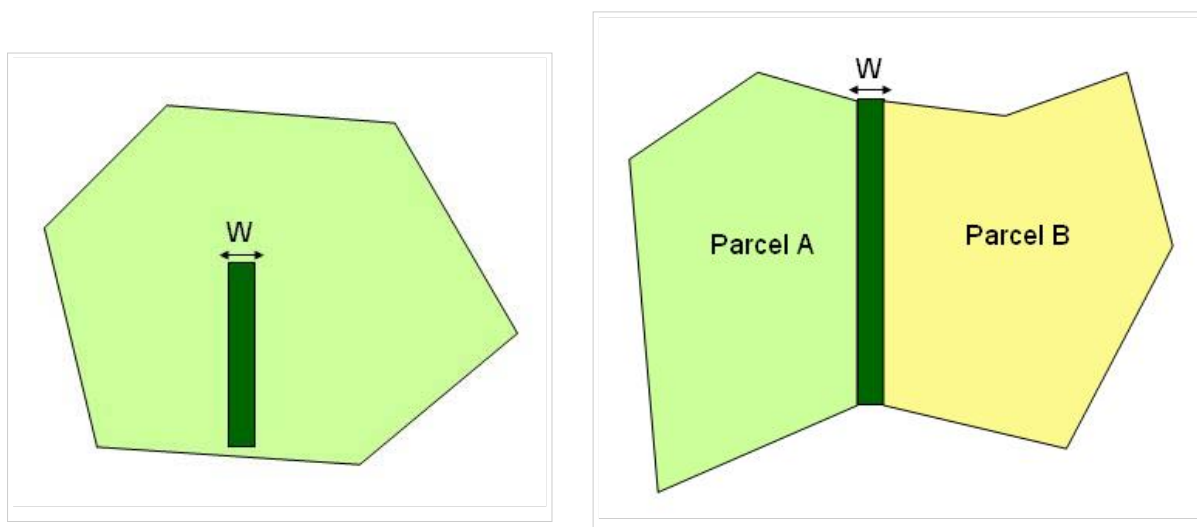
In the application of either option, the Member States should consider the exclusion of the ineligible area according to its proportion within the geographical area of the encompassing parcel.

- With regards to **ponds**, only permanent ponds are to be excluded (if not falling under Art.34(3)).
- **Paths**, other than those created by animal access, are to be excluded.

Member States shall define **beforehand** the criteria and procedure used to delimit the (in)eligible part of the parcel in order to ensure that these criteria are communicated to farmers, where necessary, correctly transposed in the LPIS and adequately included in the instructions for the on-the-spot checks; this all with the view to ensure that the land declared and accepted for payment complies with all legislative requirements (e.g. agricultural activity).

In accordance with the first subparagraph of **Art.34(2) of R.1122/2009**, the area to be measured can be the total area of the reference parcel provided that it is fully utilized according to the customary standards of the Member State or region concerned.

Where, in accordance with the second subparagraph of Art.34(2) of R.1122/2009 **features of up to 4m wide** (walls, ditches, hedges) serve as **boundaries** between agricultural parcels and are traditionally part of good agricultural practice in the region concerned (e.g. terrace walls, drainage ditches), such features may be considered as being included; half of their width up to a maximum of 2m being attributed to each adjacent agricultural parcel. **Internal features** are, under the same conditions, accepted as forming part of the agricultural parcel where their width is less than or equal to 2m. Where the feature is >4m wide (or >2m wide if internal to the parcel), the feature should be removed from the area to be measured (see figures below), unless the feature has been recognized under Article 34(3) of R.1122/2009.

Internal feature of width W: if W≤2m include the feature in the agricultural parcel; otherwise exclude the feature

Boundary feature of width W: if W≤4m include 50% of the feature area in parcel A and 50% in parcel B; otherwise exclude the whole feature from both parcels

Where, under **Art.34(3) of R.1122/2009**, features that are part of the good agricultural and environmental condition obligations or the statutory management requirements (e.g. hedges, drainage ditches, small woods according to the local regulations) have been specifically recognised and defined as (landscape) features eligible for area payment, it is recommended that during the on-the-spot checks (i.e., remote sensing or otherwise) such features should be digitized as points, lines or polygons with their corresponding attributes in the LPIS, this way making possible the control of their maintenance (cf. the respect of the GAEC obligations).

NB: Such features are also eligible for coupled payments.

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1.3. Specific considerations for area measurement
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1.3.1. Specific considerations for Nut Tree areas (section 4 of Chapter 1 of Title IV of R.73/2009)

In view of the conditions to be respected in particular in accordance with Art.15 of R.1121/2009, the objective of field checks for trees areas is confirming the size and minimum density thresholds. The field data collected therefore will focus on the positioning of the boundary nuts

trees. In a subsequent step, the determination of nuts parcel areas can be carried out using GIS tools, on the basis of these tree positions.

- The orchard

  Agricultural parcels (Art.2 of R.1122/2009) planted with nut trees are hereafter called "orchards".

  In accordance with Art.15 and 5(2) of R.1121/2009 to be eligible the orchard must have a minimum density of nut trees (i.e. number of trees per ha fixed according to the type of tree) and the surface area may not be less than 0.1 ha.

  Isolated trees: [no longer relevant - deleted]

- Measuring the area of an orchard

  The trees forming the perimeter of the orchard should be identified. The area of the orchard is then calculated including a buffer zone of half the distance inter-row or a fixed buffer zone ≤3.5 m. When applying the above mentioned buffer, the boundaries of the nuts orchard should not overlap the limits of the LPIS reference parcel, and therefore the nuts orchard area should never exceed the area of the LPIS reference parcel.

  If several groups of trees are present on one reference parcel they should be treated and measured as separate orchards, provided that the closest distance between trees of each group is >12m for hazelnuts and >20m for other eligible species.

- Estimating orchard density

  In cases where the orchard appears fully covered by nut tree crowns of eligible species, the counting of individual trees can be omitted. However, an estimate of the orchard density should nevertheless be carried out by appropriate means (multiplication of rows, checking of a sample area, etc.). This estimate should be recorded on the report and (where necessary) noted as an estimated value.

  Where the density estimate is close (e.g., within 25 trees/ha) of the regulation limits for the tree species, counting of trees (either automatically or by photo interpretation) should be made on a representative ortho-photo background. Existing ortho-photos (LPIS, Olive GIS, Vineyard register etc.) or VHR imagery should be used, compatible with the requirements of Art.17 of R.79/2009. When this method cannot be applied (no images available or identification of trees not possible on the available images), a field visit should be organised to count the trees on-the-spot.

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2. Area measurement

2.1. General considerations

The inspector should have received sufficient instructions and training, and be largely able to undertake the work autonomously. The inspector should have no conflicts of interest, and should be able to carry out the inspection independently.

Agricultural parcel areas shall be determined as laid down in Art.34 of R.1122/2009. In order to provide a result to the appropriate precision and to ensure effective verification, the inspector must have access to appropriate claim data (including map information) and measuring equipment.

On-the-spot checks of areas, as a general rule, consist of two parts:

1. A preliminary verification of eligibility and area of all declared agricultural parcels on the basis of map materials (LPIS, sketch maps, ortho-photos) and so forth (e.g. alphanumerical information such as results of administrative checks, LPIS maximum eligible area...).
2. The determination of the area of a sample of at least half of the parcels to verify the claim (eligibility, GAEC, and possibly declared crop), as well as the precise area of the agricultural parcels.

Every on-the-spot check shall be the subject of a control report in accordance with Art.32 of R.1122/2009 which makes it possible to review the details of the checks carried out independently.

2.2. Location of the agricultural parcel

The inspector should make sure he correctly located the reference parcel containing the claimed agricultural parcel.

2.3. Verification of the maximum eligible area of the reference parcel

Since the eligibility of the agricultural parcel area claimed will first be checked against the reference parcel maximum eligible area, it is

important to **verify** that this **maximum eligible area is up to date** before starting measuring (temporary) ineligible features.

The Commission services take the view that the area of permanent ineligible features larger than 0.01 ha, or of features smaller than 0.01 ha but representing together an area larger than the LPIS parcel tolerance [1] (discovered during an OTS check or through any other source) should be deducted from the LPIS maximum eligible area without applying any tolerance; in addition, features above 0,1 ha should be mapped in the LPIS (see figure below). In the LPIS updating process, the historical maximum eligible area(s) and the deducted areas should be recorded to allow an adequate control trail (cf. log process in the LPIS data management flow).

However when permanent ineligible features smaller than 0.1 ha (and larger than 0.01 ha) are located at the border of the reference parcel, it could be more appropriate to map them out of the reference parcel (rather than including them and deducting their area from the maximum eligible area).
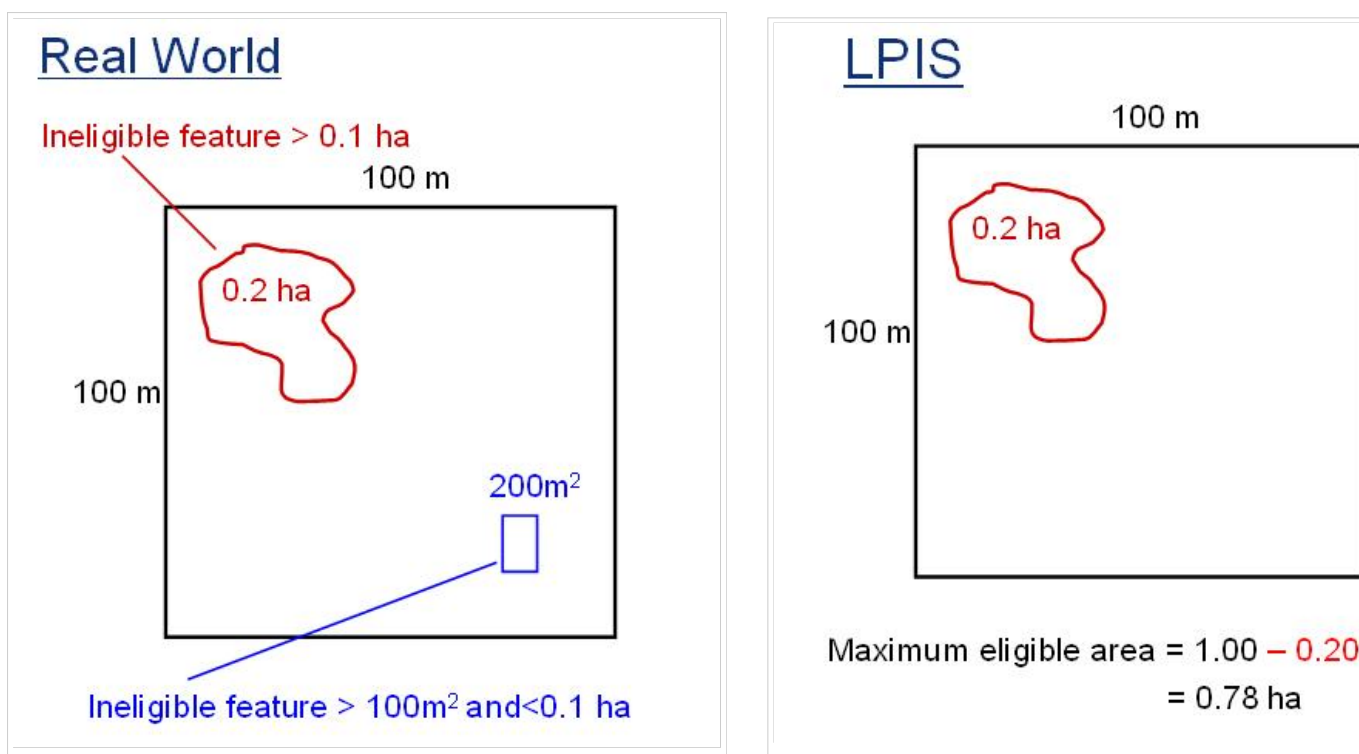

Figure: **Situation in the field (real world) and "transcription" into the LPIS** i.e. mapping of ineligible features > 0.1 ha and updating of the maximum eligible area.

2.4. Timing and advance warning

The entire check, especially *in situ* visits, has to be performed in a timely manner to ensure that unambiguous identification of the agricultural parcel limits and cropping (where necessary, e.g. for supplementary or recoupled payments) is possible.

In practice, inspections of crops, where necessary, have to be carried out in the appropriate period before, or (at latest) soon after the harvest to be effective. The Commission services consider on-the-spot checks to be completely ineffective from the moment the farmer starts to cultivate the land for the next crop season.

The use of advance warning should be kept to the minimum necessary, in order not to jeopardise OTS checks, and in any case no more than as laid down in Art.27(1) of R.1122/2009.

Notes:

1. ↑ as a general rule any **permanent ineligible** feature deducted during an OTS check is likely to trigger an update of the LPIS maximum eligible area (except for features below 0.01 ha (100 m2) which may together represent a significant area for an agricultural parcel, but not for the corresponding LPIS parcel).

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2.5. Sample of parcels to be measured
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2.5.1. Parcel Sample

Where the actual determination of the areas as part of an on-the-spot check is not done on the whole claim (i.e. on 100 % of the claimed parcels), a **sample of at least half of the agricultural parcels** must be selected for examination as laid down in Art.33 of R.1122/2009. An obligation then falls upon the **Member State to establish and justify the criteria for the selection of the sample** taking into account that the sample must guarantee a **reliable and representative level of control** (cf. Art.33 of R.1122/2009).

In this context, the Commission services take the view that the selection should be made:

- from the complete set of parcels for which an aid claim has been made;
- after the preliminary verification and measurement (e.g. on the basis of the farmer's sketches);
- before the actual inspection in the field begins.

The driving principle of the sampling is that **parcels should be selected where they represent a risk by their nature**. It is recommended that assessment of one or more of the following criteria is used in this sampling process:

- No previous measurements through control
- High value crops
- Boundary problems identified on LPIS documentation
- Agricultural parcels within LPIS reference parcels with unclaimed areas
- Distance or isolation from the main farm location
- A target of 80% of the area claimed and at least one parcel per crop group
- etc.

Parcels, once selected, should not be dropped from the set to be checked.

Agricultural parcels should be added to the selected set to be measured where problems thus identified require that a full crop group or the full application needs to be checked (see below).

Where the LPIS in the Member State concerned is based upon reference parcels where agricultural parcel location may be ambiguous, the selection should normally be made upon the basis of these reference parcels; **all agricultural parcels inside a selected reference parcel are to be checked** for coherence with respect to the crop declared and their areas. Use should be made of sketch maps returned by farmers with their applications, to reduce such ambiguity of agricultural parcel identification.

2.5.2. Extension of the parcel sample

According to Art.30(4) of R.1122/2009, the extent and scope of the sample shall be extended appropriately if the checks on the initial sample cases reveal irregularities. The Commission services take the view that if an **over-declaration of more than 3 % of the area** is determined in the measurement of the sampled agricultural parcels for a specific **crop group** (cf. Art.56 of R.1122/2009), the sample should be extended to include all the remaining parcels of the crop group concerned.

In any event, any **reduction** in area determined with respect to area claimed will be **applied to the whole crop group**, and not only the agricultural parcels included in the representative sample (cf. Art.33 of R.1122/2009).

It may be argued against this extension of the reduction that the sample may be biased towards risky parcels and therefore may not be representative of the parcels not checked. This may be true, but the primary objective of the sample is not to estimate the area discrepancy at application level but to provide sufficient assurance that the claim is correct for each crop group. Experience has shown that when discrepancies are found in a sample of 50% of the parcels, discrepancies are likely to be present in the remaining 50% parcels. On the principle, checking only a sample of parcels is allowed provided that this sample can be increased in case discrepancies are found. This principle translates in a guideline to complete the crop group in case the discrepancy exceeds 3% of the determined area of the sample. This 3% threshold was chosen because this is the threshold triggering penalties. However this does not mean that a discrepancy below 3% does not constitute a risk for the fund and may not justify a complete check.

Moreover, extrapolating the reduction found on the sample to the whole crop group (or extending the sample) is fair with respect to farmers which are checked at 100% from the beginning.

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2.6. Measuring the agricultural parcel area
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There are two options for measuring the agricultural parcel area: 1) direct measurement or 2) measurement by deduction, which is applicable only in particular circumstances.

According to Art.34(1) of R.1122/2009, MS shall use **measurement tools** that are "**proven to assure measurement of quality** at least equivalent to that required by applicable technical standard, as drawn up at Community level". The quality of a given tool is defined by the tolerance (i.e. buffer width) applicable to this tool as determined through an area measurement validation test. Only tools (e.g. GNSS equipment, remote sensing ortho-images - cf. Art.20 of R.73/2009) with a buffer width not exceeding 1.5m should be used (Art.34(1) of R.1122/2009).

The area measured will be expressed as the area projected in the national system used for the LPIS.

2.6.1 Measuring the whole parcel or making use of the LPIS maximum eligible area?

Where the Land Parcel Identification System (LPIS), together or not with ancillary data such as ortho-photos, permits the confirmation of the boundaries of the declared agricultural area, the *area measurement may focus on the determination of ineligible areas* and deductions. **This situation will be only possible when the LPIS reference parcel includes only one agricultural parcel**, and correctly reflects the current status of eligibility[1]. In all other circumstances a *direct measurement* of the parcel area, for example using GPS, is required.

2.6.2. Deduction of ineligible features

The Commission services take the view that, in accordance with general control practices, deductions of minor (i.e. <100 m²) ineligible features would only need to be made if the inspector considers that all together these features present a significant area; i.e. an area larger than the expected precision of the measuring system (see Technical tolerance) applied with respect to the total parcel area. That is, when the **total of all these minor ineligible features** within the parcel exceeds the tolerance of the parcel (calculated as the buffer width of the measurement tool multiplied by the external perimeter), the parcel area minus all ineligible areas is to be taken as the measured area. This approach is independent of the tool used for the measurement of the ineligible features.

- When temporary ineligible objects of significant size (i.e. >100 m²) are identified in the LPIS reference parcel, the measured area of the agricultural parcel is obtained by deducting the area of these features from the **maximum eligible area of the reference parcel**, irrespective of whether an actual area measurement of the reference parcel is made at the time of the control (NB: permanent ineligible features above 100 m² have already been deducted in the step of verification of the maximum eligible area).
- Where **ineligible features** are **deducted** to determine the agricultural parcel area, **no tolerance** should be applied to the area of these ineligible features.

Where the LPIS official area (i.e. maximum eligible area) is used to determine the measured area, through the deduction of ineligible areas, an absolute technical tolerance equal to the LPIS parcel perimeter multiplied by the buffer width appropriate for the current year ortho-imagery used to measure the deduction should be applied to the LPIS parcel. In case the deduction is measured with a GNSS (or any other field tool) and the LPIS parcel boundaries are checked on archive ortho-imagery, the buffer width appropriate to this imagery should be used. The recommendations on buffer widths can be found inTechnical tolerance. If no imagery was used (e.g. for LPIS based on cadastre or topographic maps), the tolerance corresponding to the mapping technique used for such LPIS (and determined through a documented validation test) should be applied.
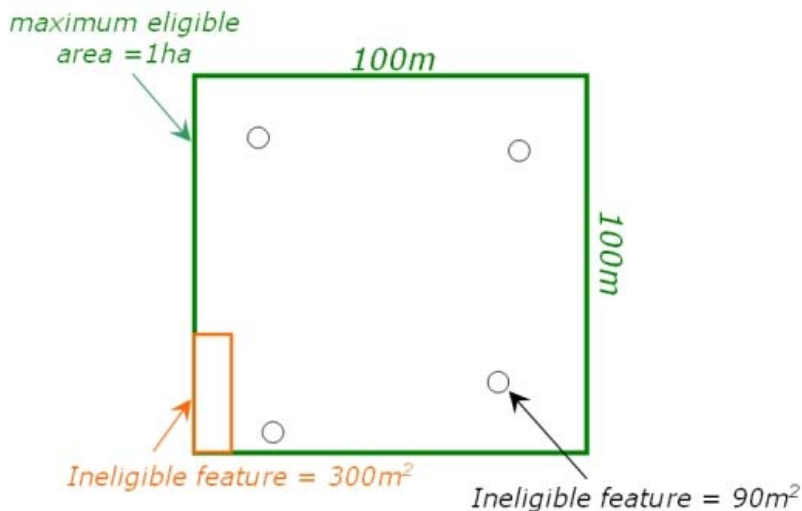
It may be argued that the tolerance should apply to the object measured and therefore to the deducted area, i.e. to an area (significantly) smaller than the eligible area to be measured. However, for the sake of equality of treatment of farmers, a tolerance based on the LPIS parcel perimeter should be used as this tolerance is close to the one that would be obtained with a direct measurement. Moreover, assuming a new (more precise) ortho-image is available, the inspector (operator) will not only measure the deduction(s) with this new ortho-image but will also check that the LPIS boundaries are correct on this new ortho-image.

Workflow and examples:

1. Establish the maximum eligible area of the reference parcel (deduct area of permanent ineligible features - see 2.3) and the tolerance (i.e. reference parcel perimeter x buffer width corresponding to the tool used)
2. Identify temporary ineligible features greater than $100m^2$, measure their area and subtract this area from the maximum eligible area
3. Identify temporary ineligible features smaller than $100m^2$ (i.e. temporary minor features); estimate if their total area is 'significant' i.e. exceeds the tolerance established in point 1
4. If these temporary minor features are significant, measure their area and subtract it from the area established in point 2
5. Compare the declared area minus the measured area from point 4 to the tolerance from point 1: if the absolute difference is greater than the tolerance, take the measured area from point 4; otherwise the declared area

Example 1 with five temporary ineligible features:

1. Maximum eligible area = 1.0 ha, tolerance on LPIS parcel = 400m x 0.75m = 0.03 ha (buffer equal to 0.75m because parcels digitized on 0.5m orthophoto)
2. One temporary feature of $300m^2$ (e.g. a muck heap or a wood pile) needs to be subtracted: 1.0 - 0.03 = 0.97 ha
3. four features of $90m^2$ each give a total ineligible area of 0.036 ha which is greater than the tolerance ($300m^2$) thus significant
4. The measured area is therefore 0.97 - 0.036 = 0.93 ha
5. If 0.96 ha is declared, this declared area is inside tolerance of the measured area (0.93 ha +/- 0.03 ha) and is therefore retained. If 0.97 ha is declared, the declared area is outside tolerance and the measured area is retained.

maximum eligible
area =1ha

100m

100m

Ineligible feature = $300m^2$

Ineligible feature = $90m^2$

Example 2 with one permanent and four temporary ineligible features:

1. Maximum eligible area in the LPIS = 1.0 ha, tolerance on LPIS parcel = 400m x 0.75m = 0.03 ha
2. One permanent feature of $300m^2$ (e.g. a new house) needs to be subtracted; the new maximum eligible area is 0.97 ha; the tolerance on the LPIS parcel remains unchanged (as the outer perimeter is unchanged)
3. four features of $70m^2$ each give a total ineligible area of 0.028ha which is smaller than the tolerance ($300m^2$), thus not significant
4. The measured area is therefore the (new) maximum eligible area i.e. 0.97 ha
5. If 0.96 ha is declared, this area is inside tolerance of the measured area (0.97 ha +/- 0.03 ha) and is therefore retained. If 0.98 ha is declared, it is also inside tolerance, but due to the cap to the maximum eligible area, 0.97 ha is retained.

2.6.3. Material to be used in CwRS

The available material to be used in CwRS will be the current year ortho images (VHR, possibly HR) and the most recent LPIS ortho images. As a general rule, preference will be given to the current year VHR imagery. Recent archive VHR imagery should be used only if it enhances the interpretation of the current year VHR imagery, therefore helping the interpreter making the decision.

2.6.4. Combination of field point measurements and on screen measurement

In classical field inspection, combining **"critical" points** measurements taken in the field, i.e. points where the parcel boundary changes direction and that are not visible on the ortho-imagery, with the available **VHR ortho-imagery**[2] allows measuring the parcel area provided that

- the available VHR ortho-image meets the specifications required for area measurement i.e. (1) the specification on geometric accuracy (the RMSE-1D measured on independent check points shall be below 2.5m) and (2) the specification on area measurement accuracy (the associated buffer width shall be below 1.5m)
- the inspector makes sure that the (part of) parcel boundary to be digitized on the archive VHR imagery matches the parcel boundary in the field

The inspector should also make sure that the "critical" points measured in the field (e.g. with a GNSS) are located as precisely as possible on the ortho-imagery. Where feasible, the location of these points should be verified against points well visible on the available ortho-imagery (landmarks), e.g. by comparing their distance to these landmarks.

Combining "critical" points measurements with archive ortho-imagery may prove less time consuming than direct measurement of the whole parcel in the field. Also, it could be an alternative to cases where measurement with GNSS equipment is not feasible due to obstacles (e.g. a mountain) or due to the particular nature of the measurement requested (e.g. permanent tree crop).

2.6.5. Procedure for features under Art.34(2) and 34(3) of R.1122/2009

See 1.2. Definition of the area to be measured

Notes:

1. ↑ i.e. the inspector should confirm at least that the boundaries of the reference parcel are up to date and correct
2. ↑ usually archive ortho-imagery, but the method may need to be applied to current year VHR ortho-imagery if the boundary between two parcels is not visible

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2.7. Area determined

The area determined for a given Agricultural parcel is the value kept following the decision made after comparing various area candidates: the declared value, a reference value, and possibly a measured value. The decision rules may use a technical tolerance, which will be based upon the measurement method or tool applied.

2.7.1. Determination of the parcel area, use of the technical tolerance

For the purpose of the determination of the area to be taken into account for the calculation of the aid in accordance with Art.57 of R.1122/2009, the area assigned to **each agricultural parcel** will be computed as follows:

- Where the absolute (unsigned) difference between the measured and declared areas is greater than the technical tolerance (expressed as an area in hectares to two decimal places), the **measured area** will be considered as determined[1].

- In the alternative case (i.e. when the declared area is within technical tolerance of the measured area) the **area declared** will be considered as determined.

In all cases, the determined area must be **capped to the maximum eligible area** of the LPIS reference parcel.

2.7.2. Determination of the crop group area

The area at the **crop group level** will be determined by summing up the individual areas of the agricultural parcels, determined as described above. No technical tolerance will be applied at the crop group level. In any case, if the area determined at the crop group level is found to be greater than that declared in the area aid application, the area declared shall be used for calculation of the aid.

Notes:

1. ↑ In other words, when the declared area falls outside the interval [measured area - tolerance, measured area + tolerance], the measured area is retained

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3. Technical tolerance

The purpose of the technical tolerance is to account for the uncertainty specific to any measurement technique. In the context of the control of area based subsidies, i.e. in the process of an on the spot check, tolerances are in general applied to the assessment of the difference between the declared and measured areas of the claimed agricultural parcel.

3.1. Regulatory basis

According to Art.34 of R.1122/2009, MS are required to use "**means proven to assure measurement of quality** at least equivalent to that required by applicable technical standard, as drawn up at Community level".

The quality of a measurement tool can be characterized by a number of parameters such as its bias, precision and accuracy (for the definition of these terms, see ISO 5725-1 or the "area measurement validation scheme" (http://mars.jrc.ec.europa.eu/mars/content/download /1366/7771/file/8307v5.pdf|) technical note); assuming there is no bias, it can also be characterized by its reproducibility limit, which is the

parameter used to determine the technical tolerance.

As from 1 January 2008, only the perimeter **"buffer" tolerance** shall be applied to agricultural parcels. This buffer tolerance, which cannot exceed 1.0 ha, is calculated by multiplying the parcel perimeter by a (buffer) **width of maximum 1.5m**.

Therefore Member State should use only tools that allow measuring both the area and perimeter and should make sure that these tools meet the measurement accuracy (i.e. the maximum 1.5m buffer width) requested by the regulation.

3.2. Determination of the buffer width of a measurement tool

In order to determine the measurement accuracy of a given tool, whether it is a GPS, an orthoimage or any other area measurement tool, **MS are requested** to systematically perform an **area measurement validation test** where needed, for instance through a validation test **before the start of the campaign** (see 'JRC Area measurement validation scheme'). The output of this test is a reproducibility limit at 95% confidence level, expressed as buffer width. The value of this reproducibility limit R determined experimentally will permit classifying the tool using, for instance, the following classes:

- (1) "better than 1.5m" for tools presenting an R falling inside]1.25m, 1.5m], i.e. buffer width = 1.5m;
- (2) "better than 1.25m" for R inside]1.0, 1.25m];
- (3) "better than 1.0m" for R inside]0.75m, 1.0m];
- (4) "better than 0.75m" for R inside]0.50m, 0.75m]; and
- (5) "better than 0.50m" for R below 0.50m.

The International Organization for Standardization (ISO) defines the reproducibility limit as "the value less than or equal to which the absolute difference between two test results (here area measurements) obtained under reproducibility conditions (with the same method but different operators and conditions, e.g. satellite configuration for GPS measurements) is expected to be with a probability of 95%".

3.3. Application of the technical tolerance on parcel area measurement

The technical tolerances should be applied only to agricultural parcels and not to subdivisions of an agricultural parcel (e.g. internal cadastral parcels) as this would lead to the application of an excessive technical tolerance. For the definition of the agricultural parcel, please see Agricultural parcel.

For the creation or update of LPIS reference parcels, the buffer width to be used is indicated in paragraph 'Measurement on-screen on a digital orthoimage'.

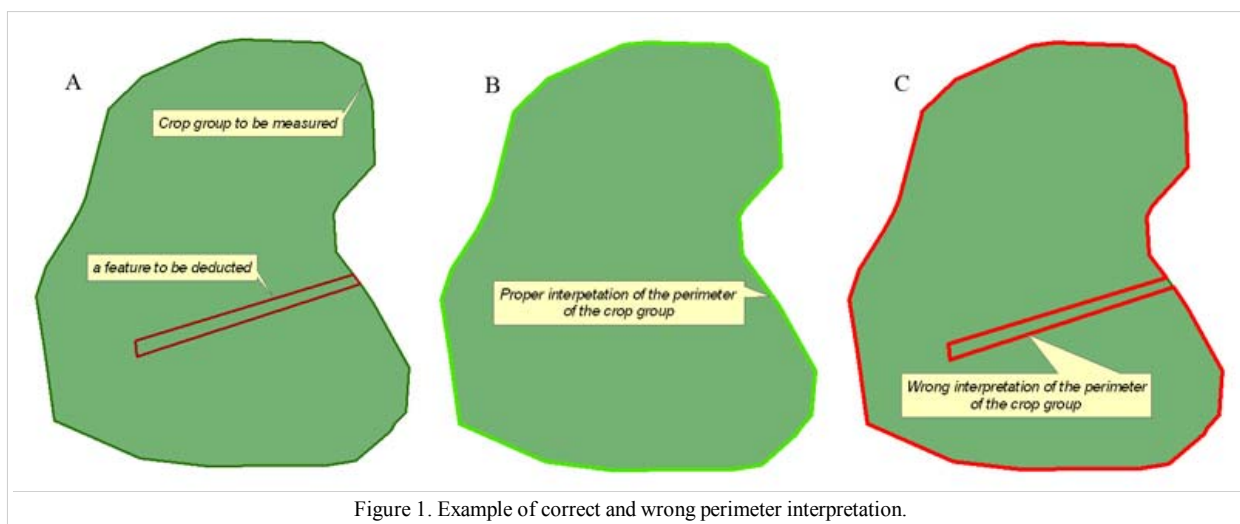The **outer perimeter** should be used for tolerance calculation as shown on Figure 1.

Figure 1. Example of correct and wrong perimeter interpretation.

Ineligible features included in the controlled area, like roads and maybe ditches or hedges, should not be taken into account when calculating the tolerance (see Figures 1B and 1C).

3.4. Tools used in conjunction with area measurement of cartographic materials (analogue or digital)

The buffer widths presented in this document should be understood as reproducibility limits at 95% confidence level (see 'JRC Area measurement validation scheme' and in particular § 7.1.3).

Planimeter

The change in the Regulation for 2008 and beyond means that, in principle, it is difficult to support the use of the planimeter, unless it is able to apply a perimeter tolerance and has been calibrated. In such a case, the Member State should make sure that the buffer width applicable to the planimeter has been proven, (e.g. certified) and in any case does not exceed 1.5m.

Measurement on-screen on a digital orthoimage

It is assumed for the purpose of these guidelines that the orthoimage quality meets at least 1:10,000 scale geometric specification (2.5m RMSE).

In absence of area measurement validation results for a given type of imagery, a buffer width set equal to **1.5 times the pixel size** will be used. For instance, in the case of images with a 1m pixel size, the tolerance will be 1.5m times parcel perimeter length, and in the case of a 50cm pixel image the tolerance will be 75cm times perimeter length (cf. Table 1).

However, before using this "rule of thumb", MS are advised to first check table 2 (cf. paragraph 3.6 below).

Table 1. Tolerance equated to map scale and pixel size

Map scale	Equivalent pixel size	Tolerance, on-screen
1:10,000	1m	1.5m
1:5,000	0.5m	0.75m
1:2,000	0.25m	0.4m

When linear features are to be measured on a digital orthoimage, it is recommended that the vector is digitised with a ground interval of around 50m (i.e., 5mm on a 1:10,000 scale image, or 10mm on a 1:5,000 scale image). A 2% tolerance may be applied to the length.

Measurement on screen on a digital map object (raster or vector)

It is assumed that the digital map quality meets at least 1:10,000 scale geometric specification (2.5m RMSE).

The tolerance, which should be applied as a buffer on the parcel perimeter, will be based upon the nominal scale of the digital map dataset which acts as source material. The values related to map scale are given in Table 1.

3.5. Tools used for physical field measurement

GNSS (standalone, EGNOS, or code differential)

GNSS area measurements made by single systems (stand alone) must work using a parcel-perimeter approach. As from campaign 2008, MS are requested to use means **proven** to assure measurement of a certain quality, i.e. certified or validated GNSS models. The list of GNSS models already validated by MS can be found here (http://marswiki.jrc.ec.europa.eu/wikicap/index.php /GPS_receivers_validated_by_Member_States) whereas the certified GNSS models are published here (http://www.tuev-sued.de/navcert /en/certification_marks/ppp_80010/references) . In absence of any certification or other test results, the tolerance to be applied is **up to 1.25m** times the perimeter of the parcel. However, as from the 2010 campaign, such a default value is expected to be used in exceptional circumstances.

In case a validation test for a particular stand-alone GNSS has been performed, the class of measurement accuracy (e.g. "better than 1.0m") determined for this type of GNSS should be used.

As from 1st October 2009, the **EGNOS "open service"** was officially announced as **available**. Technical performance parameters and terms and conditions of the use of the Open Service can be found in the Open Service Definition Document at this website (http://ec.europa.eu /transport/egnos/programme/open_service_en.htm|) .

If technically possible, MS are encouraged to use this service and to determine the buffer width to be applied with the EGNOS differential correction.

Due to the uncertainty of positioning at the start and end of measurements of linear features, it is recommended that standalone GNSS is only used for measuring linear features greater than 100m long; in exceptional circumstances shorter lengths may be measured but care should be made to check for irregularities in the recorded vector. The tolerance applied in such a case is recommended to be 2m, irrespective of the length.

Geodetic survey instruments (single of dual frequency phase GNSS, electronic total station)

These instruments are normally used for re-measurement in the case of disagreement by the applicant and therefore they will be operated by skilled, professional survey staff. A statement of their precision for area measurement expressed as buffer width around the parcel perimeter (e.g. a certificate provided by the manufacturer or a validation test result) should be a pre-condition of their use. Even if experience has shown that such instruments have a buffer width below 0.35m, a 0.5m buffer width is recommended to acount for the uncertainty in the parcel boundary itself (e.g. in case of hedge, ditch, bank). This value (0.5m) is also the default value to be applied in case of lack of such a statement.

Wheel, tape, topofil, etc.

These systems are considered as backup tools, primarily suitable for the measurement of lengths. The use, however, of a wheel on rough ground is strongly discouraged. Care should be taken when using the tape or topofil that the tool is not caught on branches, blown in the wind, etc.
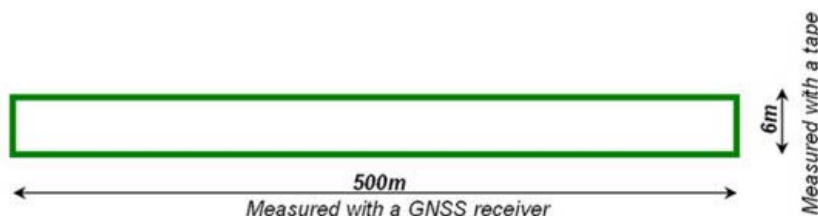
For lengths of up to 100m, a linear tolerance of 2% can be accepted. This is to avoid problems when the feature is not perfectly straight, and/or the terrain is sloped or irregular. Care should be taken with all such "analogue" tools to adjust the measured length to the projected (horizontal) length. Above 100m, other tools (e.g. GNSS) should normally be applied.

Laser range-finder tools are a preferred approach for distance measurements of absolutely straight features, and can be used for longer distances, provided that corrections for slope are possible and that the expected accuracy of the tools for such distance measurement is better than 2% linear length.

In general, the use of these tools should be restricted to linear measurements such as strip width, offset measurements from parcel boundaries, track lengths. It is not recommended that these tools are used for full parcel measurements (cf. borders, small deductions, etc.), primarily because the geometry (shape) and slope of typical agricultural fields is rarely regular. Nevertheless, in the exceptional case where such tools are used for area measurements, a tolerance based on the perimeter length multiplied by the linear tolerance shall be applied.

Example: (to be discussed)

- width $l = 6m$, linear tolerance (tape) $2\% = 0.12m$
- length $L = 500m$, linear tolerance (GPS length) $= 2m$
- perimeter tolerance on parcel length $= 500m \times 0.12m = 60m^2$
- perimeter tolerance on parcel width $= 6m \times 2m = 12m^2$
- total perimeter tolerance $= 72m^2$

```
The same tolerance is obtained calculating
the 2 ends of the interval, i.e.
an upper area: (L+2)*(l*1.02) = 3072 m²
a lower area: (L-2)*(l*0.98) = 2928 m²
```


6m
Measured with a tape

500m
Measured with a GNSS receiver

This example regards a perfect rectangle, which in the field may be difficult to find.

3.6. Remote sensing control

In absence of validation test results, the guidance given in 'Measurement on-screen on a digital orthoimage' applies. In effect, the results of the validation tests, performed on seven types of VHR images of Ground Sampling Distance (GSD) ranging from 0.20m to 2.5m confirmed that the rule of thumb allows deriving a reasonable approximation of the buffer width, especially in the range 0.5m - 2m.

For the **VHR prime** sensors, the validation test results suggest using the following buffer widths:

Table 2. Tolerance to be used with VHR prime sensors

VHR sensor (GSD at nadir)	Recommended buffer width
Worldview 1 & 2, Geoeye-1 (0.5m)	0.8m
Quickbird (0.6m)	1.0m
Eros B (0.7m)	1.0m
Ikonos (1.0m)	1.25m

In case of failure of acquisition of the current year **dedicated/prime** VHR ortho-imagery, provisions should be taken to meet the requested area measurement accuracy. These may include the use of VHR back up imagery if available or of recent archive ortho imagery in case of stable boundaries; otherwise field inspections (e.g. with GPS) should be carried out.

In case **VHR back up imagery** with a GSD above 1m will have to be used (in combination with the most recent LPIS orthophotos), a buffer **tolerance of 1.5m** will be allowed. The possible consequences of using such a tolerance with VHR back up imagery (of GSD above 1m) are presented at this page.

3.7. Tolerance in case of combined use of on-screen measurement and other tools (GNSS, field points)

In case **critical points** are taken in the field and reported on the (archive) ortho-imagery, the **tolerance** appropriate to the **ortho-imagery** should be used.

In case the boundary not visible on the (archive) ortho-imagery is measured by **GNSS** and reported on the ortho-imagery, the recommended tolerance is the **maximum** of the **GNSS** buffer width and the buffer width recommended for the (archive) **ortho-imagery**.

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4. Use of LPIS in on the spot checks
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In the office, on-the-spot checks need to be prepared by selecting the areas to be measured, grouping and/or subdividing the parcels declared with reference to the LPIS, and arranging visit itineraries as efficiently as possible so as to cover one or more holdings.

- The LPIS data must be available for use during the on-the-spot checks campaign.
- The direct – preferably in digital form – consultation of the LPIS data (including where applicable orthophotos) shall be possible for the preparation of field controls.

When performing either conventional on-the-spot or remote-sensing checks, survey officers should have all the documentation needed to do the job properly from the outset.

- The output from the control exercise should be efficiently implemented in the management of any consequent on-the-spot checks that need to be made.

A clearly documented and/or non-proprietary interface to the LPIS should be implemented for the control exercise.

- The reference parcel vector layer and the associated alphanumeric application data must be directly exploited by the body (administration, contractor) responsible for executing these controls.
- The LPIS should include consistent transaction monitoring during the application and control process also for graphical objects. Conceptually, this requires time stamping and operator identification for all operations applied to graphical objects.

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- This page was last modified on 21 April 2010, at 15:17.