

Webinar

A new Common Agricultural Policy (CAP) based on Copernicus programme and EO4GEO tools

April 28th, 2021
10:00 a.m.
Online event

Livio Rossi, e-geos, AIT President

- Index

- What is the EU Common Agriculture Policy CAP and its achievements along the time
- EO data/products used for the PAC controls and their evolution
- The Land Parcel Identification System and the CAP controls through EO
- The Copernicus Sentinel constellations
- The new "Checks by Monitoring" on the EU territory: the wall to wall monitoring opportunity
- The GeoTag in situ photo APP on mobile phones
- Additional targets: land sustainability and climate changes effect limitations: what advantages for the EU citizens
- Point of strength/weakness and perspectives of technical jobs in this sector
- The EO4GEO tools and the opportunity of free training resources.

The Common Agricultural Policy - CAP

The CAP started at the end of 1970 for the European organization of the agro-market, but since 1992 became geographical-based, through the support of **satellite data**.

It currently consists of around **40 Billion euros** of annual subsidies distributed to 8 million of European farmers and has really been promoting the EO Agricultural sector in Europe.

The in act modernization of the CAP is successfully including the opportunities offered by the **Copernicus** programme, such as EO*GI solutions and each EU farmer (also through associations, agencies, etc) is stimulated to improve his/her "**e-governance**".

CAP Main tasks: after specific analyses/controls at national and regional level, well supported by satellite and geomatic services, (nowadays by Copernicus) , EU DGAri officers **authorize the final funds transferring** to each EU Member States and then to each single farmer/beneficiary.

CAP objectives

The CAP purposes:

- ensure a stable and affordable **food supply** promoting the local and EU own food production: **OK**
- reduce the **import** of primary goods: **OK**
- enable “productive” farmers to obtain a **stable living**: **OK**
- support the rural economy and the **sustainable use** of resources: **OK/Partial**
- maintain rural landscapes and improve the environmental safeguard, particularly for the **climate changes** fighting: **Partial**

Anyway: EU CAP legislation and related subsidies achieved in EU a 20% reduction of the **agro-carbon footprint** since 1990 (unique economic sector in the world)

The CAP main working tasks

In summary:

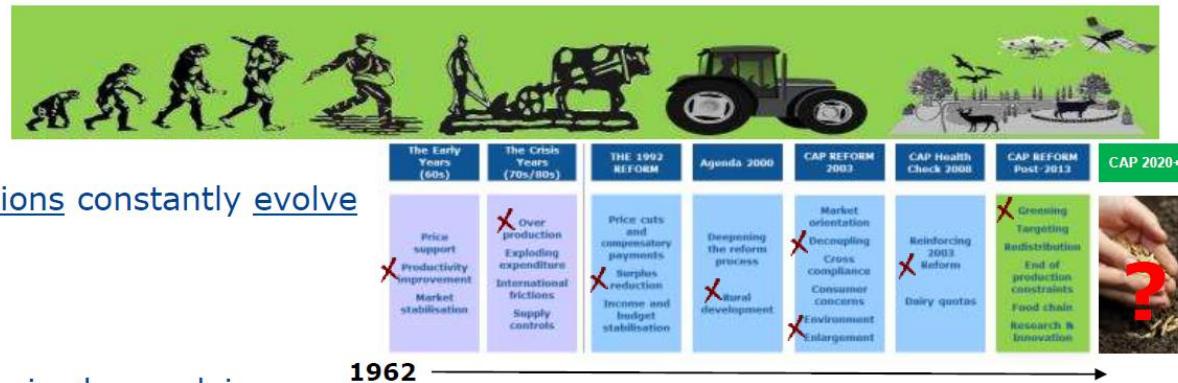
- **integrate and update** rural cartographic, cadastral and alphanumeric data
- plan and acquire **aerial and satellite** data for the agronomic mapping, both “wall to wall” and at sampling level (LPIS, controls)
- organize digital and geo-referenced 'annual "**aid applications**' for the farmers' declaration
- **check, through remote sensing**, the accuracy of the declarations and the applied envi-protection measures, based on national sampling
- calculate the **premiums to be paid** to each farmer, according to deadlines set by the EU

The CAP rules vs the technology updating along the last decades

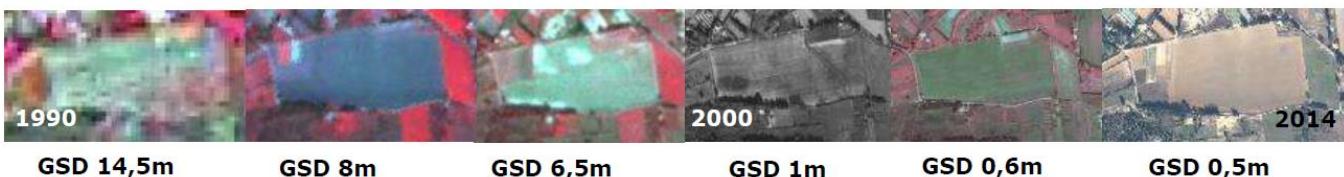
The CAP



Objectives unchanged: ... check all conditions for which aid is granted



Technology is also evolving



→ Methods constantly need update if not upgrade

JRC- by Philippe Loudjani

Example of initial used technologies (satellite + SW)(in the 90's)

Orthophoto B/N

Verifica sul campo - "Controlli 98"

landsat-TM 04/07/1998

Foto 01/05/1998

Rejected after satellite checks

Spot-XS 29/10/1997

Spot XS GSD 10 m

Consorzio ITA

Selezione da mouse attiva Zoom 480% Foto aerea

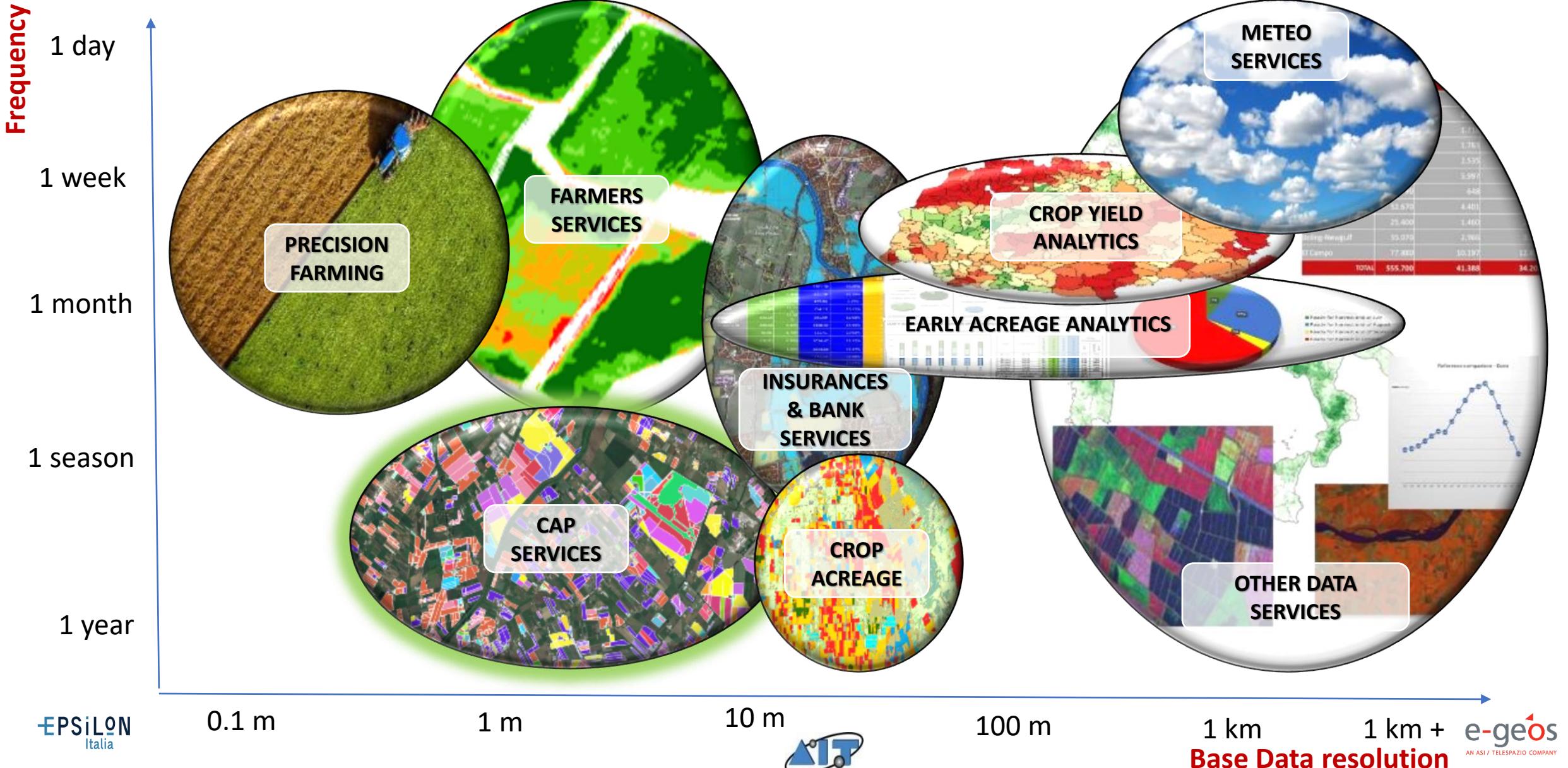
Avvio Gestione risorse - Desktop MS-DOS Prompt Verifica sul campo - "..."

1619281 5021624 18.12

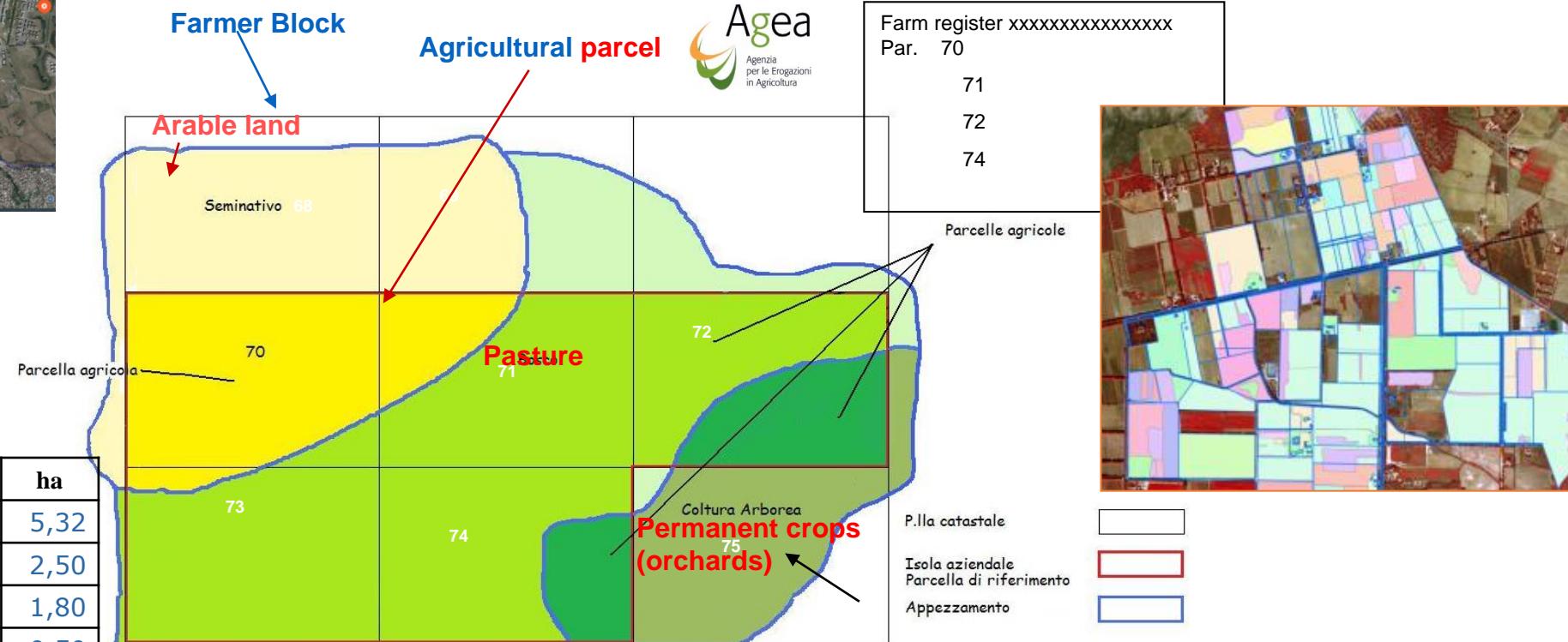
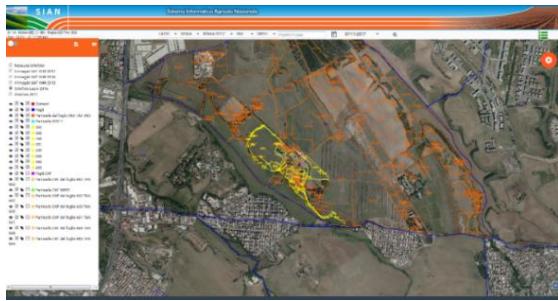
COLTURA DICH. ACC. DIFF.

Mais	3.55	-100
Frumento duro		
Altri cereali		
Soya		
Girasole		
Colza e ravizzone		
Piante proteiche		
Culture		
Superfici messe a		
Altri utilizzi	0.27	-100
TOTALE	Ettari	3.82 3.84
Provincia :	Mantova	
Comune :	Medole	
Foglio :	0007	
Particella :	00088	ha: 3.84

Earth Observation: what agriculture services for what revisit and spatial resolution?

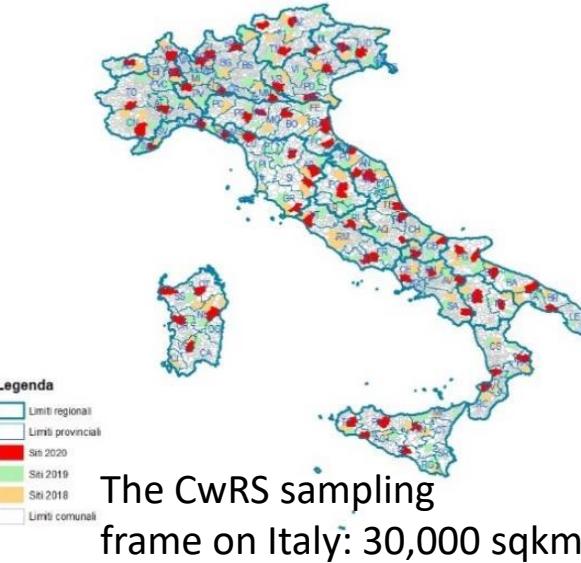


The **Land Integrated Parcel System LPIS**, mandatory for each nation, synergistically manages and updates the entire agronomic multi-annual data base of each EU nation:
satellite, air photos, cartography/cadaster, land and agronomic registers, GNSS surveys, farms' information)



property, reference parcels, land use at very large scale for the
maximum possible amount of subsidies calculation

The annual CAP **Controls with Remote Sensing CwRS**, through a risk based sampling on declared areas: scattered” acquisitions over Europe of Very High Resolution VHR satellite, processing, interpretation and ground visits before the CAP payments at the end of the year



The CwRS sampling frame on Europe
 > 500,000 sqkm altogether



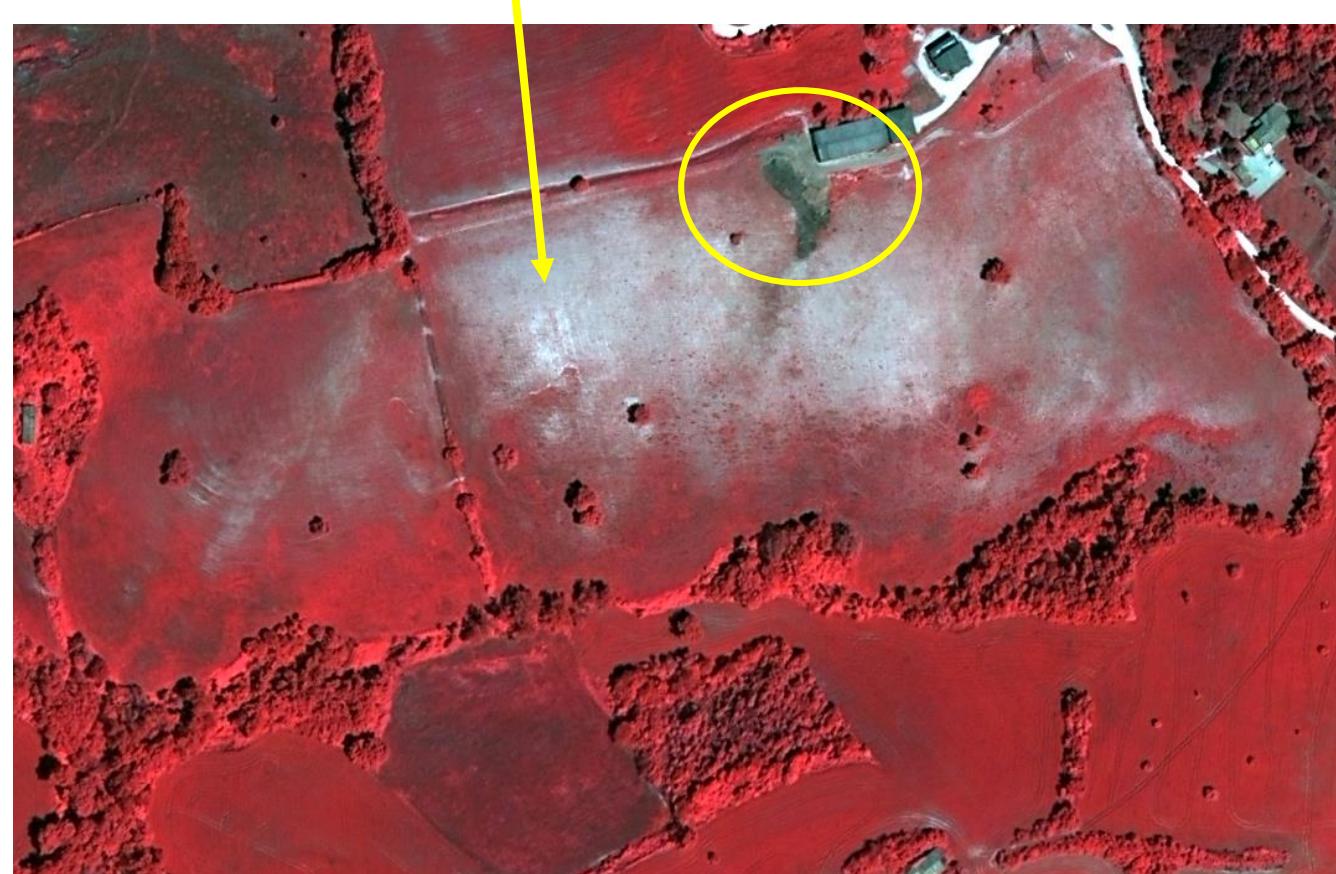
VHR satellite: Geoeye, Worldview, Kompsat at 0,5m resolution acquired on a sample base over the entire EU, previously selected by MS;
 Data, after professional data processing are submitted to expert interpreters for 5% of declaration compliances and ground survey for doubtful cases

only after this verification: farmers can be payed

EU JRC and DGAgri usually verify the correctness by annual Audits

The CwRS controls for the **agro-environmental protection** requested measures: CAP Good Agricultural Environmental Conditions -**GAEC** to be verified through very high resolution satellite

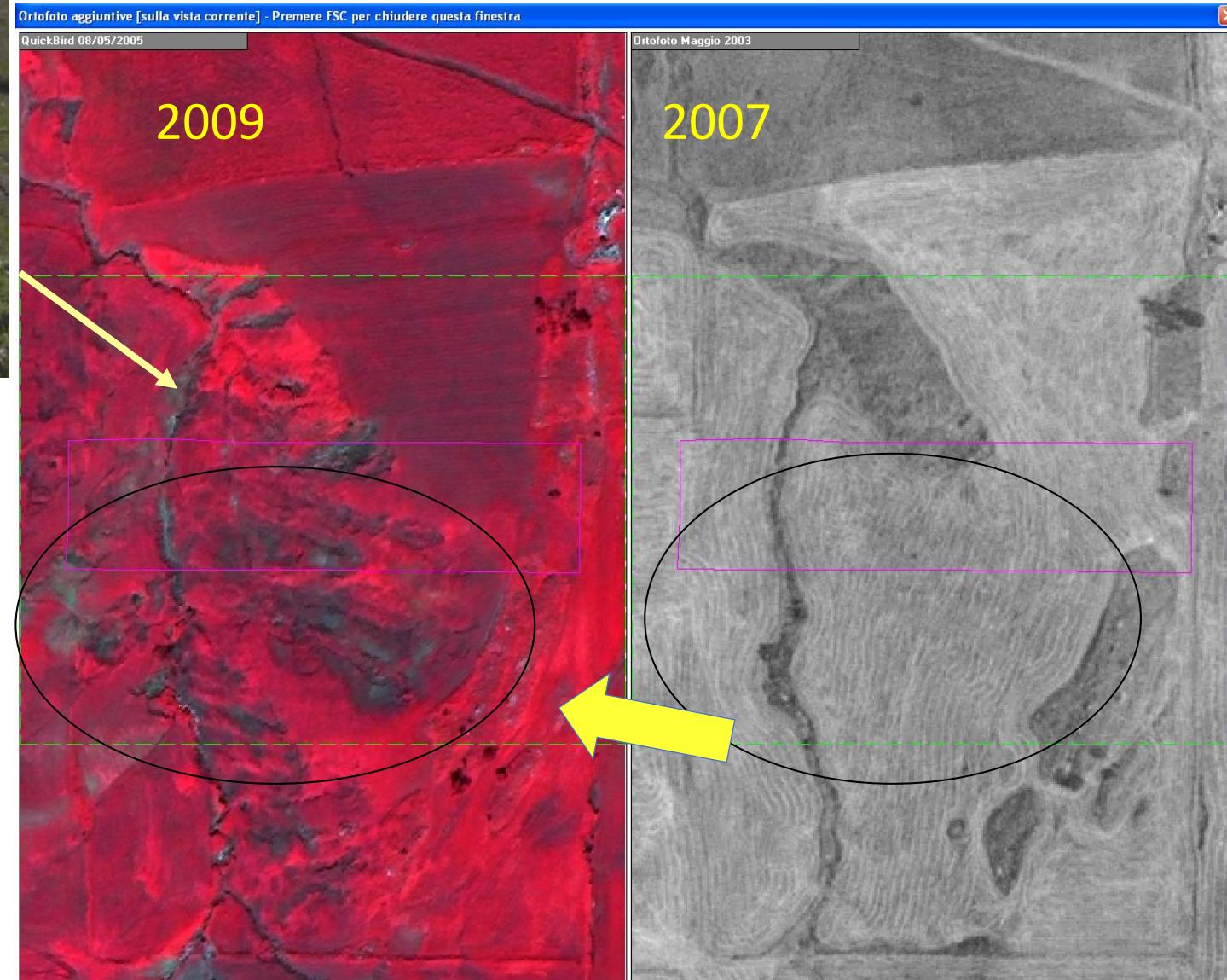
example of overgrazing and livestock waste disposal: a non compliant behaviour by farmer detected by VHR sat

Agea
Agenzia per le Erogazioni in Agricoltura

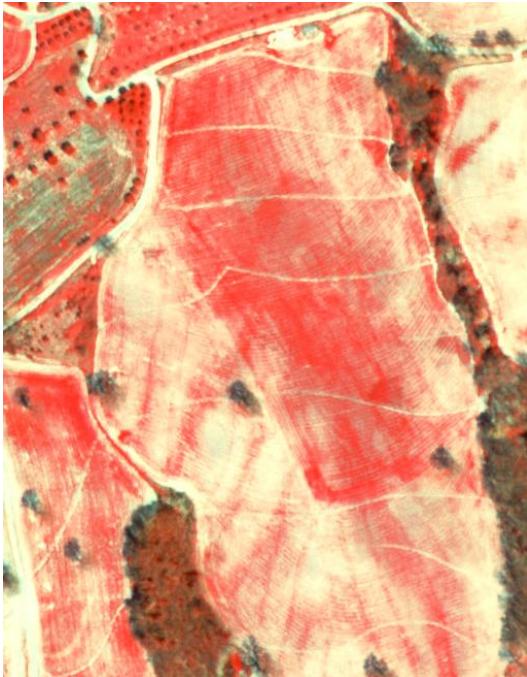
Lack of agro-soil maintenance/interventions in the last decades is destroying the local potential productivities, creating serious loss of fertile soil



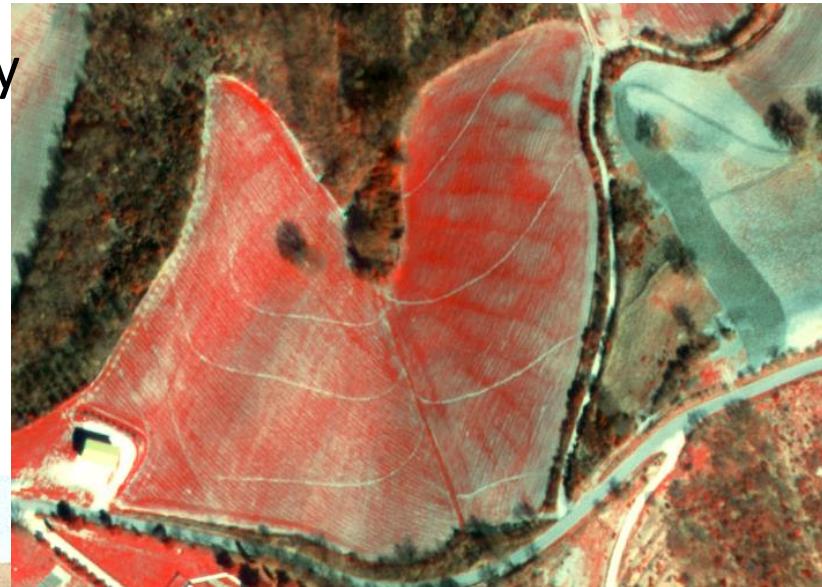
Consequences
erosion,
landslides,
organic matter loss,
higher flooding
intensity and
frequency,
and
then irreversible loss
of agricultural surfaces



GAEC - Possible remediation: temporary and stable channeling on slopes – EO has been using for addressing the corrective measures and controlling the benefits ex post

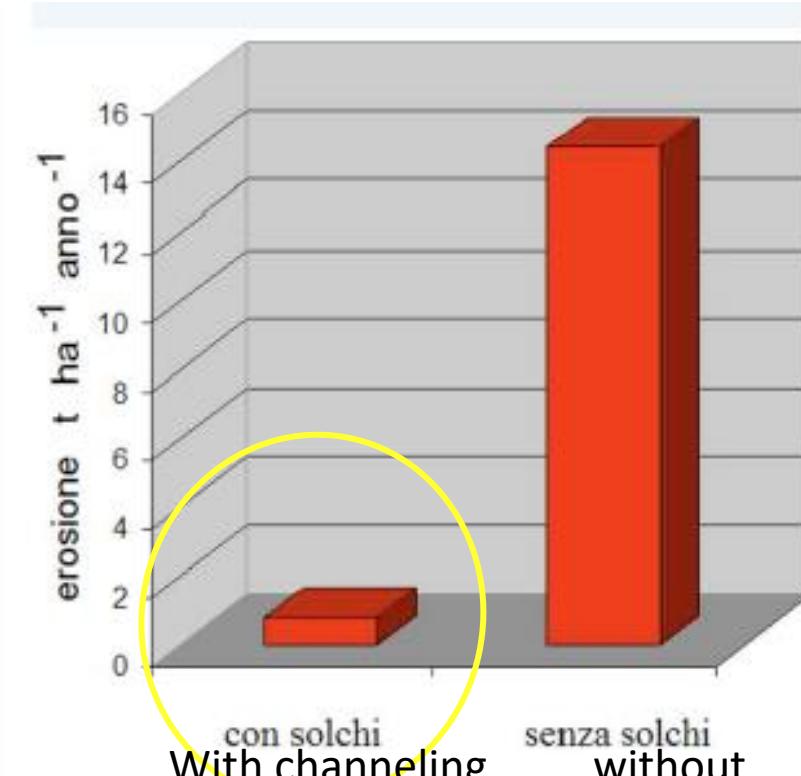


Control's capability
through
VHR sat imagery



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Agenzia
per le Erogazioni
in Agricoltura

GAEC rules and results: the temporary channeling on slope, to save water and soil appears efficacy if well applied



Efficond project
By CREA (It. Centre of
Research in Agri.)



Edge- tree/rows for water, soil and biodiversity protection

From GMES to Copernicus programme

COPERNICUS SERVICES: a strong contribution to the CAP programme

Monitoring the State of the Earth System Environment ...



Agriculture



... Six cross-cutting Thematic Services

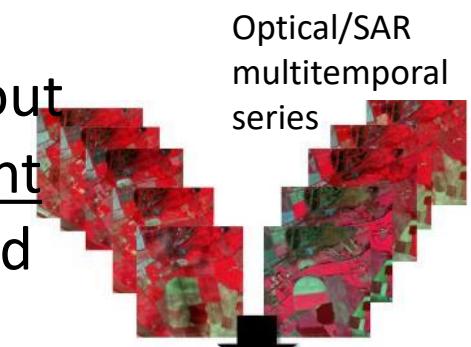


A new enabling structure
EPSILON Italia

The new Monitoring approach: Copernicus Sentinel capability => **Checks by Monitoring** - CbM

CbM:

More democracy in controlling, instead of the 5% of sampling only (leaving 95% out of controls) and create a positive deterrent for avoiding fraudulent/inaccurate CAP aid declarations

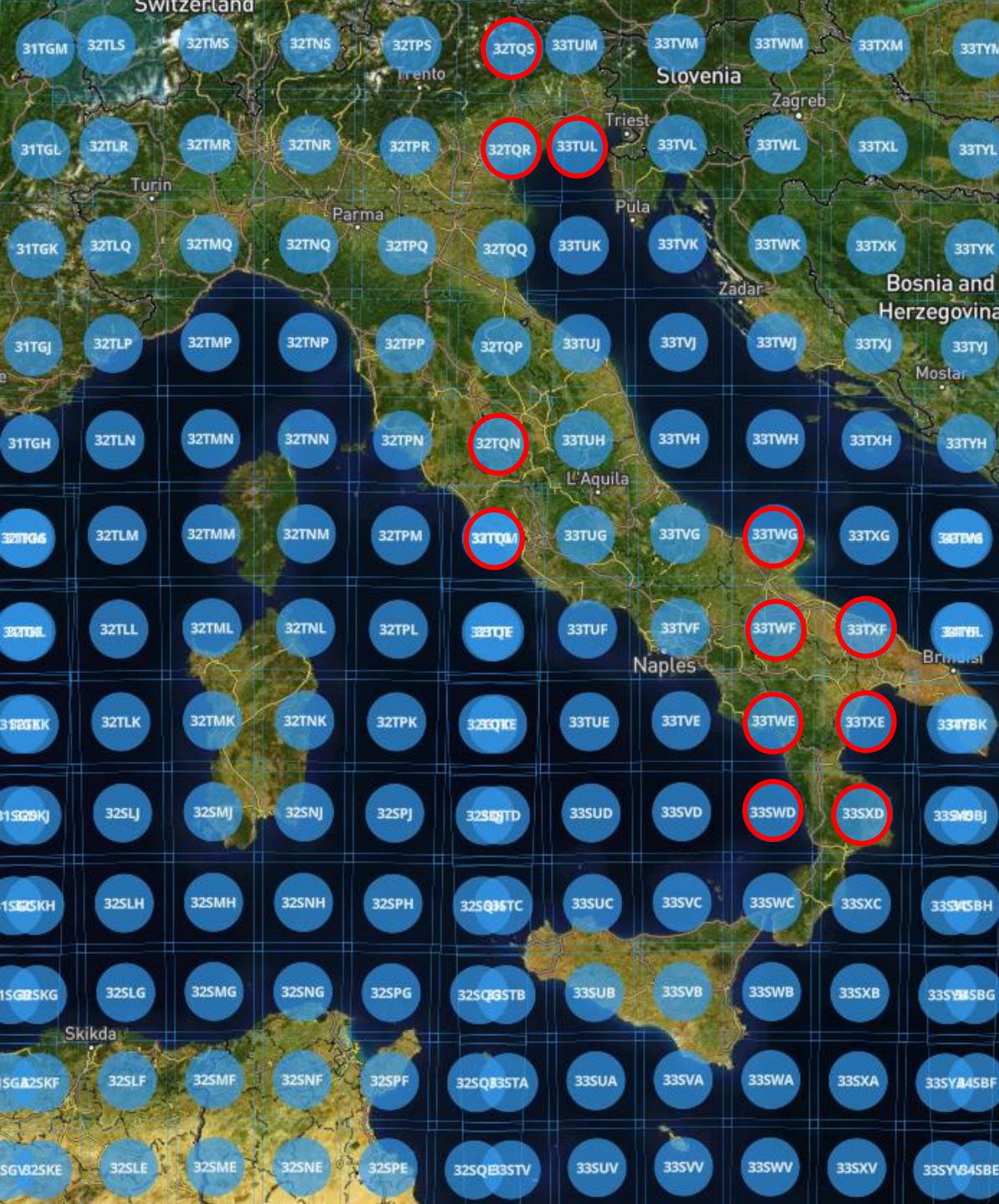


1 parcel= 1 field

Multitemporal indexes
analysis and automatic
traffic lights for
direct payments

The diagram consists of three main components arranged horizontally. At the top left is the text "Crop confidence level 98%". To its right is a green traffic light icon with the text "€€€ PAYMENTS" above it. A blue arrow points from the bottom left towards the green traffic light. To the right of the traffic light is a satellite map of agricultural fields colored in various shades of red, green, and yellow, representing "intra-parcel indexes".

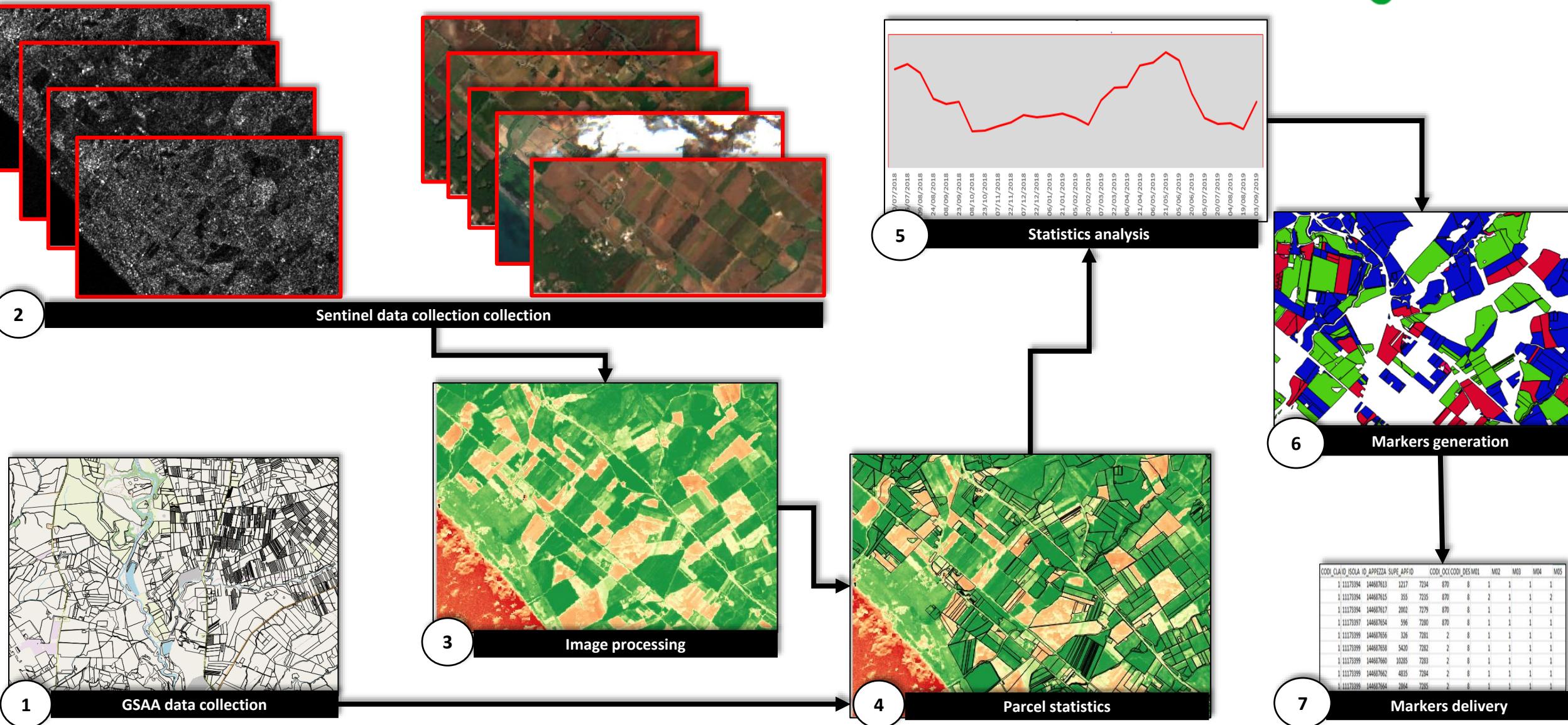
GEN	FEB	MAR	APR	MAG	GIU	LUG	AGO	SET	OTT	NOV	DIC
119	121	122	125	127	130	147	148	150	152	155	148
119	124	130	136	138	140	150	150	151	152	153	150
134	136	138	140	145	144	144	143	142	128	122	130
130	133	136	140	140	141	154	153	153	152	152	144
125	126	126	141	141	143	156	157	157	156	158	157
113	128	123	128	135	142	154	155	157	159	161	155
110	110	111	111	112	113	109	109	109	109	109	109
111	111	111	111	112	113	111	113	114	117	120	112
117	129	121	123	116	109	110	110	110	113	123	131
110	111	111	112	111	110	108	110	111	114	117	136
115	116	118	119	115	111	111	111	110	110	123	132
111	111	111	112	111	111	111	111	111	112	122	131
110	111	112	112	112	110	110	111	111	111	112	120
111	112	112	112	112	110	110	111	111	111	112	120
112	113	114	116	113	110	110	110	110	110	113	115
121	123	125	127	129	131	112	112	111	110	110	110
114	122	110	108	109	110	121	126	132	140	148	154
141	131	121	111	109	107	109	115	121	131	140	159
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117	119	121	122	124	125	127	128	121	119	117	117
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121	126	131	135	138	142	146	150	157	156	157	147
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113	112	113	114	114	115	115	115	115	115	115	115
120	123	124	125	126	127	128	129	130	131	132	133
130	130	130	130	130	130	130	130	130	130	130	130
136	126	117	125	122	140	146	156	159	157	155	151
108	107	107	107	107	107	107	107	107	107	107	107
123	123	123	123	123	123	123	123	123	123	123	123
122	128	123	128	133	142	148	152	154	146	124	122
123	128	125	123	120	117	115	115	115	117	117	117
128	125	123	120	120	117	115	115	125	134	142	157



Sentinel-2 data availability and collection example for CbM

- ESA Sentinel-2 tiles «granules» extraction
- Selection criteria: cloud cover < 90%
- Example of starting date in collection (Italy): 15 July of the previous year
- Example of ending date (Italy): 15 November of the Adminstrative CbM year
- Used S2 «granules» for CbM monitoring: potentially up to 100 per Tile per year for a mediterranean agronomic season
- NB: **SAR S1** collection and processing helps to replace optical in cloud cover persistent cases and to improve grassland mowing detection events

Checks by Monitoring CbM: how to work the **workflow** applied for the Italian Paying Agency AGEA



CbM: example of **markers extraction** by Sentinel, at parcel's level

After a «crop grouping» of the declared parcels (same phenology), one or more markers must be automatically extracted on each parcel, such as:

- *Ploughed*: ploughed terrain before seeding
- *Growth*: parcel with growing vegetation (gradient ratio calculation)
- *Vegetation presence*: parcel with vegetation (threshold's verification)
- *Harvested*: parcel harvested
- *Mowed*: grassland mowed and timing
- *Grubbed*: grubbing of permanent cultivations

Contextually, different **timing scenarios** must be individuated and selected, considering :

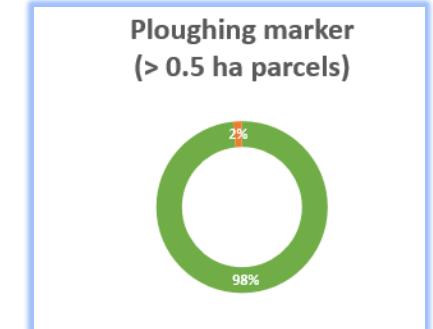
- *Type of crops*: activities carried out in different periods of the year (i.e.: harvesting or ploughing times for winter or summer crops, etc.)
- *Geographic location*: crop calendars can be different even at national/regional level, depending on the region (climate, altitude, latitude, local traditions)
- *Regulations*: some activities are ruled and performed or not performed according to specific periods (grass mowing, land lying fallow cleaning, etc)

CbM- Geo Spatial Aid Application -GSAA; CAP declared parcels by farmers
collection – green (aid request); white (not declared areas) –example in Puglia Region





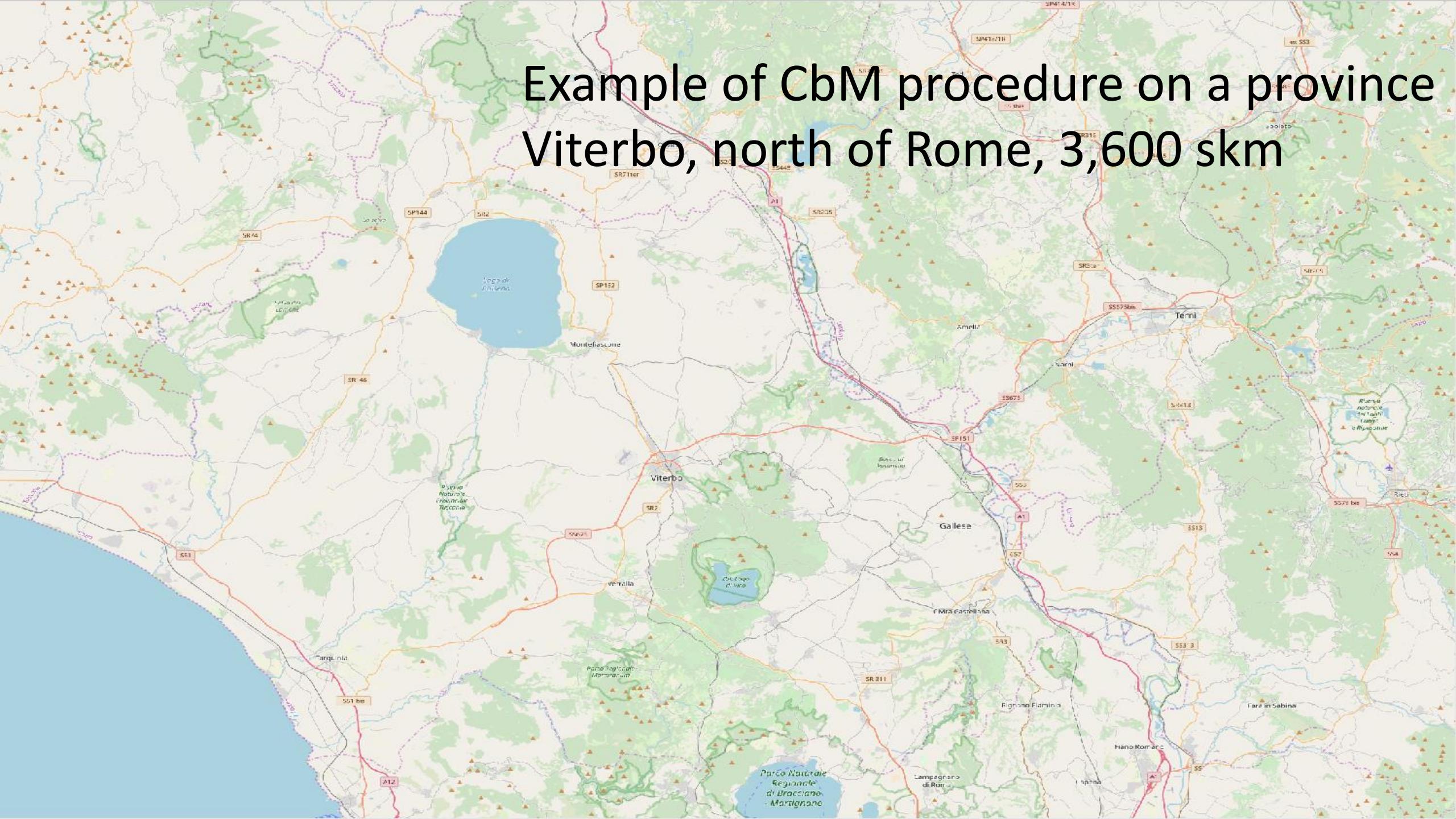
Green: marker detected
Orange: not detected

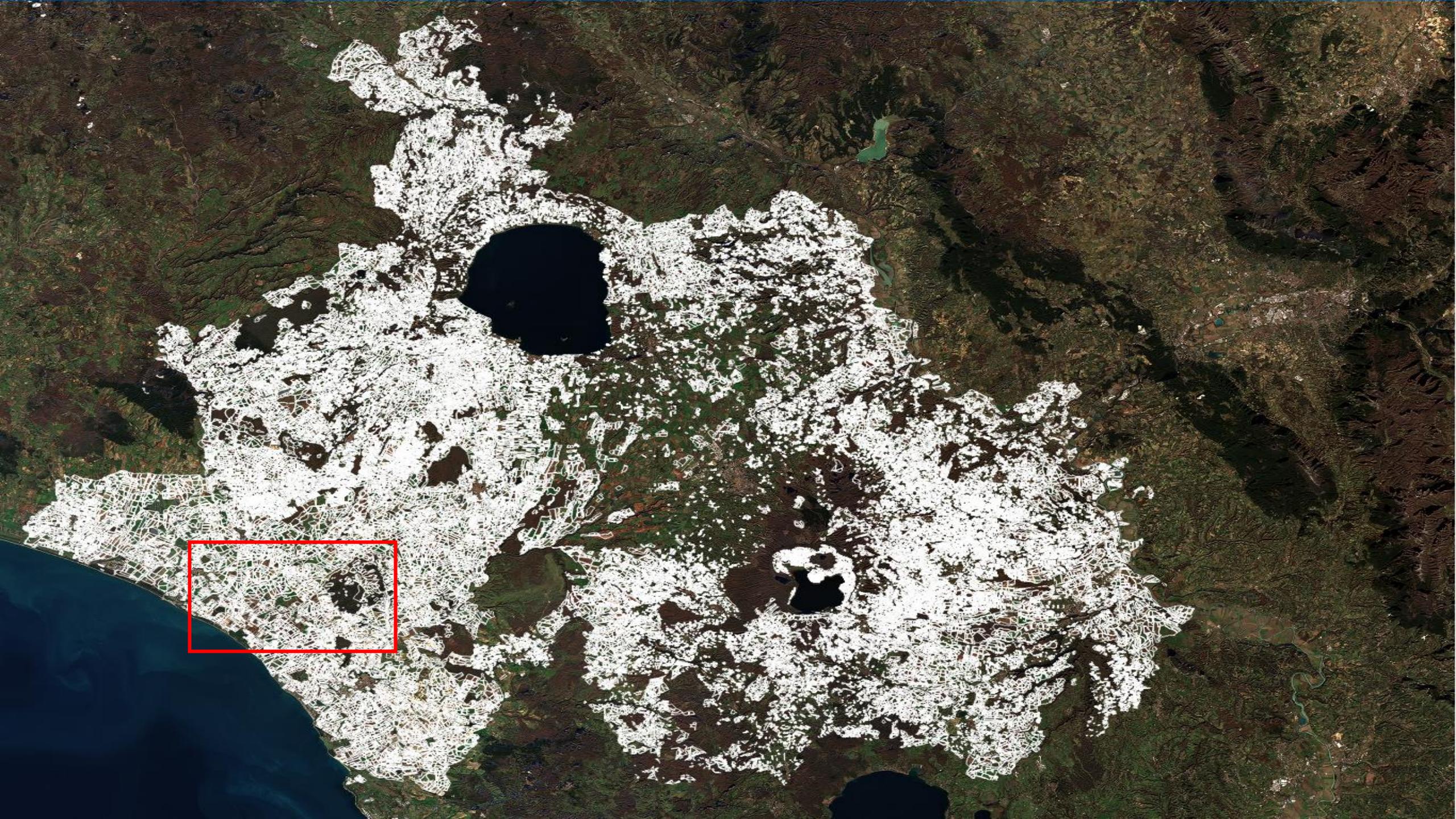


Ploughing marker details and analytics



Example of CbM procedure on a province Viterbo, north of Rome, 3,600 skm







Sentinel2 natural
colors

27/12/2018



Merging GSAA and
satellite data



S2

27/12/2018

Winter crops GSAA
and satellite data



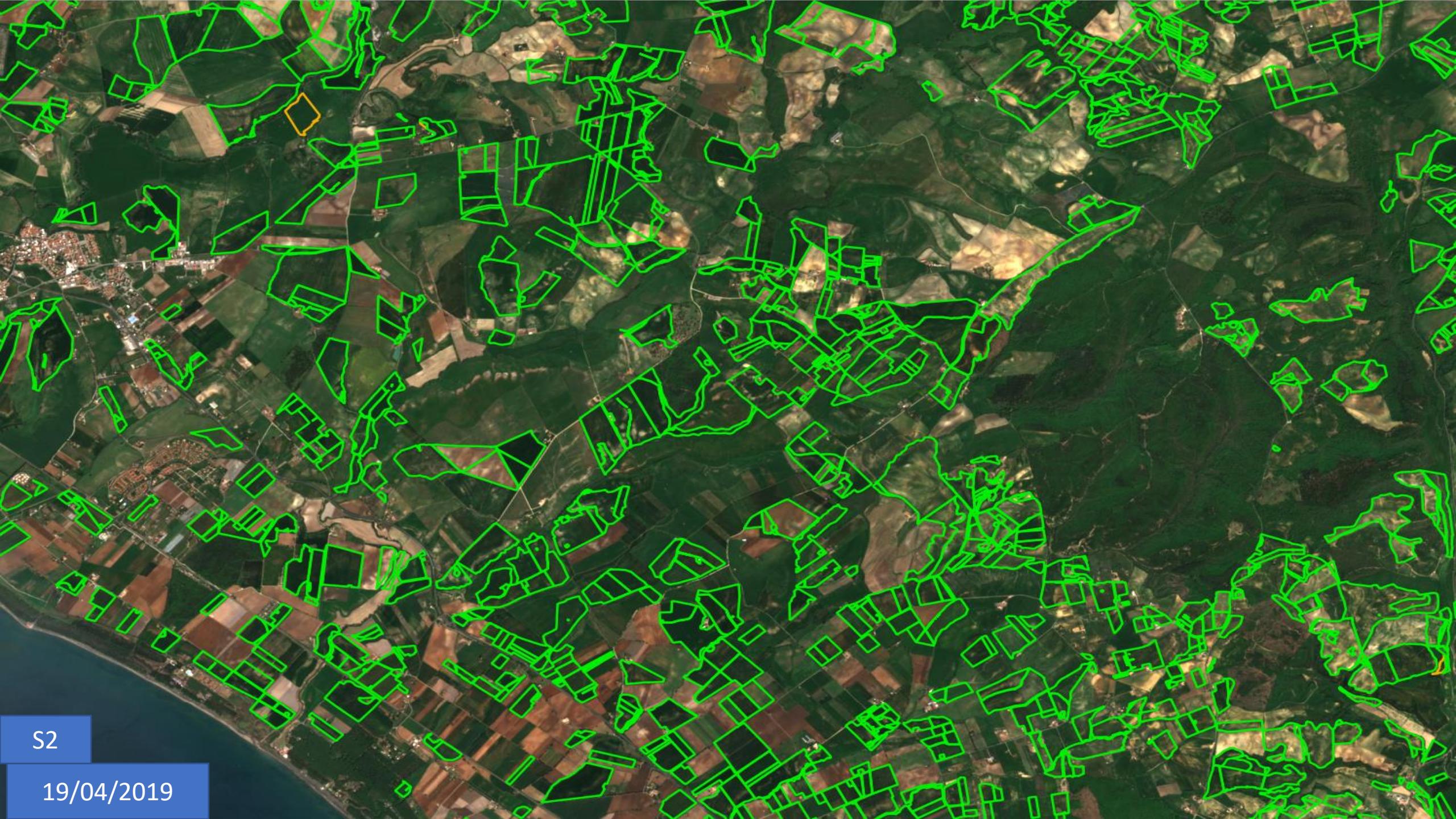
S2

26/01/2019



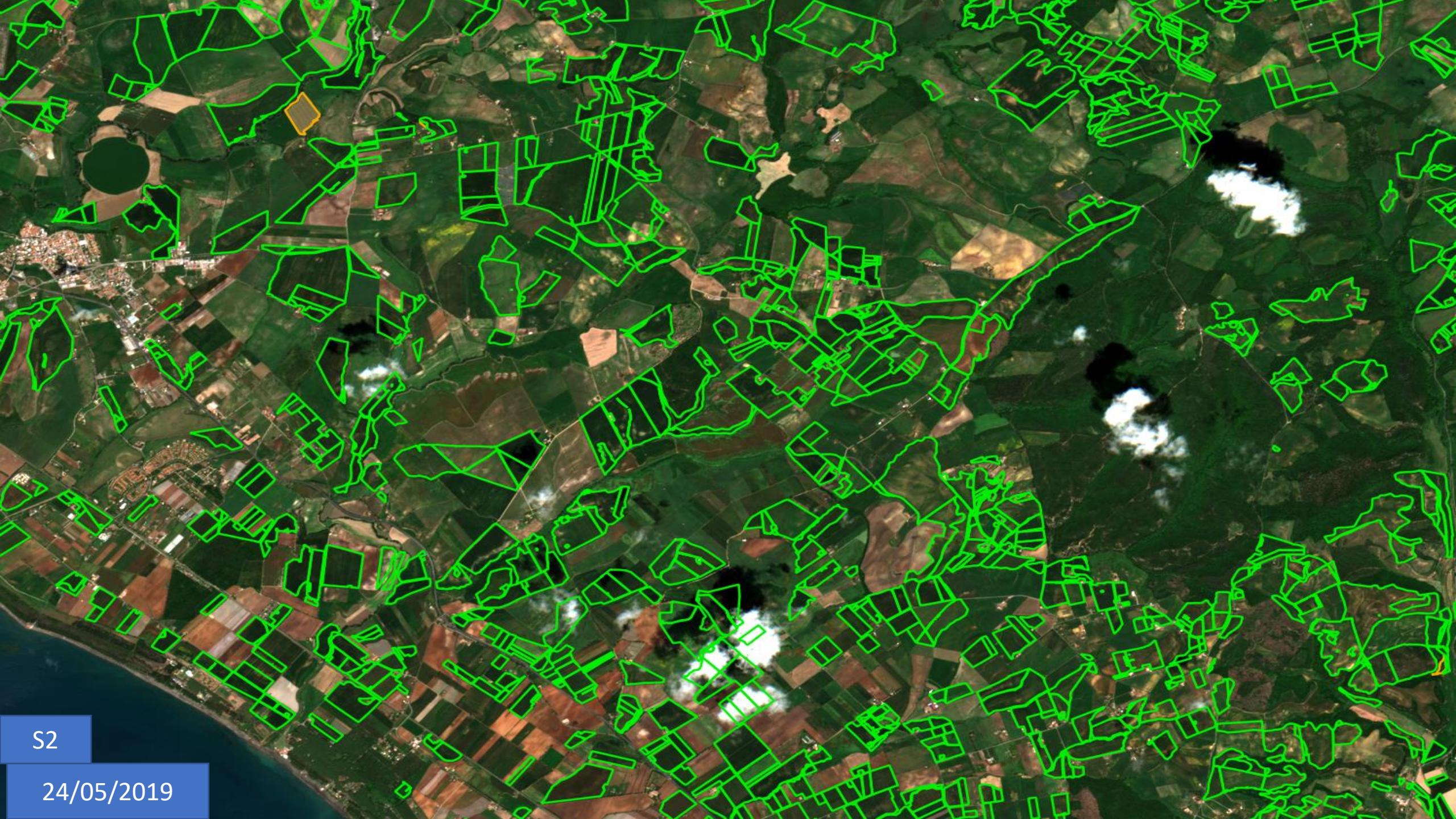
S2

28/02/2019



S2

19/04/2019



S2

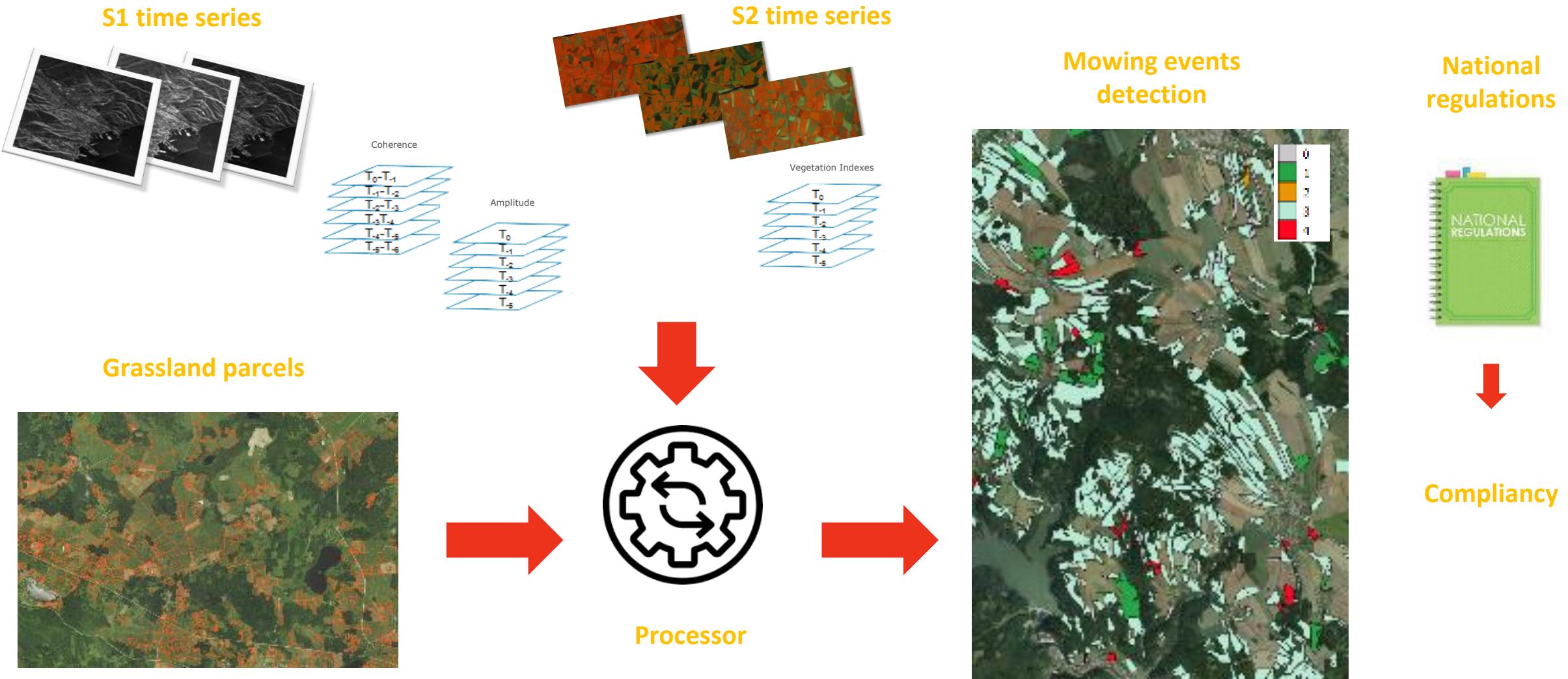
24/05/2019



S2

18/06/2019

CbM: specific processing for detecting events of grassland mowing through Sentinel 2 and SAR Sentinel 1



Use cases of CbM: operational examples in Italy

POSITIVE and eligible parcel by CbM - Barley: entire phases' evaluation

870 cod barley – arable

parcel ID: 199218200

Area 25 ha

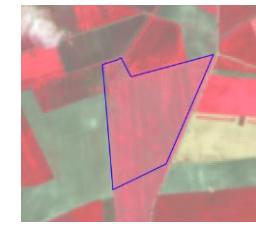
Province FG



S2A 12/02/2018



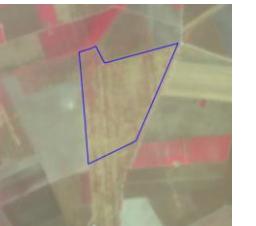
S2A 23/04/2018



S2A 13/05/2018



S2A 02/06/2018



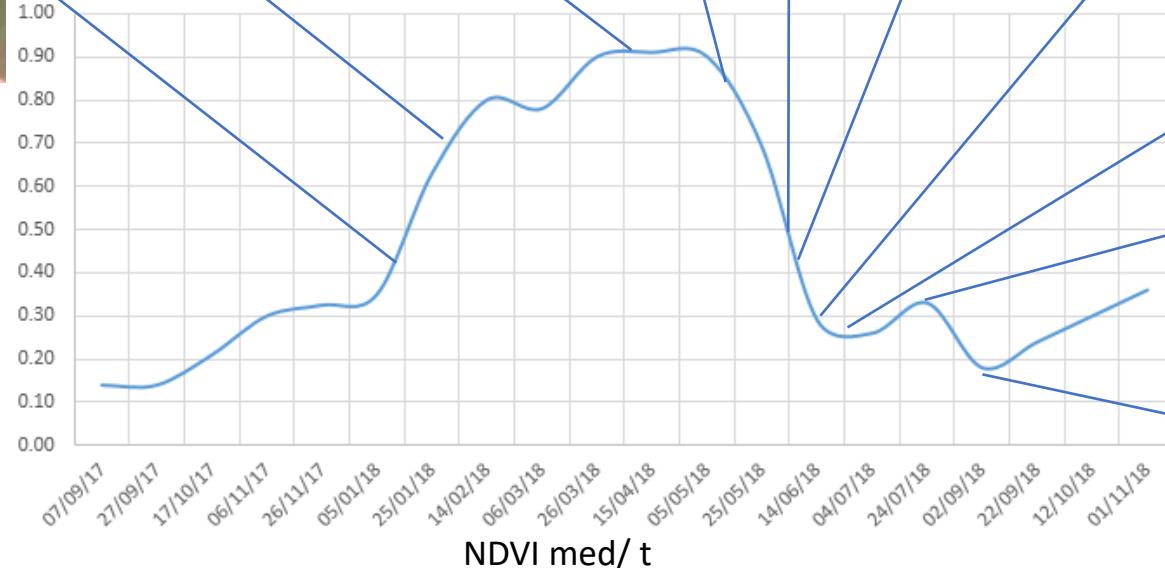
S2A 07/06/2018



S2A 12/06/2018



S2A 18/01/2018



Orthophoto Agera 2016



Bing Aerial



S2A 12/07/2018

S2A 21/08/2018

CAP CbM output, at administrative level

winter crops example: the ploughing «marker» detection

PARCELS numbers STATISTICS of a province

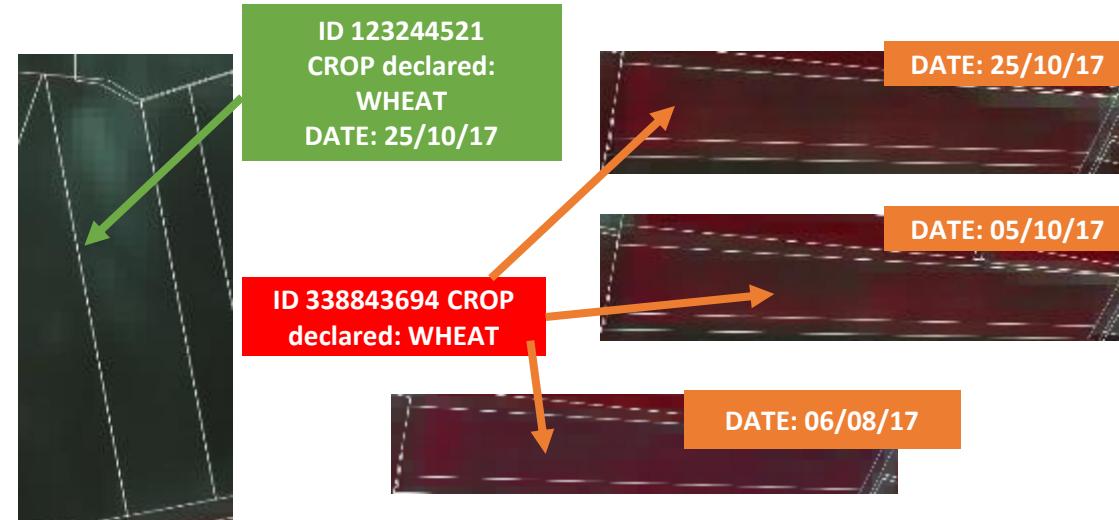
ARABLE LAND : AUTUMN-WINTER CROPS

MARKER M01 - Ploughed (period 15/7/2017 - 30/10/2017)

	PLOUGHED	NOT PLOUGHED	NOT MEASURABLE	% OVER TOTAL
<0,2 ha	19487	3418	7577	26%
0,2 - 0,5 ha	16961	899	0	15%
>0,5 ha	67927	1153	0	59%
TOTAL	104375	5470	7577	100%



Declared AREA STATS



Example of correct (green) and not correct (red) declaration by automatic analysis

CAP CbM output at administrative level

autumn-winter crops example: the harvest «marker»

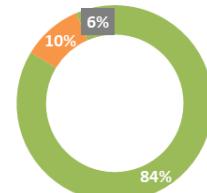
PARCELS STATS

ARABLE LAND : AUTUMN-WINTER CROPS

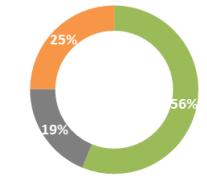
MARKER M05 - Harvested (period 1/5/2017 - 31/7/2018)

	HARVESTED	NOT HARVESTED	NOT MEASURABLE	% OVER TOTAL
< 0,2 ha	17131	5774	7577	26%
0,2 - 0,5 ha	15532	2328	0	15%
> 0,5 ha	65559	3521	0	59%
TOTAL	98222	11623	7577	100%

Harvested
(100% parcels)



Harvested



Harvested
(0.2 - 0.5 ha parcels)

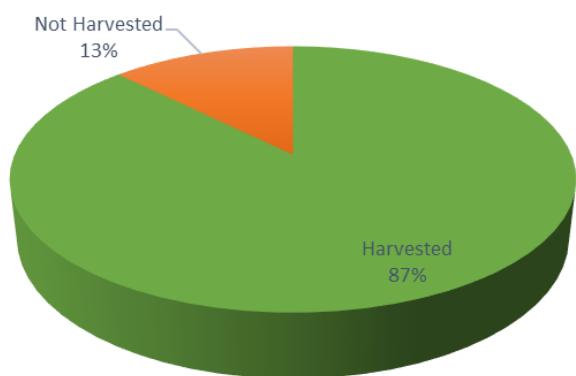


Harvested



AREA STATS

Harvested marker - Area



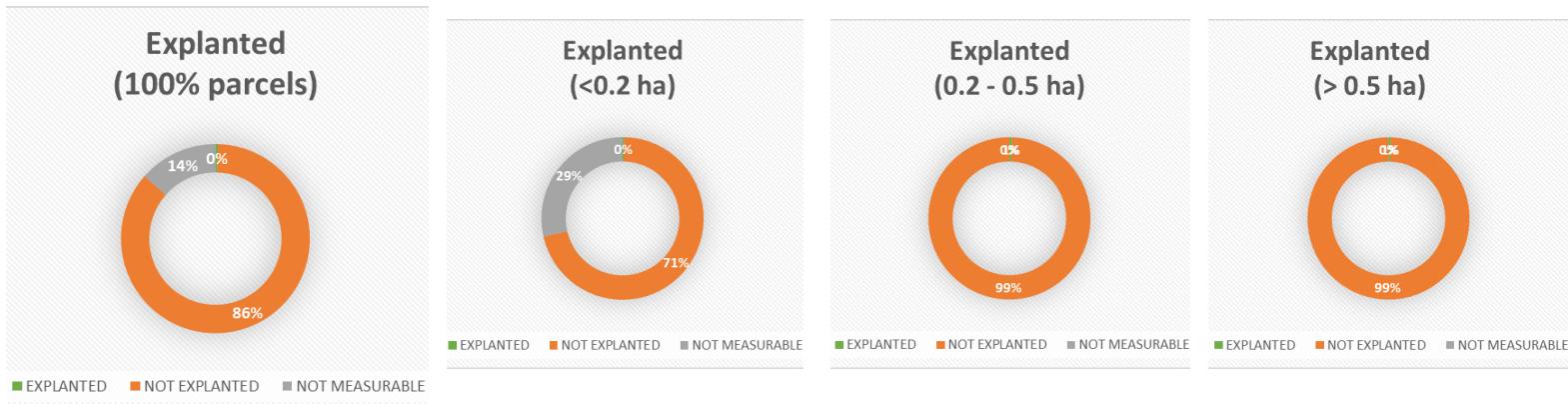
CAP CbM output at administrative level permanent crops example –vineyards: grubbing detection

PARCELS STATS

PERMANENT CROPS - VINEYARDS

MARKER M62 - Explanted (period 1/1/2018 - 6/11/2018)

	EXPLANTED	NOT EXPLANTED	NOT MEASURABLE	% OVER TOTAL
<0,2 ha	66	13113	5276	47%
0,2 - 0,5 ha	40	7438	0	19%
> 0,5 ha	67	13088	0	34%
TOTAL	173	33639	5276	100%

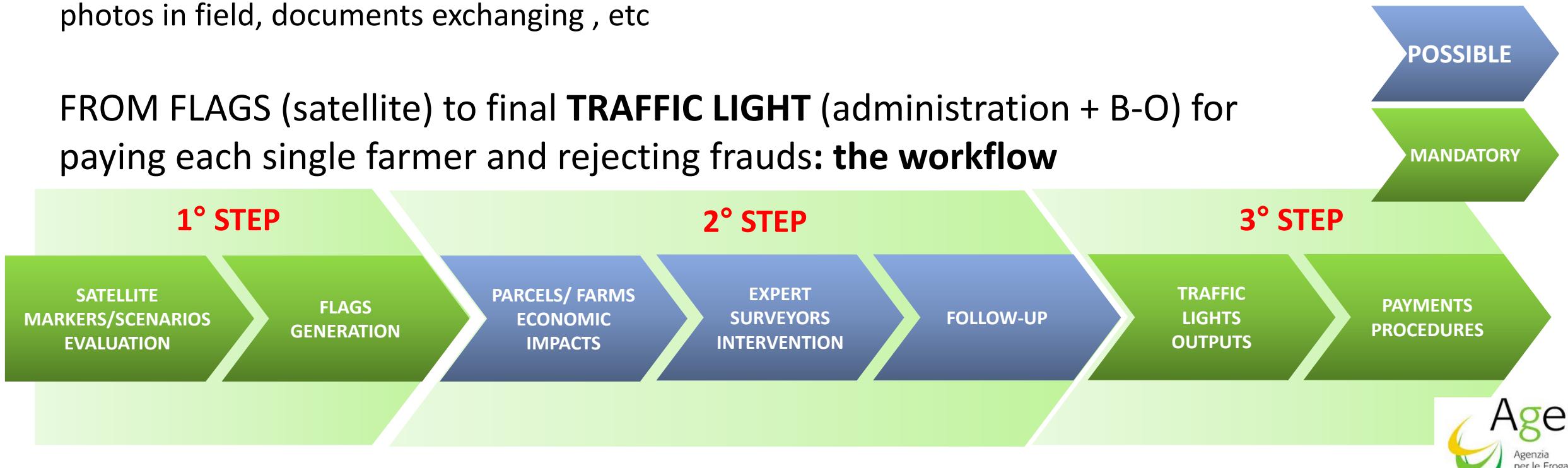


Verified by VHR satellite and
ground surveys

Follow-up and administrative procedure, after CbM automatic satellite “flag generation”

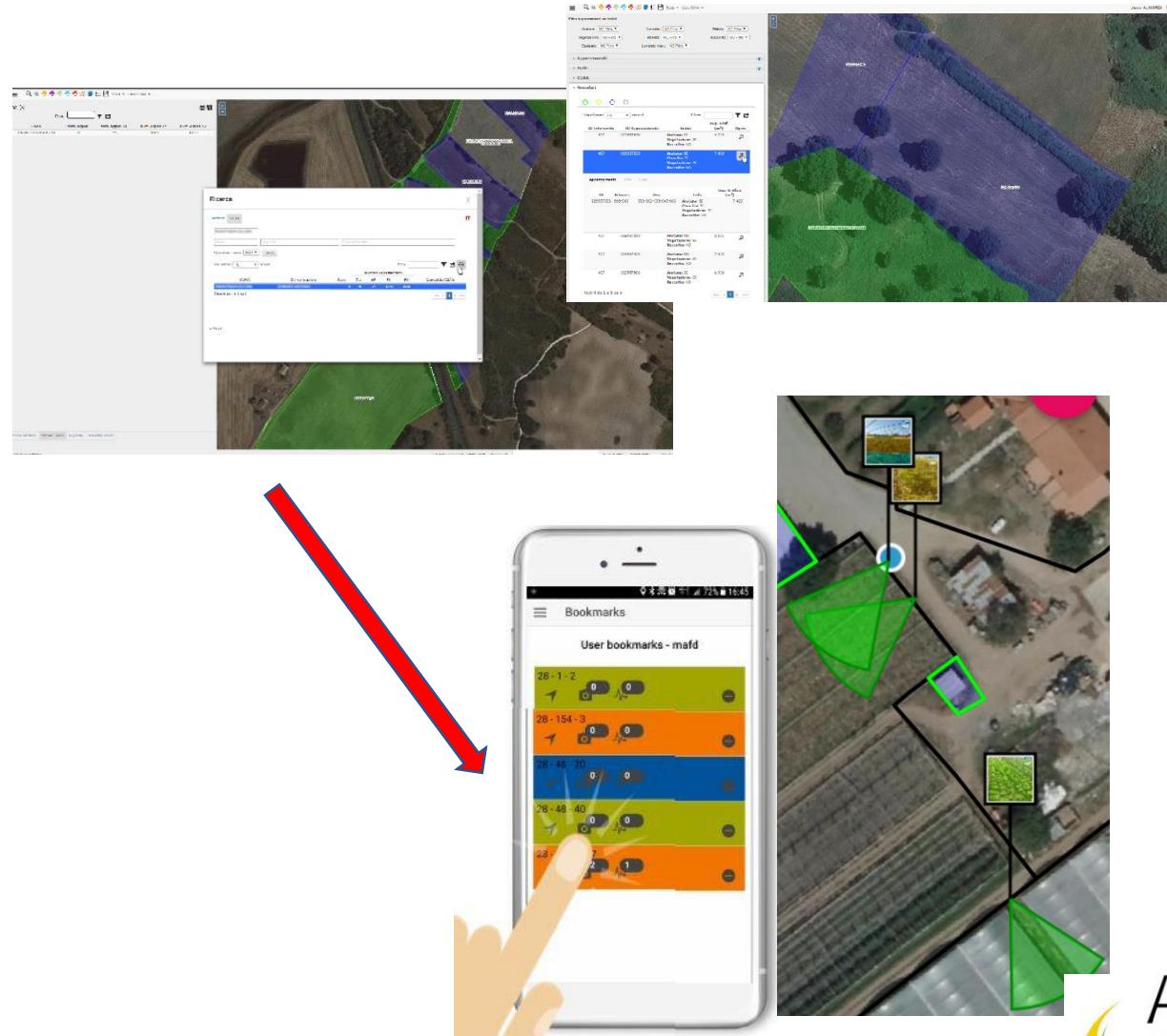
- The CbM periodic and systematic automatic procedure from **Sentinel Copernicus** often does not conclude the analysis
- For these cases **Follow-up** activities are necessary, to finalize the subsidies admissibility (especially for small, strange shapes, hilly-mountain parcels);
- **A Back Office (B-O)** activity must therefore perform additional analyses and /or through farmers information to finalize the decisions, by SW for rapid Satellite multitemporal visual analysis, georeferenced GEOTAG photos in field, documents exchanging , etc

FROM FLAGS (satellite) to final **TRAFFIC LIGHT** (administration + B-O) for paying each single farmer and rejecting frauds: **the workflow**



The AGEA Back-Office (B-O) for CAP Checks by Monitoring how to work

- When Sentinel or other remote ancillary information **do not give conclusive** answers (yellow flags), B-O expert operators must go in detail through visual interpretation or can ask to surveyors or to farmers to acquire specific **geo-tagged photos** to provide a correct ground proof
- Users (farmers or surveyors) can be guided by the APP both in reaching the parcel and in the correct **taking of the photographs**
- The APP GEOTAG of AGEA is connected to the Public Agency server and through this tool, CbM can be concluded via a final **“traffic light”** for payable farms or rejected (green or red)



« Geotag App » on phone mobile

Secure, protected and guaranteed “in-field” photos

Needs

Secure tool to avoid frauds or manipulations, through a low cost device for precise and verified **in-field proofs**

Applications

App for both surveyors and/or farmers

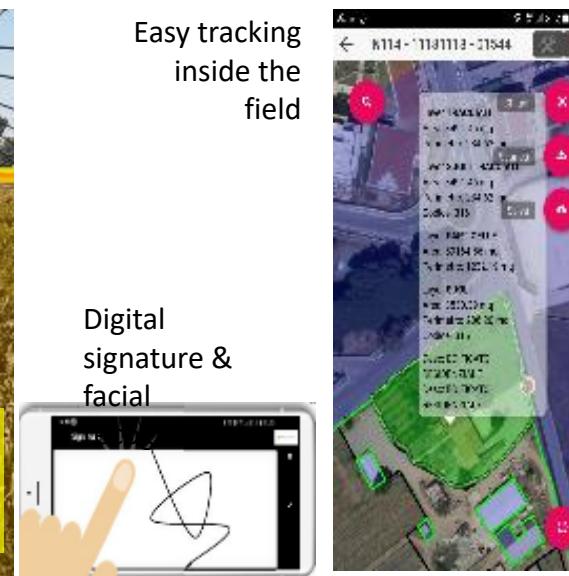
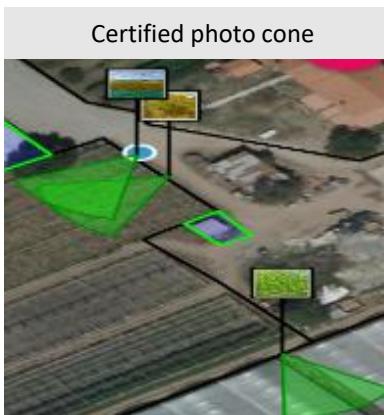
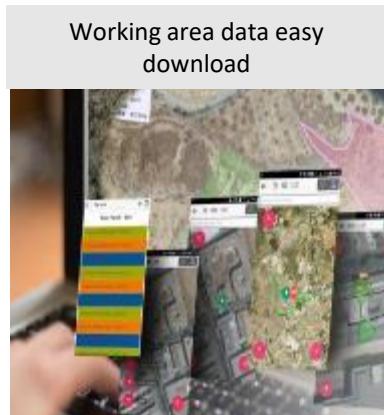
- **Time and date** from satellite, not only by device
- **On-line and off-line** capability (matching through sequential codes)
- **GNSS tracking capability** in different modes, including “walking”
- **High accuracy in positioning through Galileo EGNSS4CAP by GSA**

Availability

- Operational activities since 2018 for CbM; open in Italy through AGEA for Paying Agencies



Operational photo cones
acquired



Copernicus Checks by Monitoring CbM: operational considerations

- Monitoring of arable land parcels **worked properly**
- **Parcels less 0.2 ha** are however problematic to managed by Sentinel only (10m pixel S2 and around 20m S1)
- Permanent crops, pasture pro-rata (not mowed) are more suitable through a **systematic analysis through Land Parcel Identification System**
- Follow-up (doubtful parcels) need firstly **Back-Office photo-interpretation** to reduce expensive and time consuming investigations in situ
- Dissemination/learning to farmers of CbM methods improve their **pro-active involvement**, allowing to receive digital documentation and/or geo-tagged photos, speeding up the overall project cycle, **reducing errors and frauds**

New targets addressed to **farmers and EU citizens** by the next CAP :

- Precision and organic farming expansion
- CO₂ > absorption/ carbon footprint reduction
- Improve the recovery of biodiversity (improve natural elements)
- Push remote and proximal EO sensing towards a «soil/water/food chain» health

What does this new goal need?

A continuous **mutual support and interaction** among:

- **Public Institutions** (P. Agencies, EU DGs, JRC, ESA, GSA)
- **Scientific entities and their achievements**
- **Industry and their challenging propositions**

The next **new scenario**, leveraging on a complete EO agro-monitoring by the CAP

- Expand a > benefit/costs EO agro-services to:**

medium-small farms, insurances and local professionals

- Offer, at marginal costs, further geoinformation tools**
(also by intermediate products) for:

CO₂ adsorption fluxes calculation and

- ecosystem** status
- forest fires**
- legal/illegal clear cuts**
- flooding**
- water provision**
- disaster management**

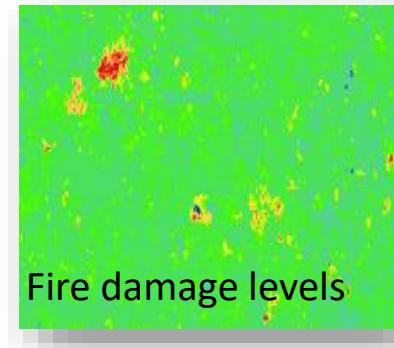
In synthesis... "to **deny an oxymoron**":

*safeguard both the vital-healthy agronomic business
and our living environment*

Flooding monitoring
by Sentinel

Bleu: water

Light blu: muddy water



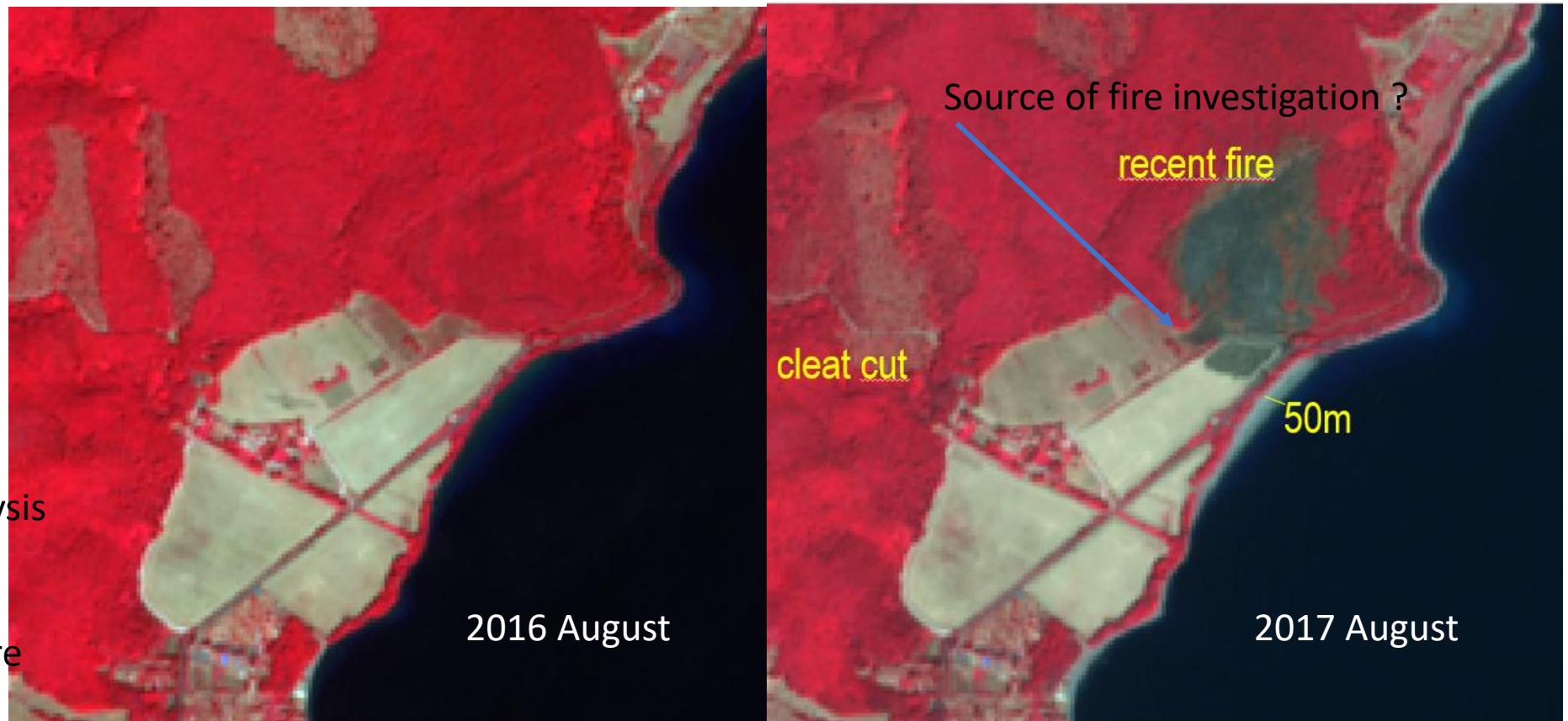
Forest monitoring by Sentinel

Multitasking use of the same CbM data-set operational examples

-Forest **clear cut** dynamic checks
-Burnt scar mapping not only
at the end of the season

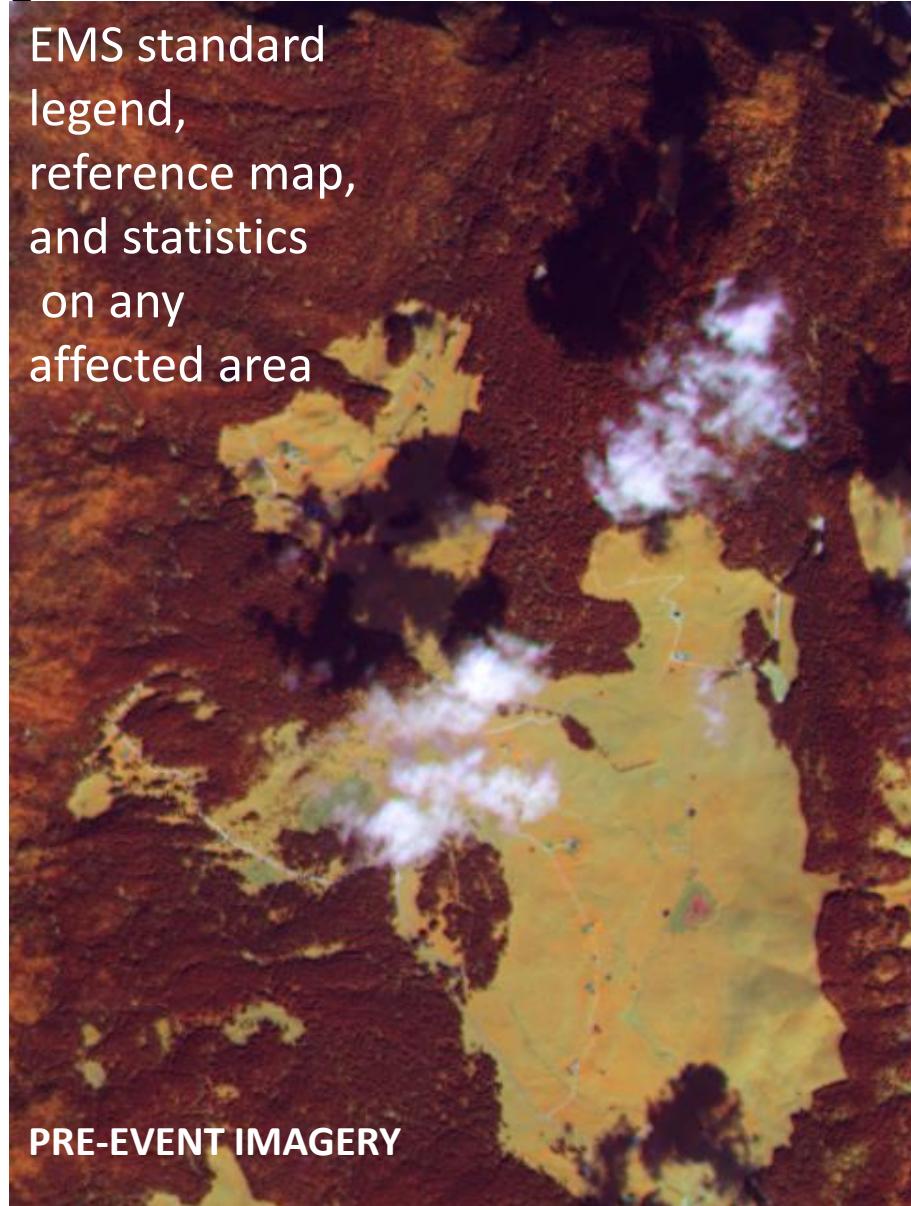
Info layer for:

- Water availability
- Ecosystem/climate effect analysis
- Legal/illegal forestry
- Wild fire damages and administrative land-use of post fire

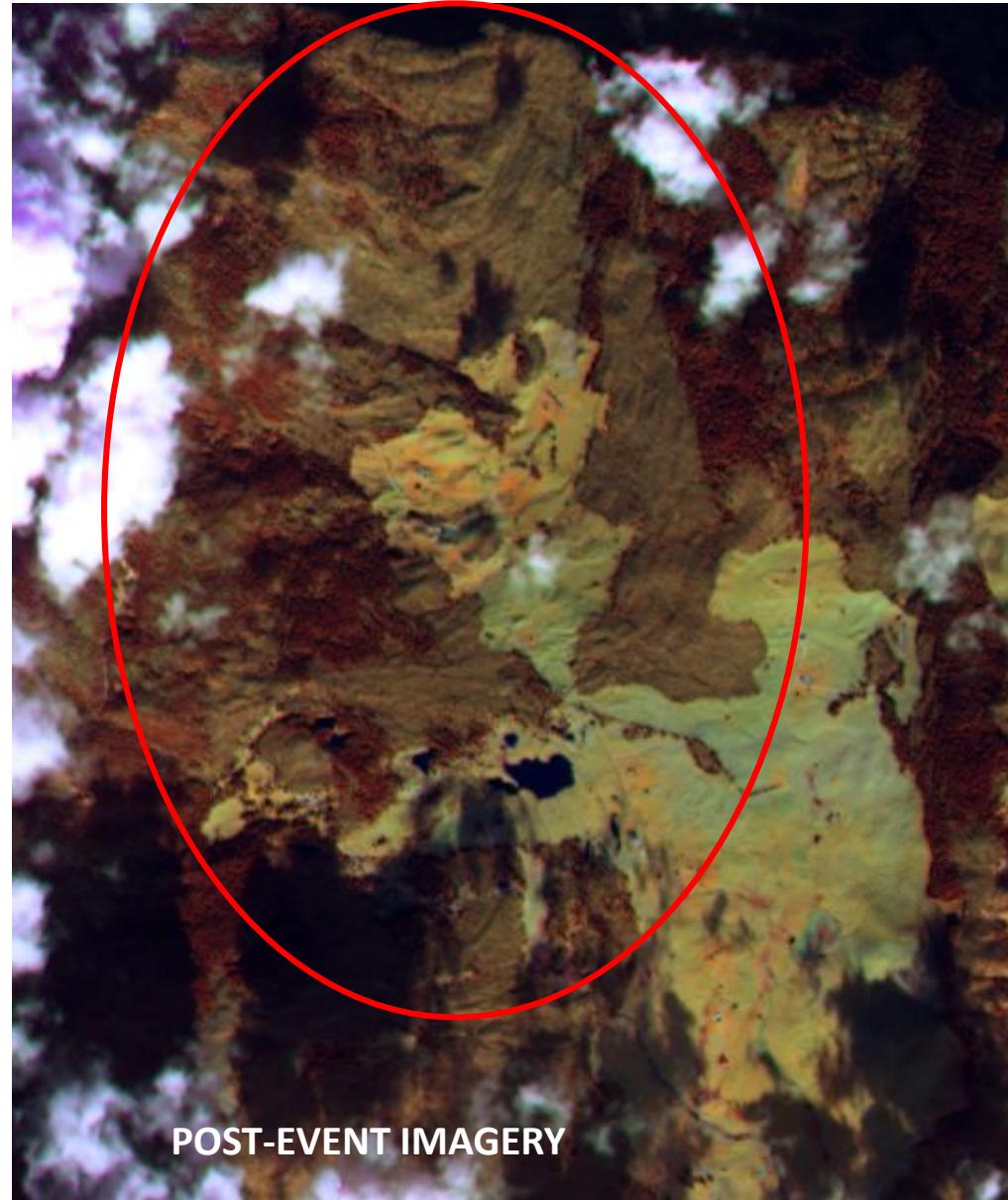


Emergency Mapping Services EMS Sentinel 2; red circle well delineates the large crash of
high valuable forest Veneto 27-30 October 2018

EMS standard
legend,
reference map,
and statistics
on any
affected area

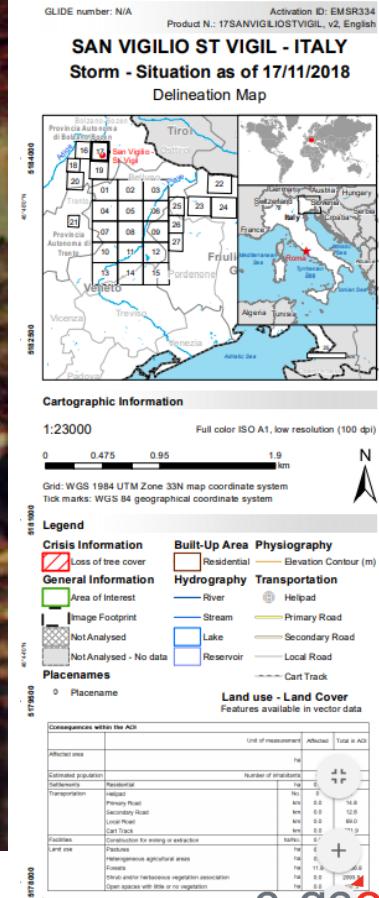


Copernicus Sentinel2 September 21st 2018



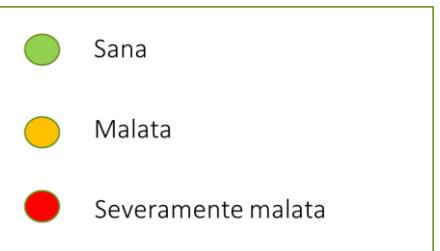
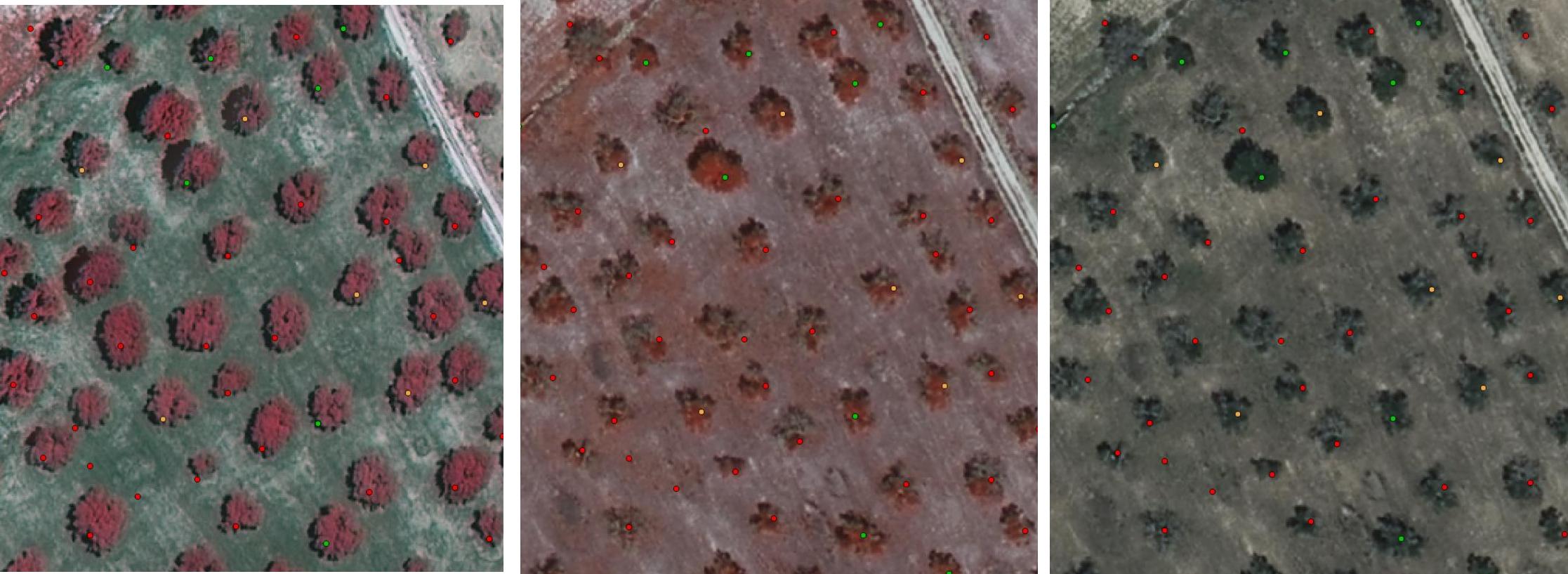
Copernicus Sentinel2 October 31st 2018

North East Italy
totally destroyed:
41,314 hectares
8,548,099m³ timber



Going in depth: use of **airborne** and **drones** for local targets: Xylella disease on Olive groves management starting from the CAP LPIS

measurable decreasing vigor on olives through the airborne acquisition cicles: the role of drones



2016

2019

Italy, Puglia region

Comments/perspectives- 1

The induction of the Agriculture sector in **Copernicus'** community of users / providers is simplifying and improving responses to the needs, giving the opportunity to **provide new and previously unthinkable “wall to wall” services** as well as information of public interest.

The availability of **Galileo** signals opens the way to more mass market applications, providing easy-to-use positioning solutions in the sector

In this innovative context, the **Geomatic Community** must have the role of **“digital transformation facilitator”** of the whole system, also beyond the CAP

Comments/perspectives- 2

CAP and Crop monitoring applications with Sentinel data **are raising worldwide** through commercial and ad hoc **platforms**

Digital technologies (Analytics, Cloud, super Computer), if applied to EO and GNSS, can provide lower cost systems

The single national Land Parcel Identification Systems **LPIS** (existing in all EU) can be updated using new cost effective **systems of Artificial Intelligence**

Copernicus EO and GNSS services can really speed **up new valuable jobs**, among:

EU/MS public administrations (national/local Paying Agencies/local assistance centers): new graphic declarations, **open GIS expert on semi-natural resources**,

Industry : experts on AI and cloud systems management

SME/scientific bodies: experts in EO innovative indexes extraction and new figures as “data scientists”