



Impact of ETS performance on the LPIS QA outcome

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14-15 October 2013, Baveno, Italy



ReSAC



The Remote Sensing Applications Center (ReSAC) was established in 1998 as part of the Bulgarian Aerospace Agency with the support the Food and Agriculture Organisation ([FAO](#)) of the United Nations ([UN](#)) in 1998.

Since 2005 it is registered as private research organization

Long cooperation history with the Bulgarian Ministry of Agriculture and Food:

Creation of Digital Orthophoto map on part of the territory of Bulgaria (33 000 sq. km.) on the base of VHR satellite images for the elaboration of the LPIS, Ministry of Agriculture, Bulgaria

FP6 Project IST-2002-507427 SAFIR, as external expert of the Regional Administration of Vratza for the elaboration of the Agriculture Pilot

Pilot Study on Elaboration of Land Parcel Identification System on a Test Area in Bulgaria, Ministry of Agriculture and Forestry, with the support of JRC

Pilot study on the Control with Remote Sensing of Area Based Subsidies in Bulgaria, JRC/EU project, Contract No. - 21615-2003-12 F1ED ISP BG, in consortium with AIRECTS, France/Spain

Technical consultation and on-the-job-training for the implementation of 2012 LPIS QA in Bulgaria, Contract with the Bulgarian Ministry of Agriculture and Food

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Outline



1. Challenges of the Bulgarian LPIS
2. Implementation of 2012 LPIS QA
3. Findings and Conclusions

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Challenges of the Bulgarian LPIS

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Recalling LPIS objectives

LPIS system should fulfill two explicit functions:

the unambiguous localisation of all declared agricultural parcels by farmer and inspectors, and the quantification of all eligible area for crosschecks during the administrative controls by the paying agency.

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Challenges of the Bulgarian LPIS



localisation
agricultural farmer
quantification eligible area

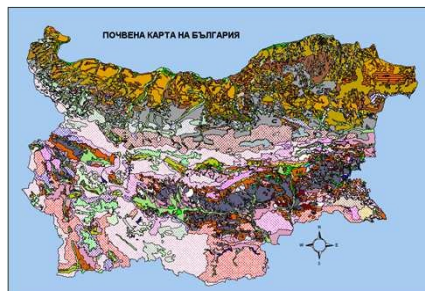
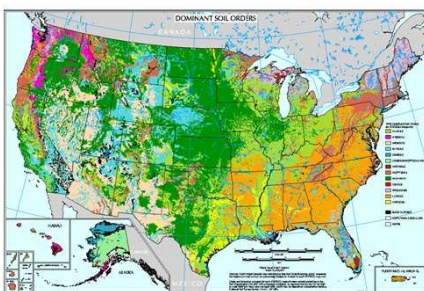
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Challenge 1: Quantification



Complex landscape and diverse soil characteristics



**Same soil variety from San Francisco to New York (4000 km)
as from Sofia to Varna (400 km)**

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Challenge 2: Agriculture

Still lower use of pesticides and mineral fertilizers



Germany



Bulgaria

Rapid growth of sporadic vegetation on actively cultivated arable land

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Challenge 3: Farmer

Mixture of big and small beneficiaries



Different farmer objectives and perceptions

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Challenge 4: Localization

Dynamics in the agriculture land after land restitution



Chaotic process of land restitution; collapse of industrial farming; land fragmentation

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Challenge 5: Cadastre legacy

Pre-EU couple aids based on the digital cadaster

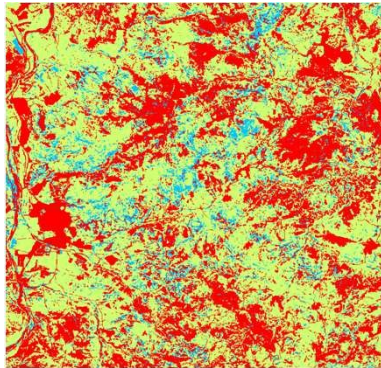


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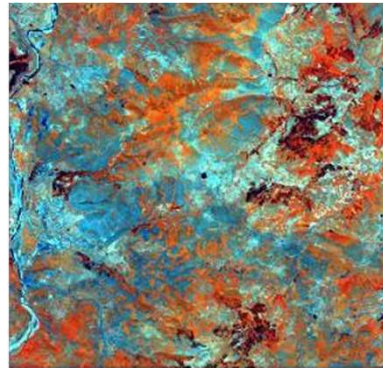


Challenge 5: Eligible area

Lack of SAPS reference year and flexible GAC



JRC Pilot Study on Bulgarian GAC, 2009



Momchilgrad, Bulgaria, RappidEye

Great amount of pasture land and abandoned arable land gradually introduced in the LPIS in the post-EU accession years

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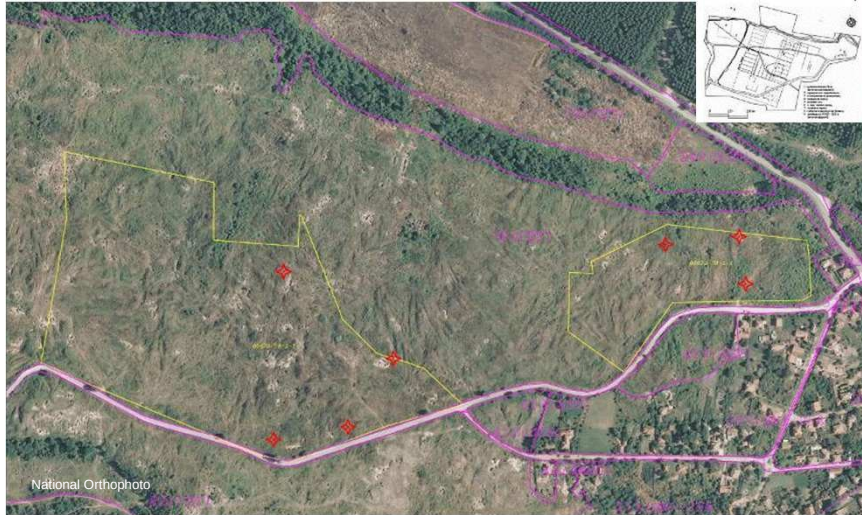
Distinct features of the Bulgarian LPIS

1. Multilayer system, based on production (physical) block
 1. Ref parcel + eligibility layer
 2. ReferenceArea calculated on-the-fly
 3. Eligibility Layer based on land properties and farmer activities
2. Land in GAC, if used for agriculture (national regulation)
 1. Land should be accessible (natural obstacles)
 2. Agriculture activity should be allowed by law
 3. Should be used for agriculture activity in the given year
3. LPIS covers the whole territory
 1. Reference parcels with zero RefArea on non-agri land
 2. Farmer are not restrained to declare in such zero eligible RPs

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Complex LPIS upkeep workflow



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Implementation of 2012 LPIS QA

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ATS setup

Special attention given to the ATS testing

Reference parcel type; Mandatory attributes

Calculation of ReferenceArea

Log info on RP update

Elaboration country-specific eligibility profile

Natural grasslands with complex definitions

Specific classifiers for permanent crops

Fallow land requires ploughing

Application of waiver C

If contamination is outside eligibility layer

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ATS setup - eligibility profile

lps.c	reporting	ns1:landCoverClass	ns1:landCoverClassDefinition	ns1:minimumMappingL	ns1:userDefined	ns1:ccCode	ns1:representati	ns1:elig
ode	year			egend	LegendCode		onOffEligible	blefect
BG	2012	Arable Land (rainfed with fallow system, which requires ploughing in early spring)	Herbaceous Crop(s) - With Fallow System	Arable land	A	10660(G)(Z201)	yes	100
BG	2012	Greenhouses	Industrial Area/Or Other Area(s)	Greenhouse	H	5003-B-A442p10	yes	100
BG	2012	Permanent pasture (self-seed or sown) with grass height below 1.5 m	of Plant Species // Permanently Cropped Area With Graminoids Crop(s)	Grassland	G	20439-T2(1)(Z211) // 11512-S0701	yes	100
BG	2012	Kitchen Gardens	Dominant Crop: Fodder - Fodder	Kitchen garden	K	11135	yes	100
BG	2012	Permanent crops (shrub type) with additional requirement for life status and maintenance	Permanently Cropped Area With Small Sized Field(s) Of Irrigated Non-Grainoid Crop(s)	Permanent Shrub Crop	S	10188(G)(Z202Z03)	yes	100
BG	2012	Permanent crop (tree type) - with additional requirement for life status and maintenance	Permanently Cropped Area With Rainfed Shrub Crop(s)	Permanent Tree Crop	T	11492(G)(Z202Z03)	yes	100
BG	2012	Tree plantation (short rotation coppice, Predominantly Paulownia)	Permanently Cropped Area With Rainfed Tree Crop(s)	Tree Plantation	P	S2W7(G)(ZB)(1)(Z204)	yes	100
BG	2012	Permanent (natural) grassland with sparse Trees and Shrubs and 10% intrusions of natural and anthropogenic origin	Crop Type: Non-Food Crops, Crop Cover: Plantation(s)	Permanent Grassland 1	NA	22614(1)(Z206Z092)	yes	100
BG	2012	Permanent (natural) grassland with sparse Trees and Shrubs and 20% intrusions of natural and anthropogenic origin on specific soils	Closed to Open Herbaceous Vegetation with Trees and Shrubs // Built Up Area(s)	Permanent Grassland 2	NB	21317(1)(Z206Z092)	yes	100

11 user-defined (Z) attributes:

Fallow system, requiring deep ploughing in early spring

At least 70% of the plants should be alive

Up to 10% small (less than 0.01 ha) intrusions of sealed surface and bare areas

Soils of 8, 9 or 10 category, according to BG specifications

Medium To Low (i.e. grass height between 0.03 - 1.5 m)

.....

Some agriculture LC types require additional information

CONDITIONAL instead of YES?

No landscape features for retention

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LC class:

Interpretation Keys:

1. Arrays of fruit trees planted in rows at different distances depending on the tree type.
2. Trees are usually of the same age with similar height and crowns.
3. The distance between the trees and their crowns big enough to reveal the land beneath.
4. More than 70% of the trees are alive (they have apparently thick enough live foliage)
5. Rows between the trees are adequately maintained - plowed, turfed or covered with grass



Stratification of RPs based on NTP field (type of land use) in LPIS

Agricultural; Potentially agricultural; Certainly non-agricultural

Reference parcels located on “Certainly non-agricultural” land AND intersected by farmer declaration with less than 0.1 ha are excluded from the scope

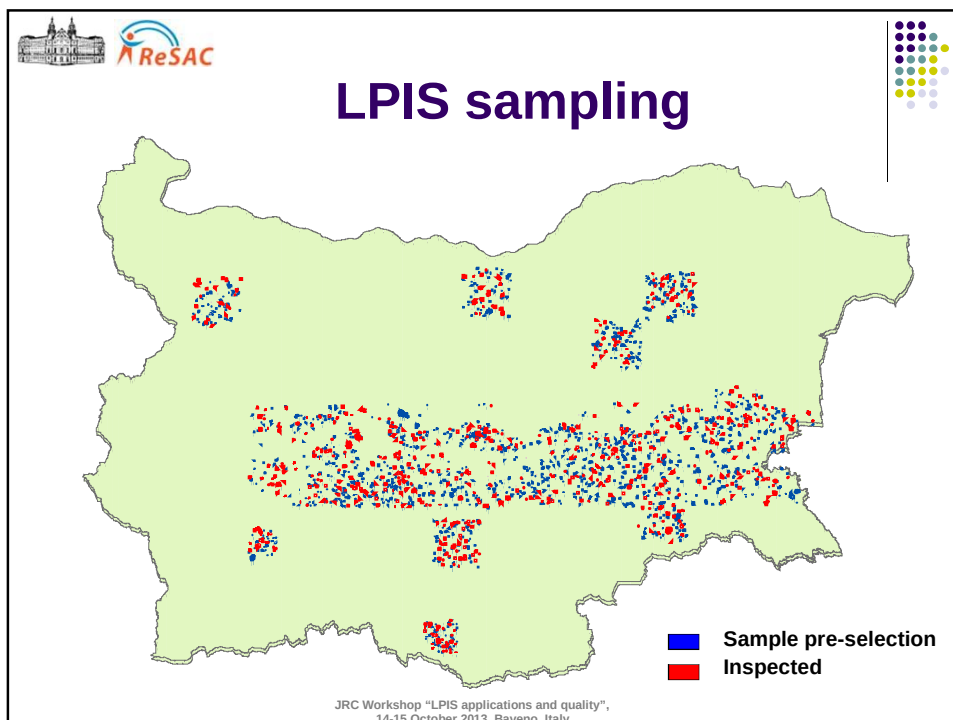
239 RPs out of 2400 from the sample pre-selection are with zero Reference Area

Total LPIS QA population clipped with CwRS and Proprietary zones

11 CwRS acquired with GE-1 (3 CwRS zone with IKONOS excluded from LPIS QA)

Aerial orthophoto acquisition in 2012 considered random for LPIS QA.

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ETS key success factors

- Sufficient amount of very skilled operators (8 persons)**
 - Background in Agriculture, Environmental and Soil science
 - Experience in land cover/land use mapping
 - IT/GIS literacy
- Adequate infrastructure**
 - GIS environment/ Orthoimagery
 - Ancillary data for inspection and categorization
- Proper ETS setup**
 - Training/on-the-job support
 - Rigorous inspection procedure
 - Inspection and analysis not mixed
- Four-eye control**

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Use of ancillary data



Google and StreetView extensively used

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ETS - Example 1

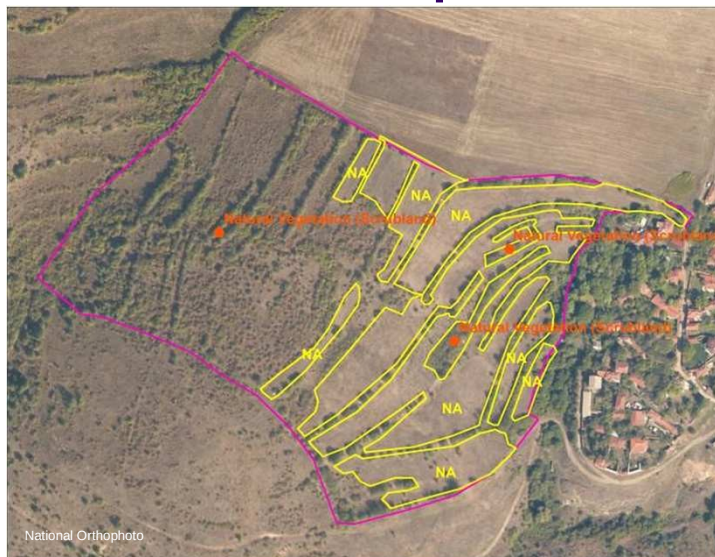


National Orthophoto

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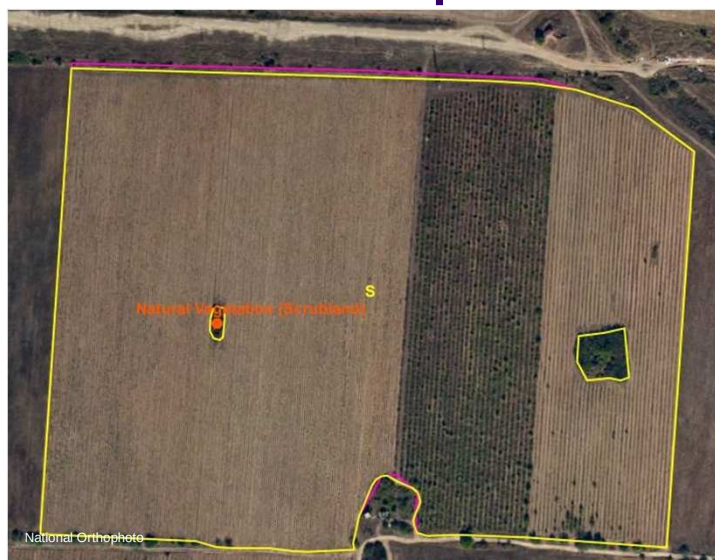
ETS - Example 2



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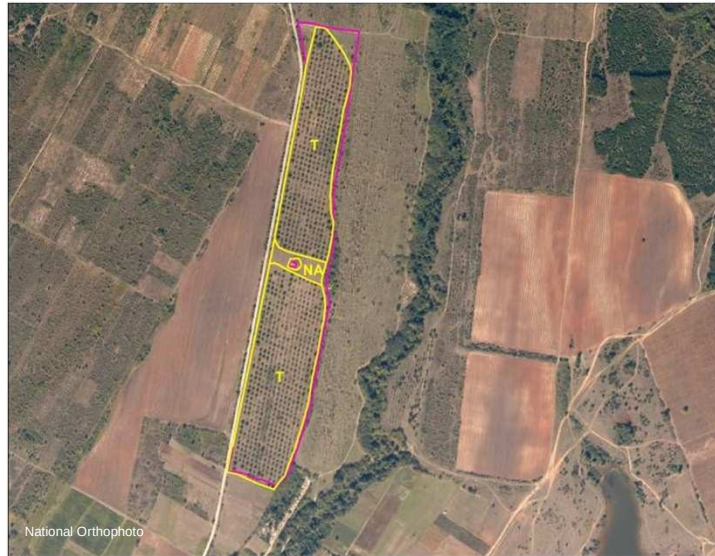
ETS - Example 3



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ETS - Example 4



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ETS - Example 5



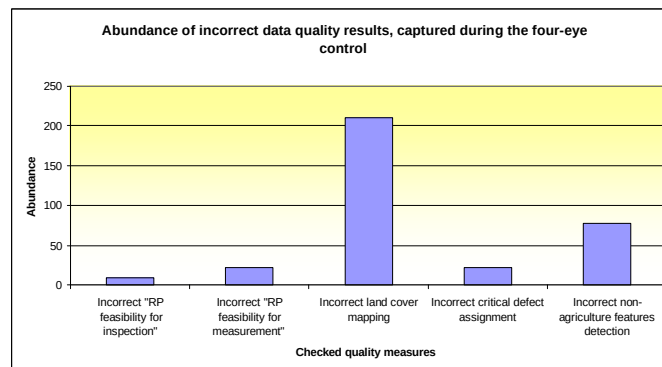
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Result of 4-eye control

One operator check another
Operators were very stringent during 4-eye check
298 RPs returned for major or minor revisions
Not all were fully confirmed after analysis
Learning curve



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Findings and Conclusions

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LPIS QA results

888 RPs gone through the ETS

88 skipped from inspection:

- 71, due to non-persistent identifier (A3)
- 4, due to invalid geometry (T5)
- 6, due to full or partial non-availability of image data (T2)
- 5, due to cloud cover (T4)
- 1, due to impossible image interpretation (C4)
- 1, due to fire on the field (F1)

800 inspected out of which:

- 782 measured
- 18 not measured

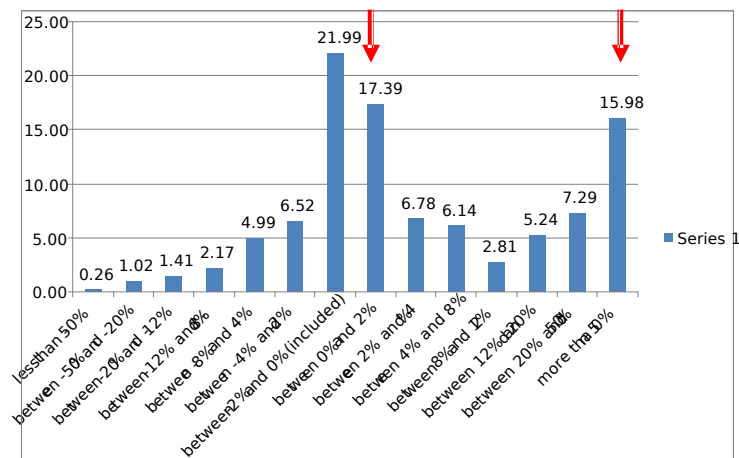
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LPIS eligibility rates

Bi-modal histogram

15% of RPs with Aobs>>>Arec



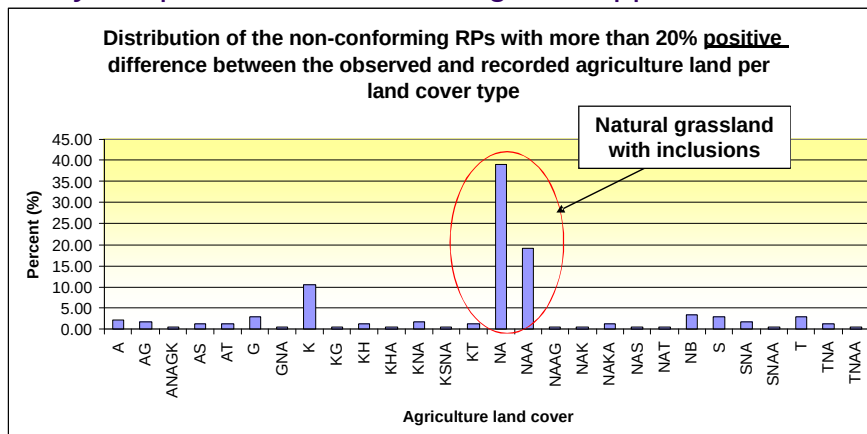
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LPIS secondary measures

Most of these 182 non-conforming RP are located on natural grassland

Only 1 reported with land change not applied

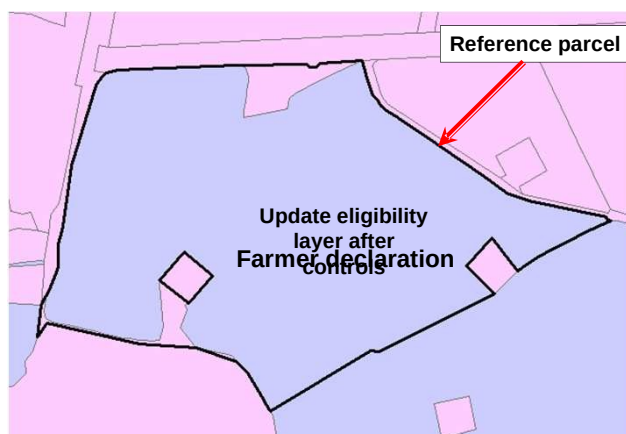


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Analysis

Incomplete processing of RPs on natural grassland, as the eligible land is often governed by the area declared by farmer, while ETS operator maps what he sees -> consequence of 3rd GAC rule!



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Issue of Common land



Official Bulgarian Agriculture Statistics

общински нива	69 693	75 025	71 084	71 457	83 062	80 285	81 045	92 330	98 820	116 131
лозя – чиста култура	100 873	103 049	100 564	106 033	117 041	122 080	122 299	139 087	143 047	152 113
селекционни трайни насаждения	12 759	9 541	10 182	9 292	10 782	9 026	9 312	9 363	10 420	12 900
постоянно затварени площи и ливади-пашаби	1 828 865	1 842 141	1 876 391	1 904 015	1 805 711	1 791 718	1 757 305	1 785 908	1 803 752	1 820 740
сенокоси, пасища и високи нивеси	2 129	2 024	1 912	1 998	1 954	2 011	2 020	2 220	2 220	2 220
ИЗПОЛЗВАНА ЗЕМЕДЕЛСКА ПЛОЩ	5 100 825	5 116 220	5 190 003	5 264 521	5 330 489	5 326 328	5 324 701	5 499 342	5 582 050	5 678 622
ПЛОЩ СЪС СЕЛСКОСТОПАНСКО ПРЕДНАЗНАЧЕНИЕ	5 648 206	5 668 336	5 709 731	5 725 663	5 785 688	5 782 461	5 796 208	5 854 242	5 874 560	5 921 266

БАНСИК. Застот и използване на територията през 2008 год.

стр. 21

ИЗХ

дирекция "Агростатистика"

Резултати и анализ. № 133 - 2008

ТАБЕЛИЦА 4 ФУНКЦИОНАЛНО ИЗПОЛЗВАНЕ НА ЗЕМЯТА ПРЕЗ 2008 ГОДИНА

хектари

НАИМЕНОВАНИЕ	2008	2007	2006	2005	2004	2003	2002
Много дено и дено за разтоварване	34 002	33 057	32 230	32 830	31 720	32 484	32 439
Селско стопанство и работилница	5 614 470	5 613 891	5 645 080	5 717 639	5 723 927	5 625 348	5 685 603

EUROSTAT

Table 1.3.2: Utilised agricultural area by Member State, 2005

MT	Utilised agricultural area				Average UAA/holding
	Total	arable land	permanent pastures	permanent crops	
1000 ha					
EU-27	161 617.9	100 134.3	50 800.9	10 482.2	20.7
BE	128.7	84.9	51.7	21.0	22.9
BG	2 487.6	2 369.0	59.0	59.4	21.1
CZ	3 522.9	2 634.4	847.3	39.1	131.7
DK	2 588.1	1 398.4	180.6	9.1	53.8
DE	16 975.3	11 897.1	4 877.4	196.1	45.7
EE	763.8	562.5	197.0	1.9	57.0
IE	4 160.4	1 142.4	3 015.9	1.8	33.2
EL	3 905.8	2 027.2	821.4	1 045.1	5.8
ES	23 741.0	11 855.4	7 663.4	4 218.3	24.8
FR	27 490.4	18 330.9	8 042.4	1 103.0	52.1
IT	12 405.9	6 891.3	3 254.2	2 231.1	9.0
CY	142.1	105.2	0.4	36.4	4.8
LV	1 301.5	916.8	367.7	16.3	29.0
LT	2 338.2	1 680.2	635.0	23.0	18.2
LU	128.7	95.9	67.2	1.5	54.3
HU	4 045.3	3 445.5	454.6	140.5	26.0
MT	8.9	7.0	0.0	1.1	1.2
NL	1 958.1	1 117.0	808.7	32.3	23.9
AT	2 690.2	1 383.8	1 235.3	67.9	19.6
PL	13 132.3	10 290.5	2 510.4	293.5	12.1
PT	3 502.9	1 171.6	1 727.3	590.1	16.0
RO	10 337.1	6 626.5	3 369.3	278.5	8.4
SI	448.1	169.2	250.6	26.7	7.4
SK	1 840.4	1 300.0	515.4	23.8	143.0
FI	2 261.5	2 231.2	25.6	4.7	32.3
SE	3 095.9	2 616.4	477.9	3.8	46.7
UK	14 961.6	6 042.9	8 884.9	33.8	81.6

Source: FSS

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Mixed Land use



Multitude of small patches of arable land, grassland, permanent crops and kitchen gardens – quite common in Bulgaria



Functional mix of arable and grass?

Low density urban?

Cartography related mix of arable, grass and sealed surface?

LCML+TEGON could be the solution to that



Follow-up action by BG

Short-term corrective actions:

Immediate revision of interpretation and digitalization approach
The declared parcel should NOT be considered as bounding the eligibility

Medium and long term corrective actions:

Additional training of the technical personal on orthoimage quality and interpretation ,
Revision of national GAC regulation
Clarification of LPIS model and associated business processes

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Conclusions

LPIS Unit in MAF gained considerable understanding of the model and performance of the Bulgarian LPIS

LPIS QA gave also important clues on how the systems should be upgraded in future

ETS provided important basis for the setting-up of the LPIS upkeep strategy

ETS-related hints having strong impact on the LPIS QA results:

Do inspection, then analysis – do not mix it

Map the land cover as much detailed as possible – greatly helps the assessment at later stage

Invest in ETS operators - the inspector and analyst should be different persons

Always perform 4 eye control – it improves the quality

ATS is essential for the ETS – do not underestimate it

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Thank you for your attention!



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