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MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE

The application of the pro rata system
established in article 10 of Regulation
640/2014 :
AN AUTOMATIC APPROACH

LPIS WORKSHOP

Brussels, 25th september 2014

FEQA
Fondo Español de Garantía Agraria

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BACKGROUND

Conformity clearance audits undertaken in the last few years by the **European Commission** have highlighted certain issues that might give rise to undue payments in the single payment scheme, in particular the **eligibility in pasture parcels**.

The **European Court of Auditors** mentions eligibility in pasture lands in special report N 5/2011.


Both institutions consider that reference parcels (recintos in Spanish LPIS) of pasture should not, as a general rule, be considered 100% eligible.

FF According to the Commission's interpretation of **Regulation 1122/2009 art.34**, Member States may use an eligibility coefficient to calculate the non-eligible area that should be excluded from pastures.

EE The Commission requested measures to address the said issues. This gave rise to the **LPIS improvement Plan**, which includes 14 corrective measures and the schedule for their application. Three of the measures apply specifically to the control of eligibility in pastures.

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LPIS IMPROVEMENT PLAN

- DIVULGATIVE ACTIONS
- ON THE SPOT CHECK ACTIONS
- UPDATE OF THE ORTHOIMAGERY
- INTEGRATION OF PUBLIC WORKS
- DETECTION OF UNDUE PAYMENTS
- CONTROL OF NEW AGRICULTURAL AREA
- ACTIONS RELATED TO PASTURES

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1. Review of declared pastures that should be considered forested area.
2. Additional revision of declared pastures.
3. Establishment of objective criteria to apply an eligibility coefficient in pastures.


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MEASURES TO CONTROL PASTURES IN SPAIN



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DEFINITIONS

PASTURE: land used to grow forage naturally or through cultivation techniques

Terms used in Spanish LPIS (SIGPAC):

Pasture (PS): pasture with predominance of herbaceous species, with scarce or null presence of shrubs or trees.

Pasture with bushes (PR): pasture with a remarkable presence of shrubs or bushes.

Pasture with trees (PA): pasture with a remarkable presence of trees, including fruit trees.

FOREST LAND: land occupied by dense trees, grown naturally or by cultivation to obtain forestry products, or subject of reforestation through adequate silviculture techniques

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Pasture land (PS)




30.03.2011

Castilla y León (beginning of spring)

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Pasture land (PS)




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Extremadura (end of spring)

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Pasture land (PS)



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Extremadura (end of summer)


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Pasture with bushes (PR)




30-03-2011

Castilla y León (beginning of spring)

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DEHESA (particular type of pasture land with bushes and trees)



Extremadura (end of spring)

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PASTURE WITH TREES (PA) AND FOREST LAND (FO)



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Asturias (end of summer)


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FOREST LAND (FO)

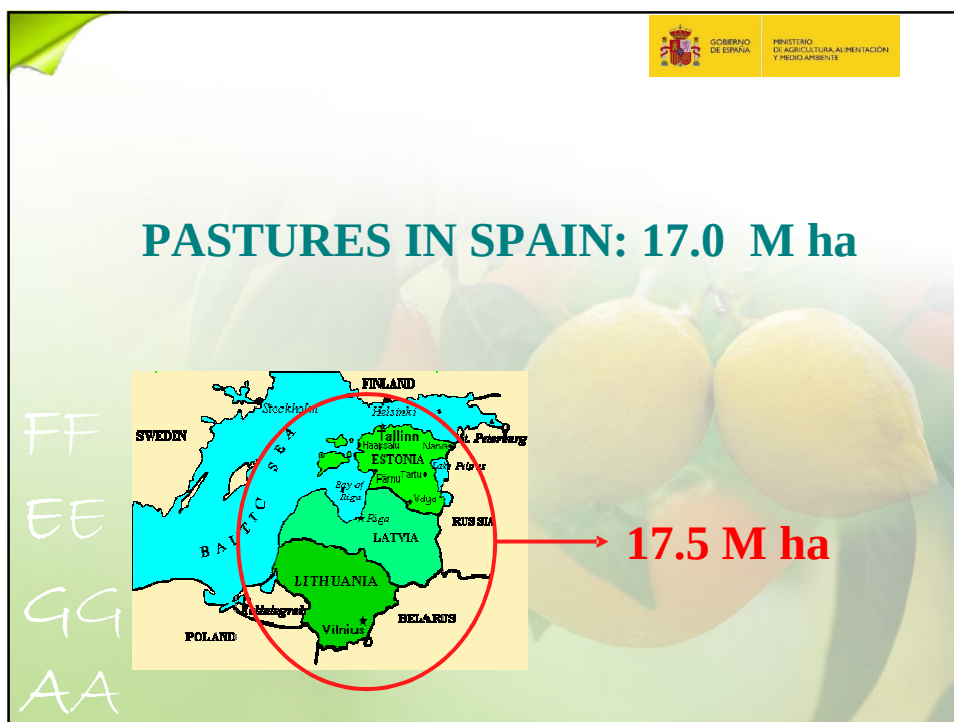


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Galicia (end of summer)

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	LPIS area	Declared area
Pasture land (PS)	2.2 M ha	1.0 M ha
Pasture with bush (BR)	9.9 M ha	3.3 M ha
Pasture with tree (BA)	4.9 M ha	2.7 M ha
TOTAL	17.0 M ha	7.0 M ha



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NATIONAL LEGISLATION

- **Eligibility requirements:** eligible hectare - *permanent pastures must be maintained in adequate conditions to avoid its degradation or invasion by shrubs.*
- **Definition of the eligibility coefficient in pasture:** *a coefficient will be applied to each reference parcel in the LPIS of the type "pasture with trees" or "pasture with shrubs" that cannot be fully utilized due to the presence of unproductive elements such as rocks, water or other bare areas, or of high slope*
- **SPS application:** *the farmer will declare in the aid application the utilization of pasture lands, and the maintenance techniques applied.*
- **Specific control to verify the eligibility of pasture lands:**

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SPANISH LPIS IMPROVEMENT PLAN

ACTION 12: Review of declared pastures that should be considered forested area

ACTION 13: Further improvements in pastures eligibility control

ACTION 14: Establishment of an eligibility coefficient in pastures

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THE GOALS ARE TO DETECT:

PASTURES THAT ARE NOT PASTURES	→	GOAL 1
PASTURES IMPROPERLY MAINTAINED	→	GOAL 2
NON-ELIGIBLE AREAS INSIDE PASTURES	→	GOAL 3

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ESTABLISHMENT OF AN ELIGIBILITY COEFFICIENT IN PASTURES

GOAL 3: DETECT NON ELIGIBLE AREAS INSIDE PASTURES

- Some Autonomous Communities were already applying a coefficient before 2013
- In 2013 Spain implemented an **AUTOMATIC** eligibility coefficient based on two objective parameters:

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- Absence of vegetation

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- Slope

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ELIGIBILITY COEFFICIENT IN PASTURES 2013

GROUND FACTOR (GF)
It enables measurement of vegetative activity of the ground by remote sensing techniques.

Using the Normalized Difference Vegetation Index (NDVI) and the Soil Brightness Index, the ground is classified as “with vegetation” and “without vegetation”.


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GROUND COVER	GROUND FACTOR (GF)
With vegetation	1
Without vegetation	0


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ELIGIBILITY COEFFICIENT IN PASTURES 2013


SLOPE FACTOR (SF)

It is considered that the existence of a higher slope limits pasture production since there will be less vegetative cover, and access for livestock will be handicapped. Therefore the following correction factors are applied, according to the average slope of each pixel:

AVERAGE SLOPE OF PIXEL (Pm)	SLOPE FACTOR (SF)
$Pm \leq 60\%$	1
$60\% < Pm \leq 75\%$	0,75
$75\% < Pm \leq 85\%$	0,5
$85\% < Pm \leq 100\%$	0,25
$Pm > 100\%$ (45°)	0

CALCULATION OF THE ELIGIBILITY COEFFICIENT (ECP)

The eligibility coefficient is computed pixel by pixel, as a result of multiplying the ground factor by the slope factor, and by 100 to express it as a percentage.

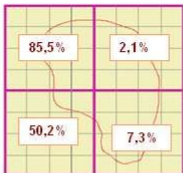

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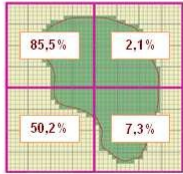
ELIGIBILITY COEFFICIENT IN PASTURES 2013

$$ECP = GF * SF * 100$$


The eligibility coefficient of a parcel is the weighted average of the coefficients of the pixels included in the parcel. Pixels are resampled to 1 meter in order to increase the calculation accuracy.

Nº celdas afectadas	CA
11	2,1
10	85,5
12	7,3
3	50,2
TOTAL: 36	31,01





Nº celdas afectadas	CA
209	2,1
185	85,5
221	7,3
53	50,2
668	30,73

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Exemple 1: PR parcel in MAZAZOLEJA – Segovia

Referencia del recinto SIGPAC

PRO	MUN	POL	PAR	REC	USO	SUP (ha)
40	137	7	5021	1	pr	0,41

Factores cálculo

C Suelo	C Pendiente	CAP	SUP. ADMSIM
0,3132	1	31,32	0,128412


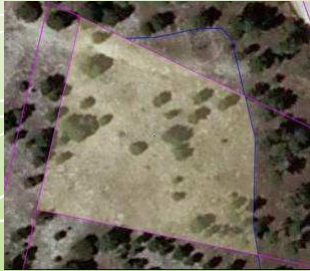




Image classification



RP on the ortophoto



Picture of the RP

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Ejemplo 3: Recinto de PS en el municipio de CANGAS DE NARCEA-Asturias

Referencia del recinto SIGPAC

PRO	MUN	POL	PAR	REC	USO	SUP (ha)
33	11	74	579	1	PS	1,49

Factores cálculo

C Suelo	C Pendiente	CAP	SUP. ADMSIM
0,9952	0,543	54,03936	0,805186464

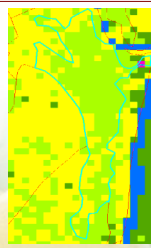




Image classification



RP on the ortophoto



RP picture


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Pastures Pro-rata coeficient 2015 - 2020

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INTRODUCTION

LEGAL FRAMEWORK: Article 10 of Regulation (EU) 640/2014:

PRO-RATA SYSTEM FOR PERMANENT GRASSLAND CONTAINING LANDSCAPE FEATURES AND TREES:

As regards permanent grassland with scattered ineligible features, such as landscape features and trees, Member States may decide to apply a pro-rata system to determine the eligible area within the reference parcel.

The pro-rata system referred to in the first subparagraph shall consist of different categories of homogeneous land cover types for which a fixed reduction coefficient based on the percentage of ineligible area is applied. The category representing the lowest percentage of ineligible area shall not exceed 10 % of ineligible area and no reduction coefficient shall apply to that category.


Any landscape features subject to the requirements and standards listed in Annex II to Regulation (EU) No 1306/2013 which form part of the total area of an agricultural parcel shall be considered part of the eligible area.

his Article shall not apply to permanent grassland containing fruit trees which yield repeated harvests.

EC GUIDELINES:

CHANGES NEEDED IN SPANISH elegibility coeficiente in pastures (ECP)

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REVISED ELIGIBILITY COEFFICIENT


New vegetation Factor: The automatic coefficient does not take into account the limitation of eligibility due to the bush coverage and the tree density in pasture parcels. That is why it has been improved by adding a new factor, the vegetation penetrability, or in other words, the vegetation that can make pasture land non-eligible.

The formula to calculate the ECP 2015, including the new vegetation factor is as follows:

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$$\text{ECP} = \text{Ground Factor} * \text{Slope Factor} * \text{Vegetation Factor}$$

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MEASUREMENT OF NON-ELIGIBLE VEGETATION IN PASTURES

It is not possible to discriminate pastures from bushy and/or woody areas with the CAP that is currently being used in Spanish LPIS, which is based only on ground and slope factors.

In order to implement a revised coefficient a procedure has to be established to compute a Vegetative Factor that may quantify the eligibility of the vegetation found in pasture parcels, considering that the ineligibility of the vegetation is proportional to the impenetrability or the restriction on the utilization as grazing land.

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Wooded areas with dense vegetation may be accessible to livestock if the tree crowns are high enough. But if the canopy is very thick, it may happen that pasture land cannot fully develop under the trees.

Consequently the density and the height of the vegetation are the two parameters the Vegetation Factor can be based on, to compute the revised coefficient. Both attributes can be measured using LiDAR technologies.

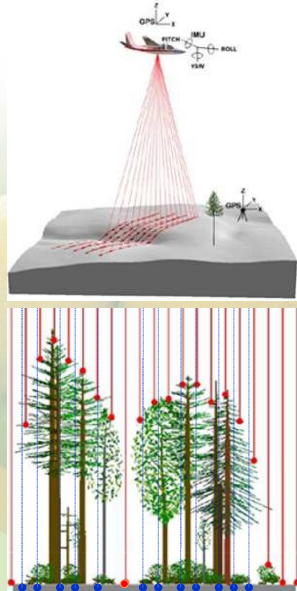
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LIDAR TECHNOLOGY:

LiDAR (an acronym of Light Detection And Ranging or Laser Imaging Detection and Ranging) is a technology that determines the distance from a laser transmitter to an object, by measuring the time elapsed between sending the laser pulse and receiving the signal reflected by the object.

Airborne LiDAR systems make it possible to obtain the coordinates of the points where each laser pulse is reflected. A pulse may be reflected by more than one object, thereby producing several echoes, the analysis of which allows discriminating different types of vegetative coverage.



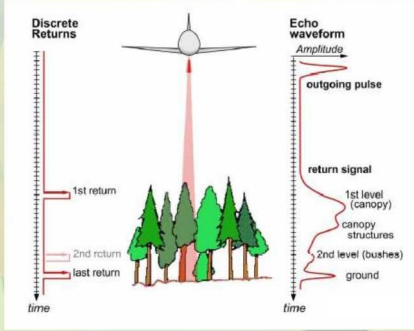
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The point cloud may be classified into ground points and different kinds of non-ground points, vegetation, buildings, water, etc. which allows for digital terrain model (DTM) and vegetation model generation with a considerable amount of detail.

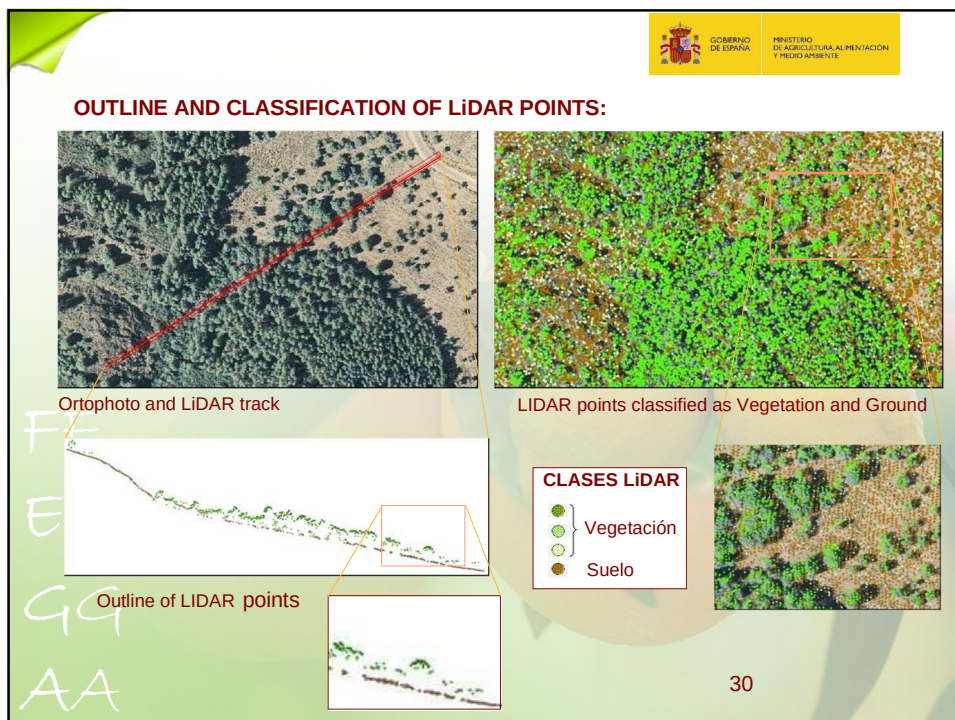
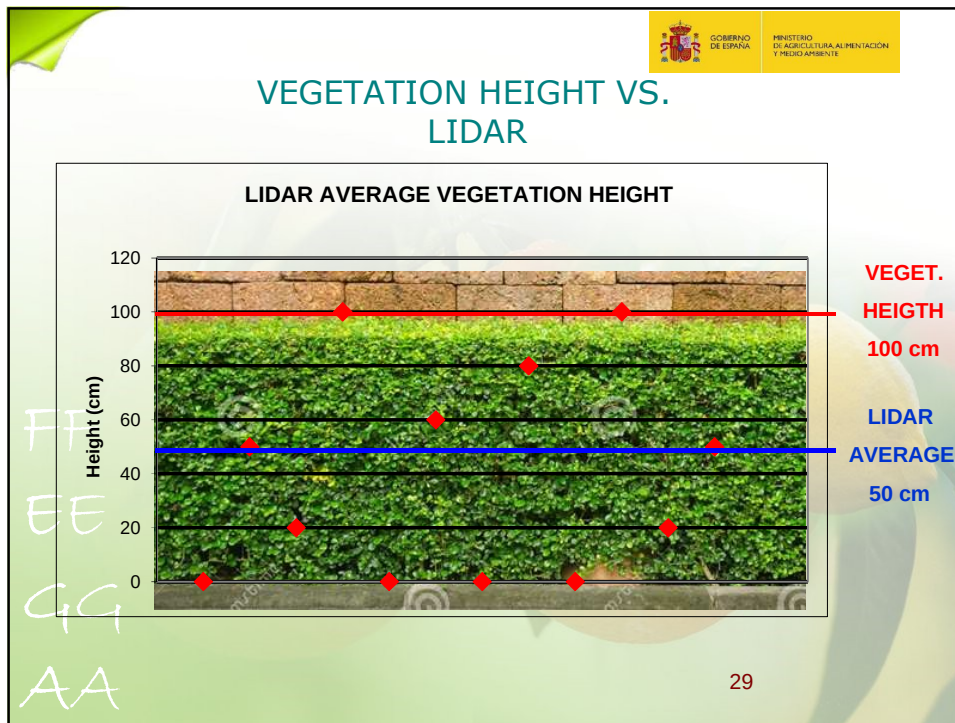
LiDAR sensors are classified according to how the return signal is recorded.


1. Discrete return sensors which record the pulses as discrete returns.
2. Waveform sensors which record the entire waveform of the returning laser pulse. Waveforms are processed to generate the desired number of returns, depending on the information required.



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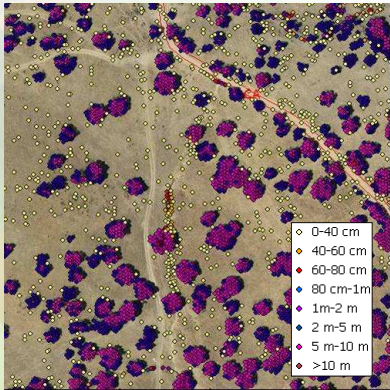



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CLASSIFICATION OF LiDAR POINTS:

LiDAR data form a cloud of points with xyz coordinates that are automatically classified according to the height of each point. Each of the points has one of the following categories assigned to it:

1	Default
2	Ground
6	Building
12	Overlap
15	Vegetation Height 0 – 40 cm.
16	Vegetation Height 40 – 60 cm.
17	Vegetation Height 60 – 80 cm.
18	Vegetation Height 80 cm – 1 m.
19	Vegetation Height 1 m-1,5 m.
20	Vegetation Height 1,5 –2 m.
21	Vegetation Height 2 –3 m.
22	Vegetation Height 3 – 5 m.
23	Vegetation Height 5 – 10 m.
24	Vegetation Height > 10 m.



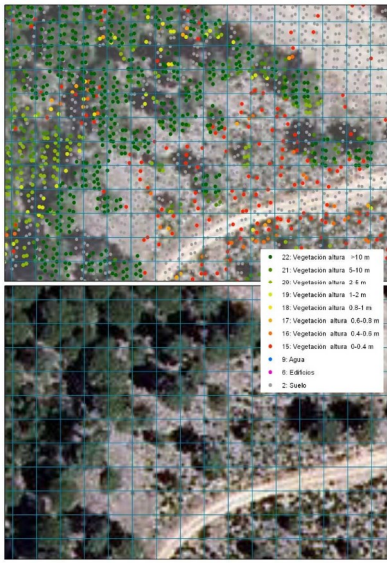
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VEGETATION RASTER:

The Vegetation factor is stored in raster format with a pixel grid of 5x5 meters, as are the Ground and Slope factors. The average density of LiDAR flight is 0,5 points/square meter, equivalent to 12 points/grid pixel.

At the end of the process, each pixel of the Vegetation coverage is assigned one single category (eligible or non-eligible). A pixel is classified in the category assigned to the majority of LiDAR points included in it.



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CLASSIFICATION OF THE VEGETATION RASTER:


In zones with pasture land with bushes or trees it is common to find that most of the LiDAR points are classified as ground category, notwithstanding the presence of high or medium-height vegetation.

This has led to the conclusion that the classification of Vegetation Raster pixels must be done excluding the LiDAR points with ground height, or with heights from 0 to 40 centimeters, in order to avoid classifying the greatest part of pixels as ground or penetrable vegetation in areas with bushes or sparse trees.

Once these points have been removed, it is necessary to establish criteria on what height of predominant vegetation should be considered herbaceous (penetrable) and which should be considered bushy or woody. Based on the results of the pilot studies, we have considered vegetation from 0,6 meters to 1 meter as bushes, and vegetation over 1 meter as trees.

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DEFINITION OF VEGETATION TYPES AND VEGETATION RASTER CLASSIFICATION

LIDAR POINTS CLASSIFICATION		RASTER LIDAR CLASSIFICATION	
CLASS	DEFINITION	CLASS	DEFINITION
2	Ground	1	Ground and Veg. Height <60 cm (Admissible)
15	Veg. Height 0 – 40 cm.		
16	Veg. Height 40 – 60 cm.		
17	Veg. Height 60 – 80 cm.	2	Veg. Height 60-100 cm (scrub)
18	Veg. Height 80 cm – 1 m.		
19	Veg. Height 1 m-1,5 m.	3	Veg. Height > 1 m (woodland)
20	Veg. Height 1,5 – 2 m.		
21	Veg. Height 2 – 3 m.		
22	Veg. Height 3 – 5 m.		
23	Veg. Height 5 – 10 m.		
24	Veg. Height > 10 m.		
6	Building	4	Building
12	Overlap	5	Overlap

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ELIGIBILITY CRITERIA AND SCREENING:

The eligibility raster is generated using the vegetation height raster, with the following criteria:

GENERAL CRITERION

5 x 5 m pixels with average height equal to or lower than 60 cm are considered eligible.

SOLITARY PIXELS

Isolated pixels with vegetation height from 0.6 to 1 meter are considered eligible if the reference parcel is of the type "pasture land" or "pasture with trees".

Isolated non-eligible pixels with vegetation height between 0.6 and 1 meter, in parcels of the type "pasture with bushes" will be considered eligible if at least 4 out of the 8 neighboring pixels are eligible.

REDUCTION IN WOODED AREAS

In a mass of pixels higher than 1 meter, border pixels are considered eligible if any of the neighboring pixels are eligible.

MASS ASSEMBLING

Masses of continuous non-eligible pixels of less than 400 square meters (16 pixels) are dissolved, in order to admit as eligible big isolated trees or relatively small bushy areas.

For masses of continuous non-eligible pixels of more than 1 meter, this limit goes up to 2,500 square meters

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EXAMPLES OF THE PILOT STUDY FOR IMPROVING THE ECP

Example nº 1

Arenas de San Pedro (Ávila)

Class 7(bis)

SIGPAC USE	SURFACE (ha)	CAP 2013	Sur_Adm_2013 (ha)	CAP RE+LIDAR	Sur_Adm_RE_LIDAR (ha)
PA	103,06	100	103,06	69,27	71,39

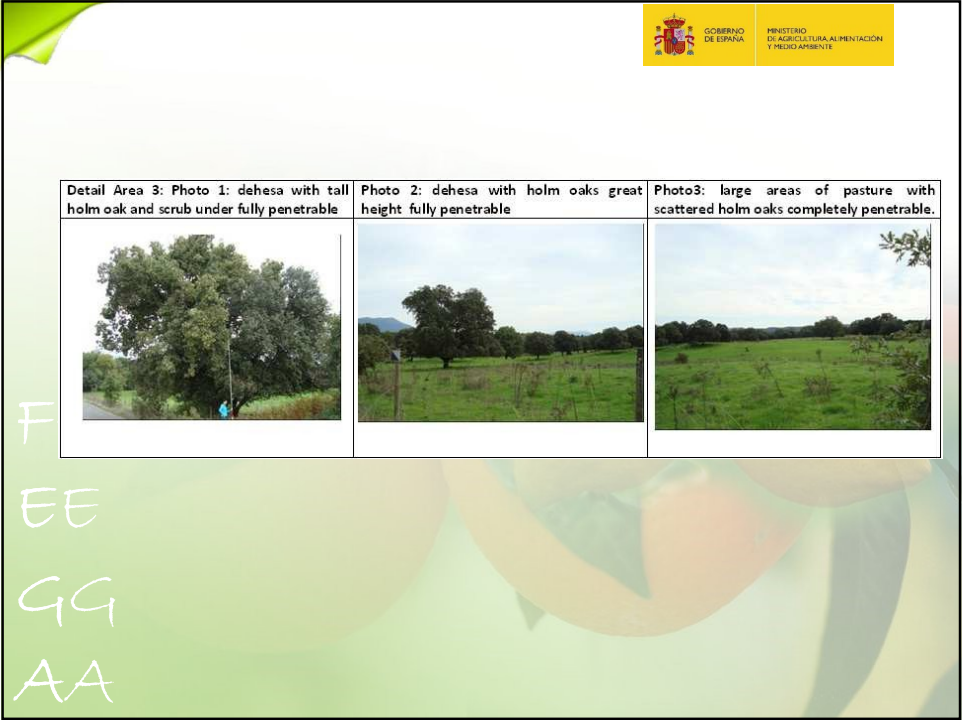
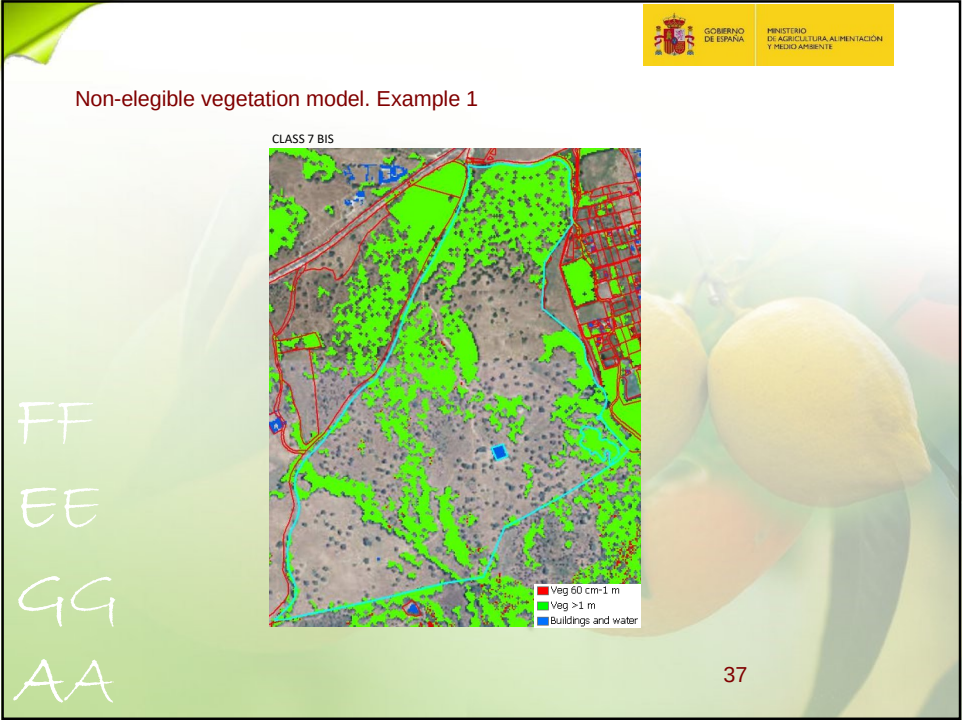
The data of the CAP is the result of applying only the slope factor, as requested by the AC. The data of the CAP improved (RE+Lidar) includes the slope factor, soil factor (RapidEye), and vegetation factor (Lidar).

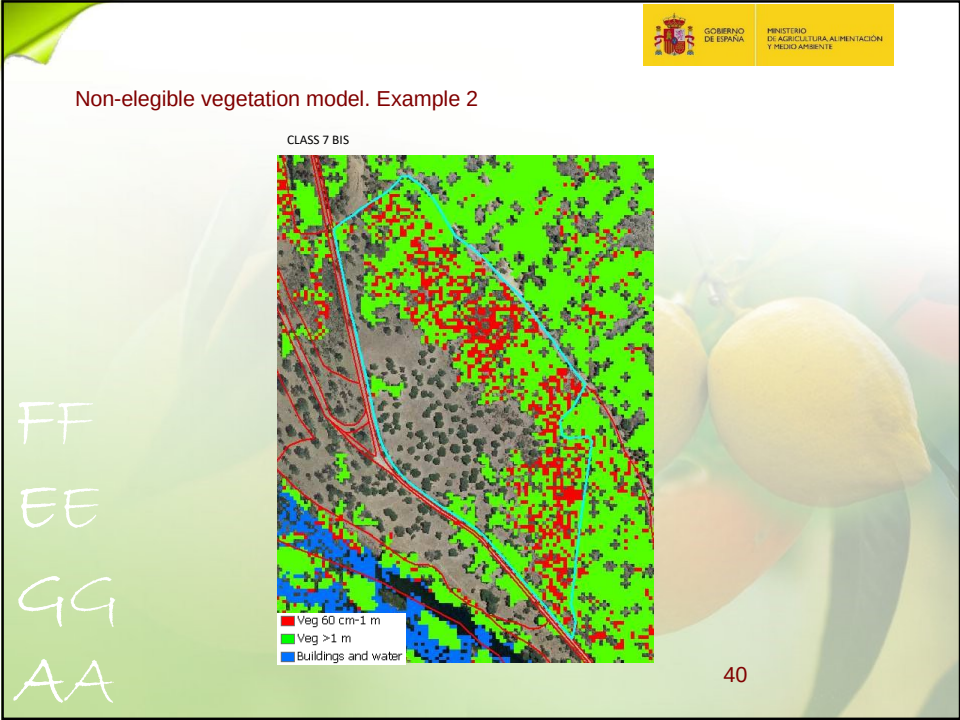
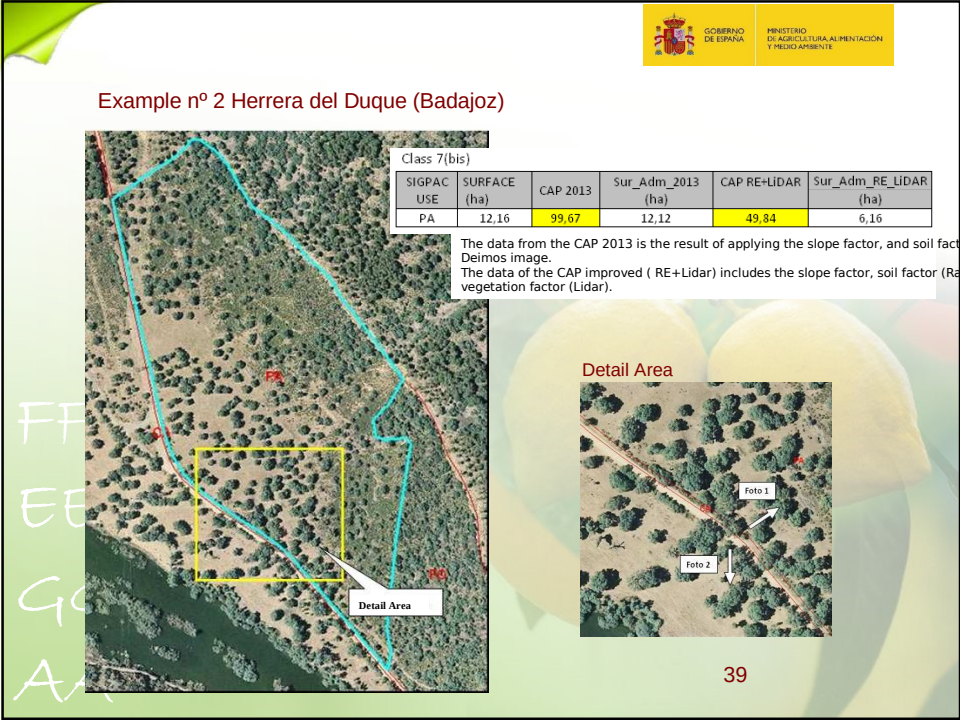
Detail Area 1


Detail Area 2

Detail Area 3


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Photo 1: Holm oaks and scrub the bottom

Photo 2: Holm oaks with some scrub

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Example nº 4 Baleira (Lugo)

Class 7(bis)

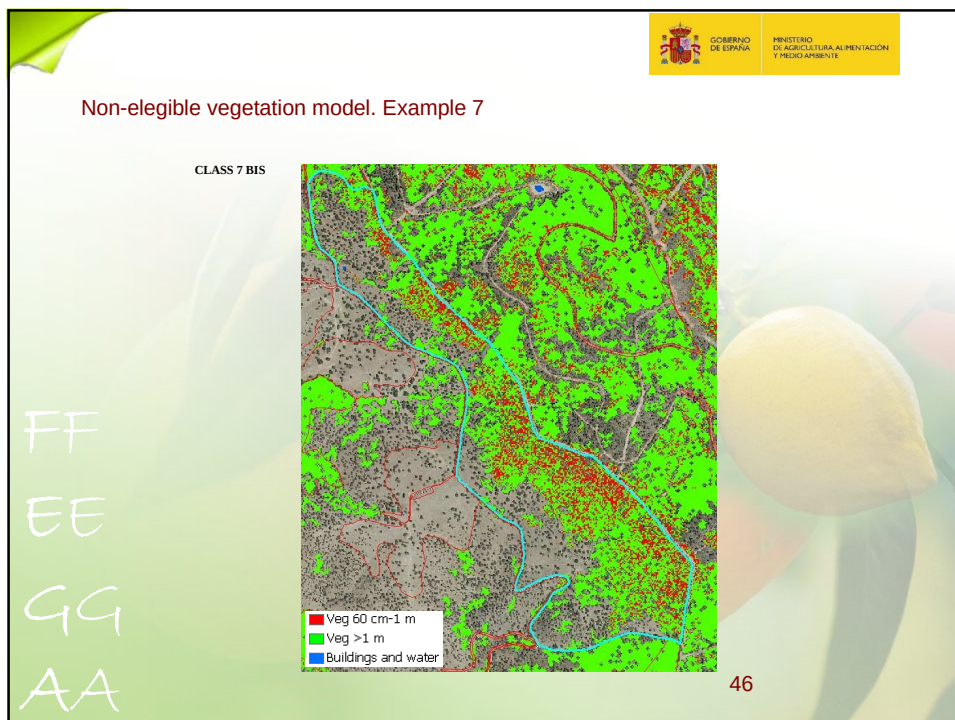
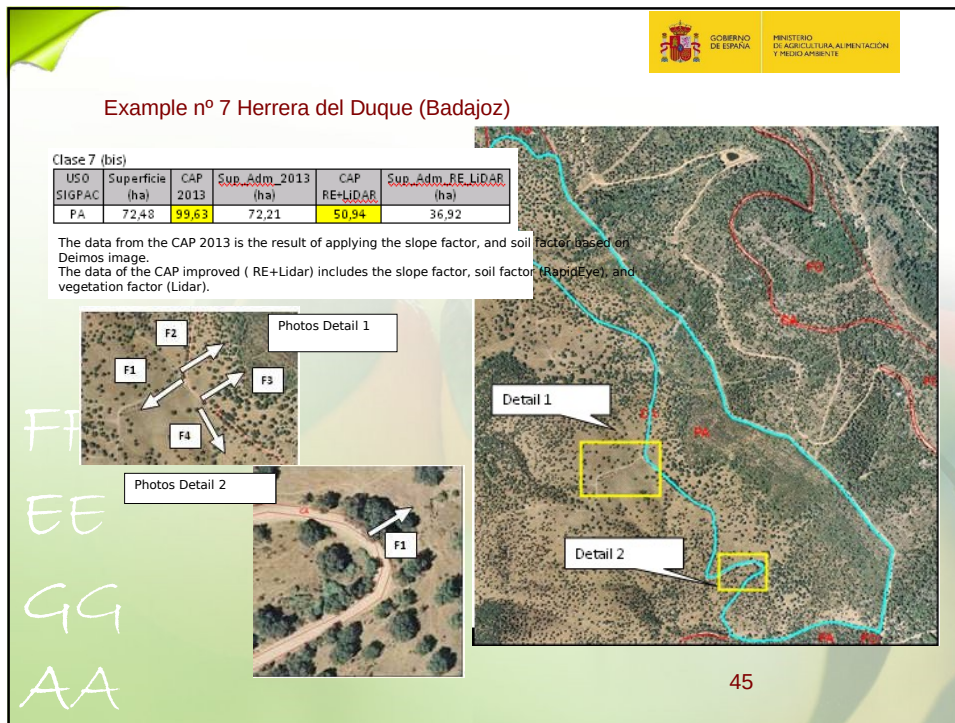
SIGPAC USE	SURFACE (ha)	CAP 2013	Sur_Adm_2013 (ha)	CAP RE+LIDAR	Sur_Adm_RE_LIDAR (ha)
PS	0,34	98	0,33	94,59	0,32


The data from the CAP 2013 is the result of applying the slope factor and soil factor based on RapidEye image.
The data of the CAP improved (RE+Lidar) includes the slope factor, soil factor (RapidEye), and vegetation factor (Lidar).

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Photo 3: Oaks of average height in transition to shrubland in the background.





Photo 4: Dehesa in the foreground with Hill of scrubland in the background.




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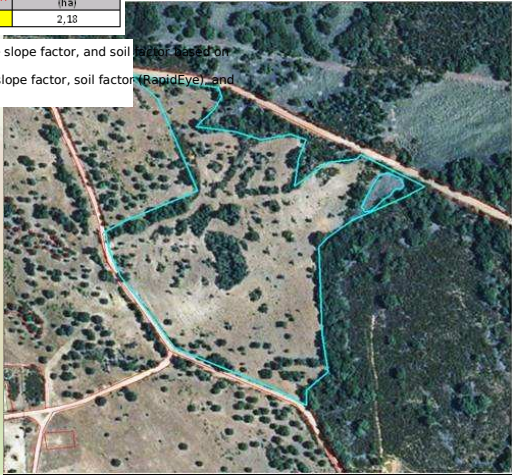
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Example nº 10 Aldeanueva de Barbarroya (Toledo)

Clase 7 (bis)

USO SIGPAC	Superficie (ha)	CAP 2013	Sub_Adm_2013 (ha)	CAP RE+LIDAR	Sub_Adm_RE+LIDAR (ha)
PR	2,52	97	2,44	86,46	2,18

The data from the CAP 2013 is the result of applying the slope factor, and soil factor based on Delmos image.
The data of the CAP improved (RE+Lidar) includes the slope factor, soil factor (RapidEye) and vegetation factor (Lidar).




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Non-elegible vegetation model. Example 10

CLASS 7 BIS




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Example nº 11 Casbas de Huesca (Huesca)

Clase 7 (bis)

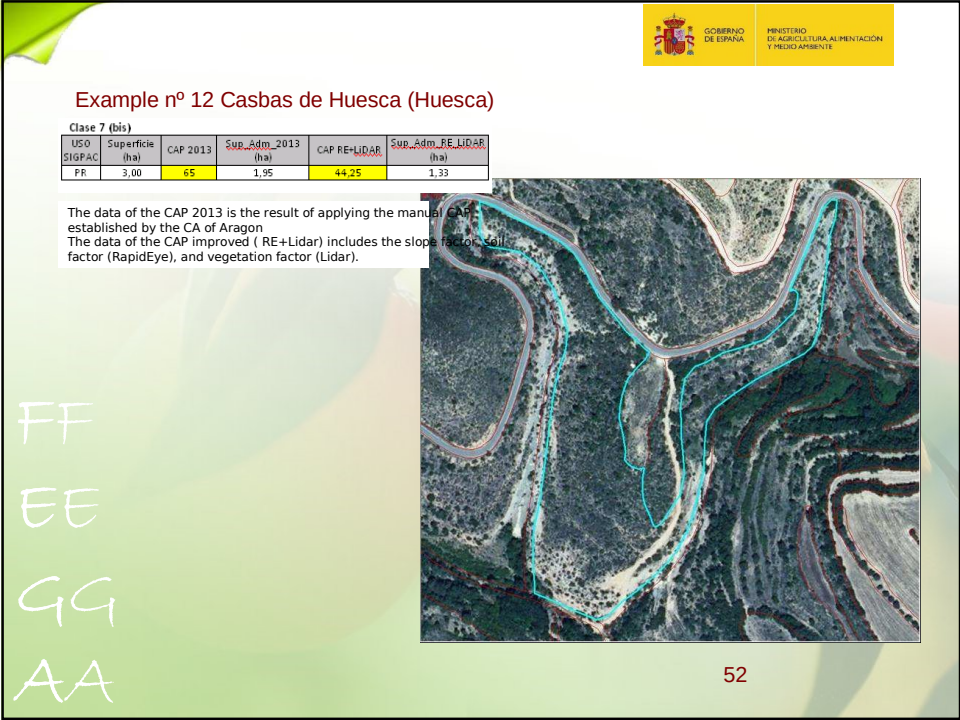
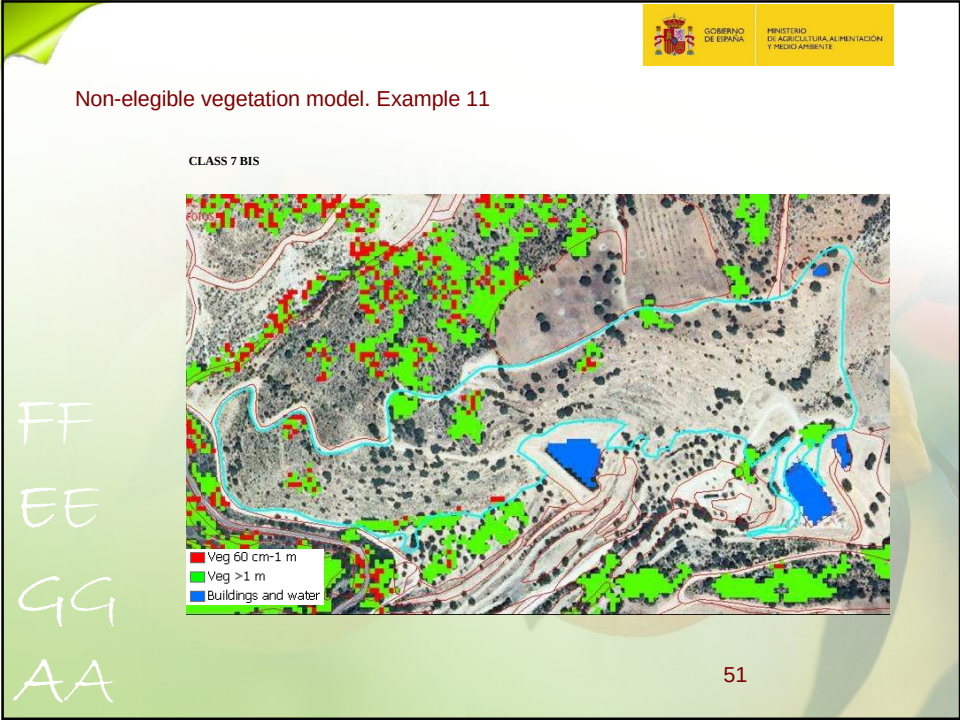
USO SIGPAC	Superficie (ha)	CAP 2013	Sup_Adm_2013 (ha)	CAP RE+LIDAR	Sup_Adm_RE_LIDAR (ha)
PR	8,23	40	3,29	16,14	1,33


The data of the CAP 2013 is the result of applying the manual CAP established by the CA of Aragón. The data of the CAP improved (RE+Lidar) includes the slope factor, soil factor (RapidEye) and vegetation factor (Lidar).




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Non-elegible vegetation model. Example 12

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Veg 60 cm-1 m


Veg >1 m

Buildings and water

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Example nº 14 Baleira (Lugo)

Clase 7_bis

USO SIGPAC	Superficie (ha)	CAP 2013	Sub_Adm_2013 (ha)	CAP RE+LIDAR	Sub_Adm_RE_LIDAR (ha)
PR	0,99	100	0,99	61,68	0,60

The data from the CAP 2013 is the result of applying the slope factor and soil factor based on RapidEye image.
The data of the CAP improved (RE+Lidar) includes the slope factor, soil factor (RapidEye), and vegetation factor (Lidar).

FF

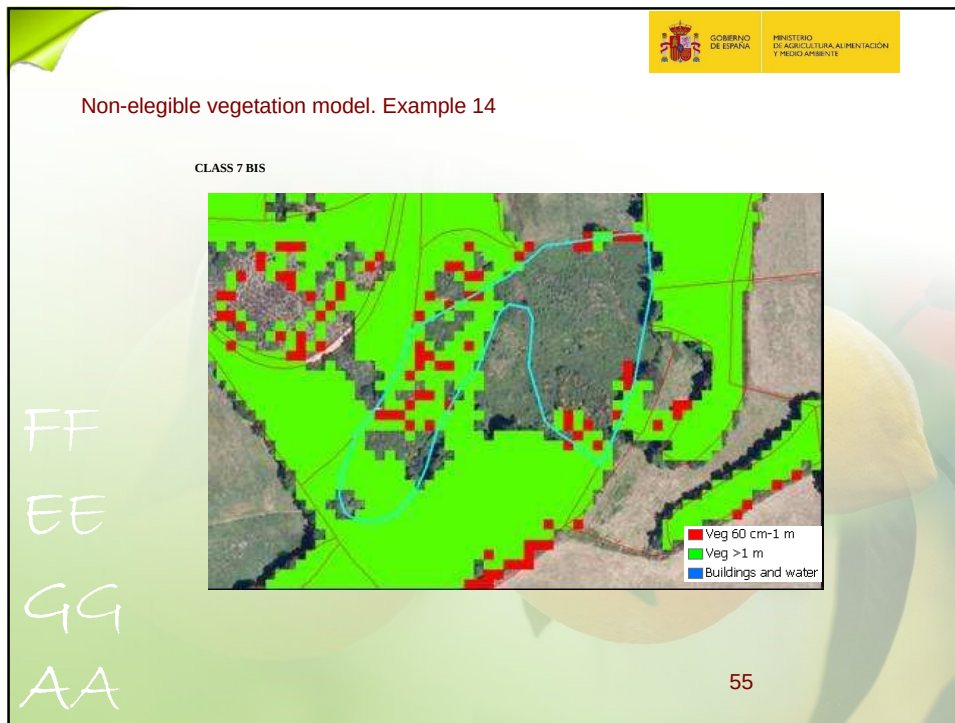
EE

GG

AA



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ECP RANGES

Elegible area percentage	ECP Value
90% - 100%	100%
80% - <90%	85%
70% - <80%	75%
60% - <70%	65%
50% - <60%	55%
40% - <50%	45%
30% - <40%	35%
20% - <30%	25%
<20% - 0%	0%

FF
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REVIEW OF THE AUTOMATIC ELIGIBILITY COEFFICIENT:

MANUAL COEFFICIENT

GOAL 2: DETECT INCORRECTLY MAINTAINED PASTURES

GOAL 3: DETECT NON-ELIGIBLE AREAS INSIDE PASTURES

It may happen that the automatic coefficient does not truly reflect the proportion of agricultural land in the total area of a parcel.

FF Therefore a **revision** has to be carried out **BY FARMERS AND/OR INSPECTORS** based on the following **criteria**:

EE -Type of agricultural activity: maintenance work or grazing activity of effective livestock.

GG -Degree of pasture farming, which will be evaluated by: the kind and density of the vegetation (bushes and/or trees), the unhindered access to all/part of the parcel, proof of grazing activity or of maintenance work of the pasture, etc.

AA


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REVIEW OF THE AUTOMATIC ELIGIBILITY COEFFICIENT:

MANUAL COEFFICIENT

BY THE FARMERS:

- DELINEATE IMPENETRABLE ZONES
- DECLARE AN EXTRA REVISION COEFFICIENT


FF **IMPLEMENTED MECHANISMS:**

- Autonomous Community decision.
- In the **SPS APPLICATION** or through **SURVEY**

EE Declare maintenance work/grazing activity for every reference parcel

GG Evaluation of the accessibility and vegetation structure for every reference parcel

AA




EXTRA REVISION COEFFICIENT FOR ECP


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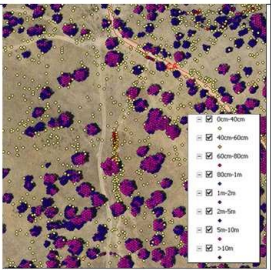
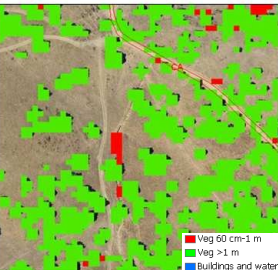
REVIEW OF THE AUTOMATIC ELIGIBILITY COEFFICIENT: MANUAL COEFFICIENT

BY THE INSPECTORS:


- The result of the inspection may bring about updates in the LPIS-creation of new parcel, and/or application of a manual coefficient
- The manual coefficient can be assessed by ranges
- All applications for increasing the ECP value will be checked.
- The criteria for abandoned parcels, where $ECP = 0$, must be taken into account.


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PRO RATA VERSUS DIGITIZATION

SIGPAC LAND USES : GRASS WITH WOODLAND (PA)	Classification by heights: shows the LIDAR points with the dimensions of the vegetation (soil points are not represented).	Classification 7bis
		

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CONCLUSIONS


The pro-rata system has to be complemented with other measures for the control of eligibility in pastures.

It is possible to use automatic methods to estimate an eligibility coefficient in pastures.

It is not necessary to digitize non-eligible elements of more than 100 sq meters because they are deducted by the system.

FF
EE
GG
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THANK YOU for your attention