

Monitoring of Agricultural land in practice, concepts, solution, and relevance for LULUCF

Second conference on Earth Observation for Monitoring, Reporting and Verification of Carbon Removals

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The CAP: What is always at stake ?

Rural areas = 75% EU territory

50% farmed

9 millions EU farmers

6.5 millions farmers claiming subsidies



- Ensure food security in Europe and in the world

Monitoring of agricultural production and trade is crucial

- CAP: 55 000 000 000 € / year

0,3 € / EU citizen / day

Average 250 € direct aids / ha



CAP direct payments

23% of farm income on average (2020)

Check that budget is granted correctly (according to eligibility conditions):

Area eligible for payment

Farming activities or practices

→ Need of Integrated Administrative and Control System (IACS)

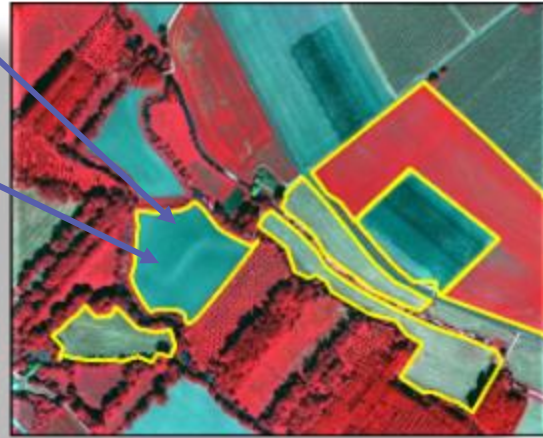


Ever evolving conditions (and tools)

Before 2003 = coupled payments (10m pixel)

Cropped area

Crop type



After 2003 CAP reform = decoupled payments

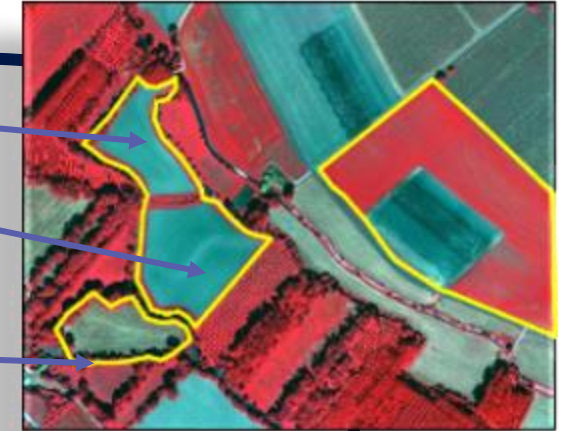
Area

Crop group

Land maintenance

Landscape elements

(1m pixel)



Through the CAP reforms, the conditions under which aid is granted change ... “

CAP 2014+

Area

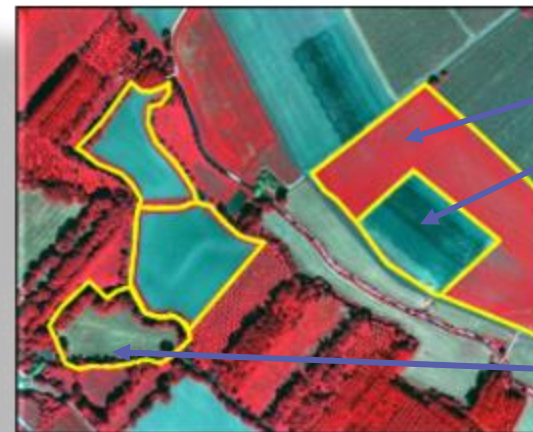
Crop type

Land maintenance

Land maintenance

Landscape features **quantification**

(0.5m pixel)



CAP 2023-2027

Area

Crop type

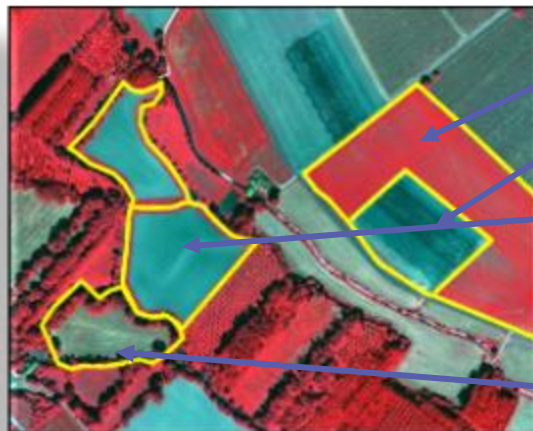
Farming practices

(Sentinel time series)

Landscape elements

quantification

(0.5m pixel)

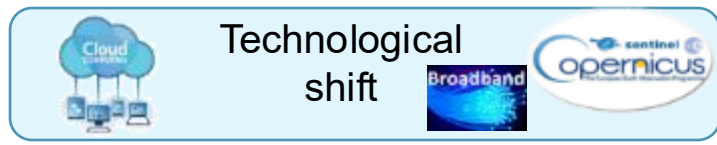


“Need to adapt tools and methods”



COPERNICUS-SENTINELS 'sudden game changer'

Free HR imagery (optical – Radar) **Weekly** available (from 2014)



On the spot check

Monitoring (2017)

Of interest for other domains

5 % sample
Few snapshots
Visual checks
Time-limited actions
Field visit



Addressing Issues of:

- ➡ Sampling
- ➡ Field visits
- ➡ Timing

Costs ↗



**All EU farms
All parcels
Regular overviews
Automated processes
All-year long monitoring
"No" field visit**



Phenological stages



To performance (CAP >2023)

Production of indicators at National level
From aggregation of agriculture parcel information

From compliance (CAP <2023)

Control of farm dossiers

Sometimes technology = legislation enabler



Need of tools to manage areas and Land Cover/Use



Early years
Surfaces declared based on cadastre (paper)



LPIS = Land Parcel Identification System

Support for declaration and checks

GSA = Geo Spatial Application

Areas and location officially and uniquely registered

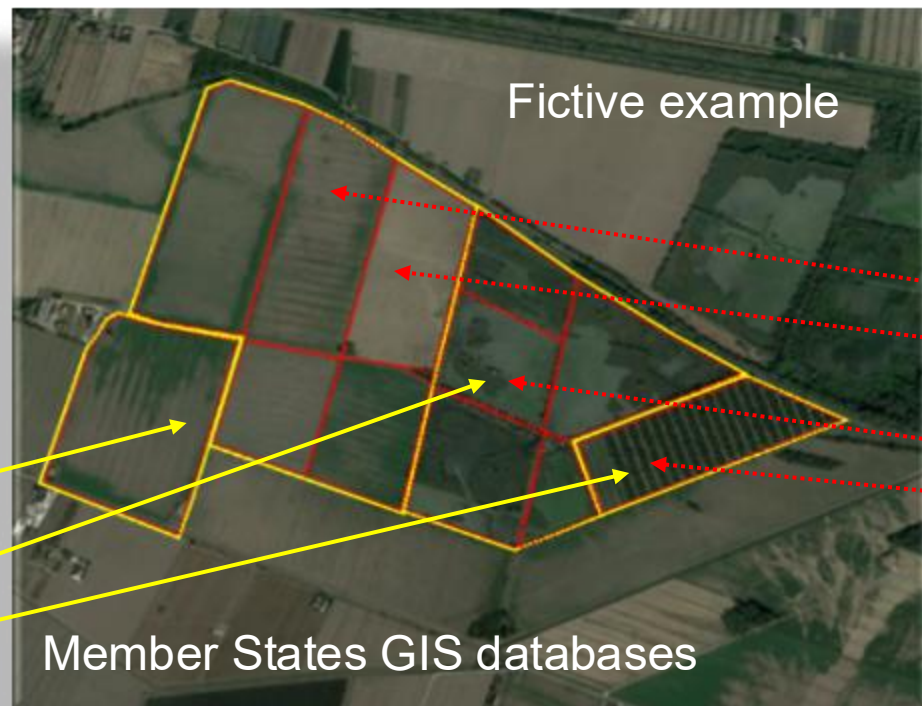
Digital since 2004

Management of agriculture eligible areas

Administration registry of stable in time Land Cover units

- Reference parcels
- Arable Land
- Permanent Grassland
- Permanent Crop

1:5.000 scale since 2015



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Regular update based on VHR images

Annual

Farmer declaration of their farming plan (land Use) + area
→ Agriculture parcels

- Wheat
- Corn
- ...
- Pasture
- Apple trees

Digital since 2018

Subject to eligibility conditions (practices)

Elements of relevance for LULUCF



Methods to check the declared Land Cover/Use

Monitoring postulation: Sentinel temporal series hold information to allow discriminating LU/LC

Wheat declared

- Markers (+ parameters)

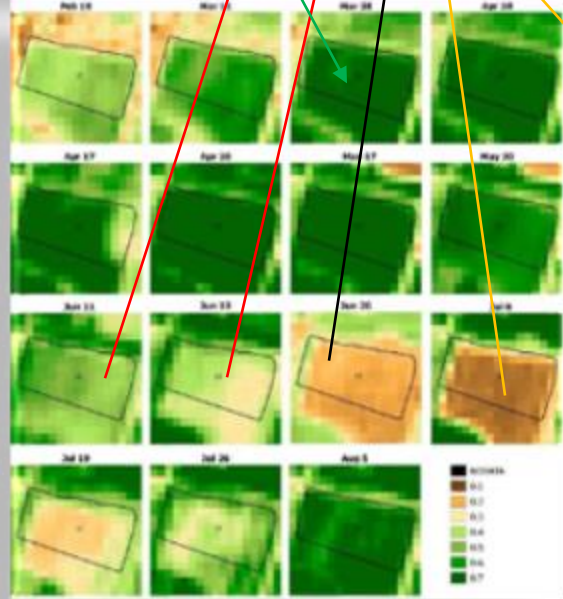
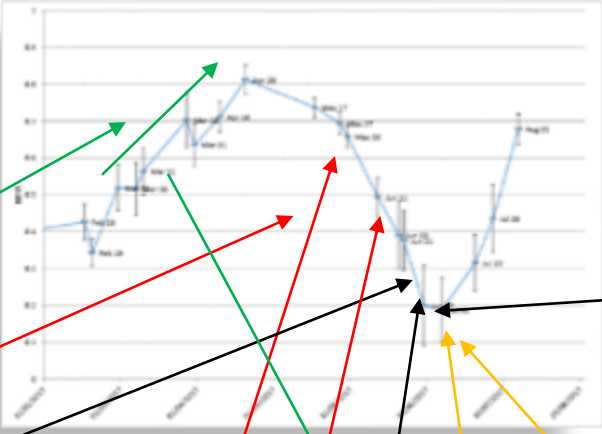
- Plant growth

- Senescence

- Harvest

Evidences of crop cycle

Evidence of agriculture activity



NDVI temporal evolution



26 June Harvested



6 July Bare soil



Visual interpretation of very large areas impossible

→ Automation necessary



Monitoring advantages

Automation of processes



Automated traffic light assignment



Out of 1900 parcels

Green = parcels confirmed as declared (Corn or grassland)

Yellow (20) = non conclusive parcels

Follow up necessary (if impact on payment)

No follow up (if no impact on payment)

Red (2) = Rejected parcels (crop different than declared)

**Area
Monitoring System
(AMS)
CAP2023+**

**Wall to wall (agriculture land)
Reliable information**

Proactive alerting message (preventing errors)



Grasslands

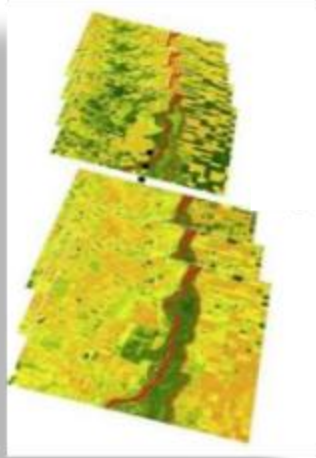
 Parcels mowed

 Parcels not yet mowed 2 weeks before deadline → Reminder message sent to farmer

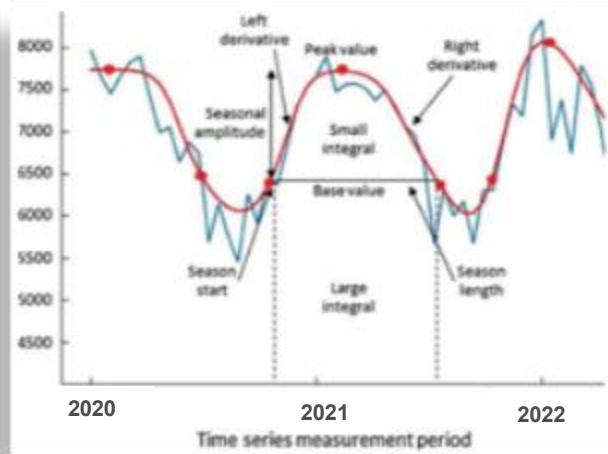
Example: Estonia (with S1 Radar data)

Monitoring: some use cases

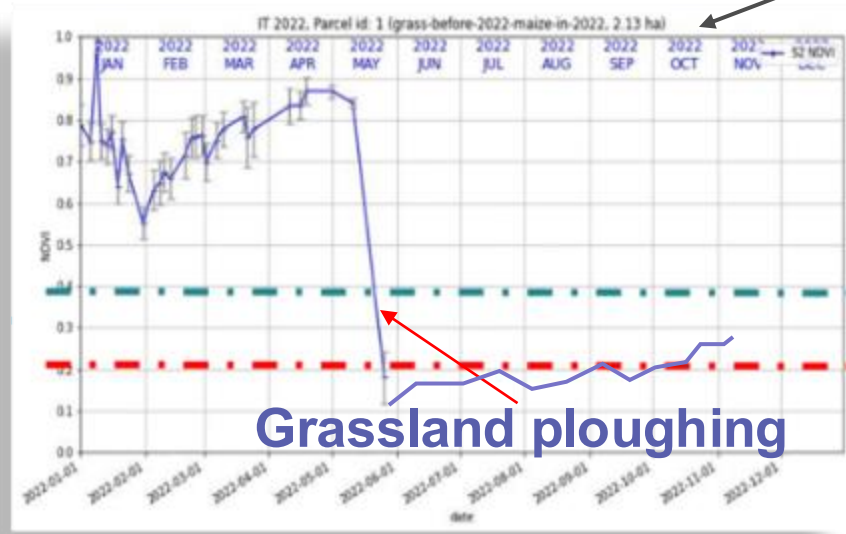
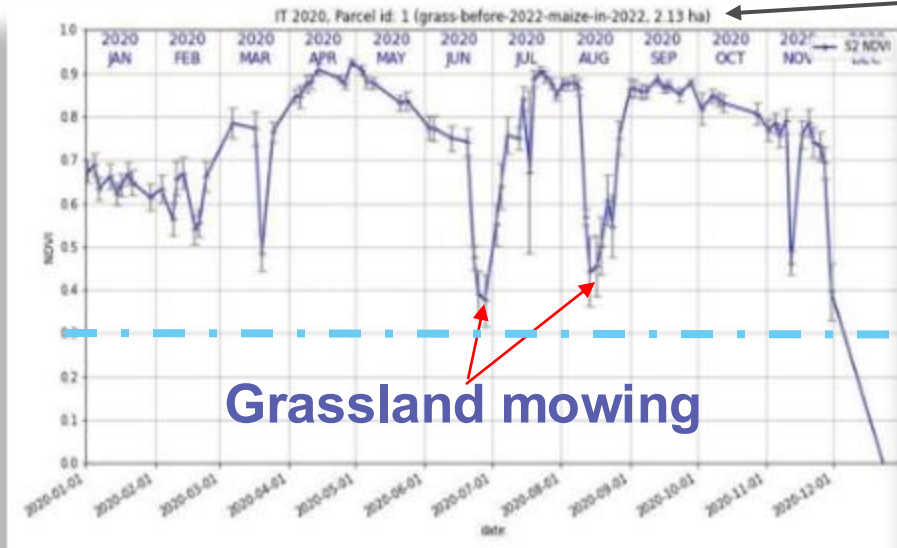
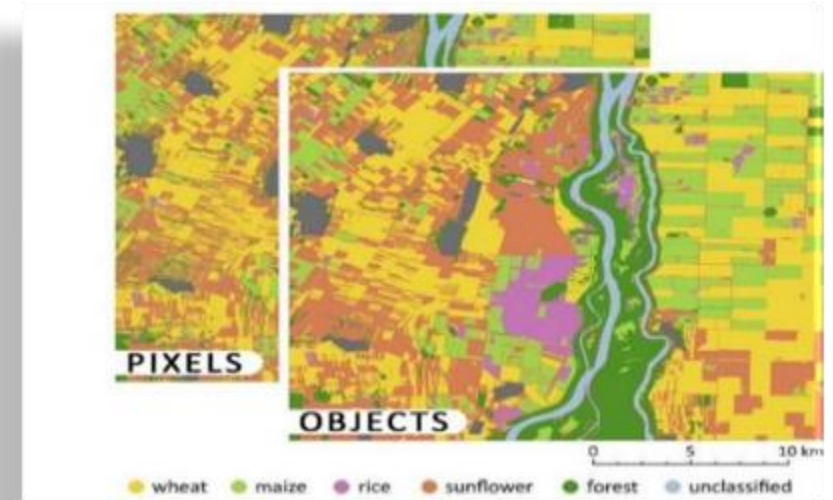
Sentinel stacks



Temporal patterns



'Say' on LU/LC



Burnt areas



Elements of relevance for LULUCF

Non monitorable with Sentinel → other tools e.g. geotagged photos or 'drones'

From farmers (or other persons)
Via mobile applet linked to IACS database

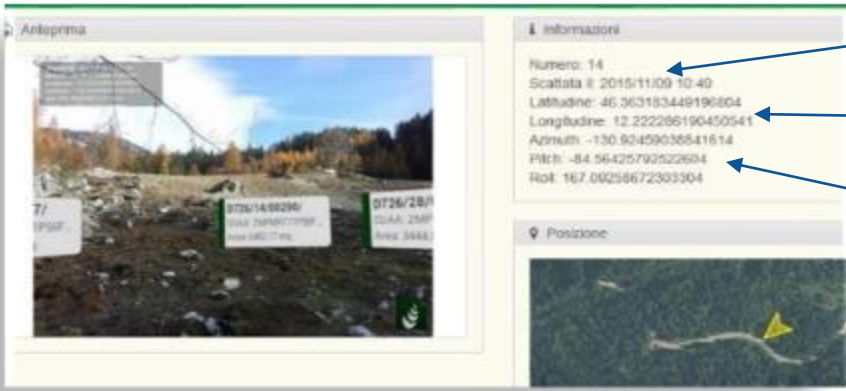
Environmentally Sensitive
Permanent Grassland
(ESPG)



Species richness



Ban of herbicides



Date - Time
Location
Orientation
AUTHENTICATED

Evidencing:

- Mowing date
- Crop mixture (catch crop)
- VCS (Durum wheat)
- Land laying fallow
- EFAs
- ...

Everything is possible

Ensure validation of outputs → reliable inputs for other purposes e.g. LULUCF



What is currently at stake ?

Necessity to produce more with less, in a sustainable way, under hectic climatic pressure
Requires more **locally adapted solutions and local knowledge for the whole EU rural areas**



Next MFF proposal (2028/2034):

Agriculture embedded in National & Regional Partnership Plans (NRPPs);
“**a single rulebook** for cohesion / social / **rural areas / agriculture.**”

Aggregation

Set a framework for the **description/recording** of **what is happening** at the level of the **units of management of land**

Where most things happen →

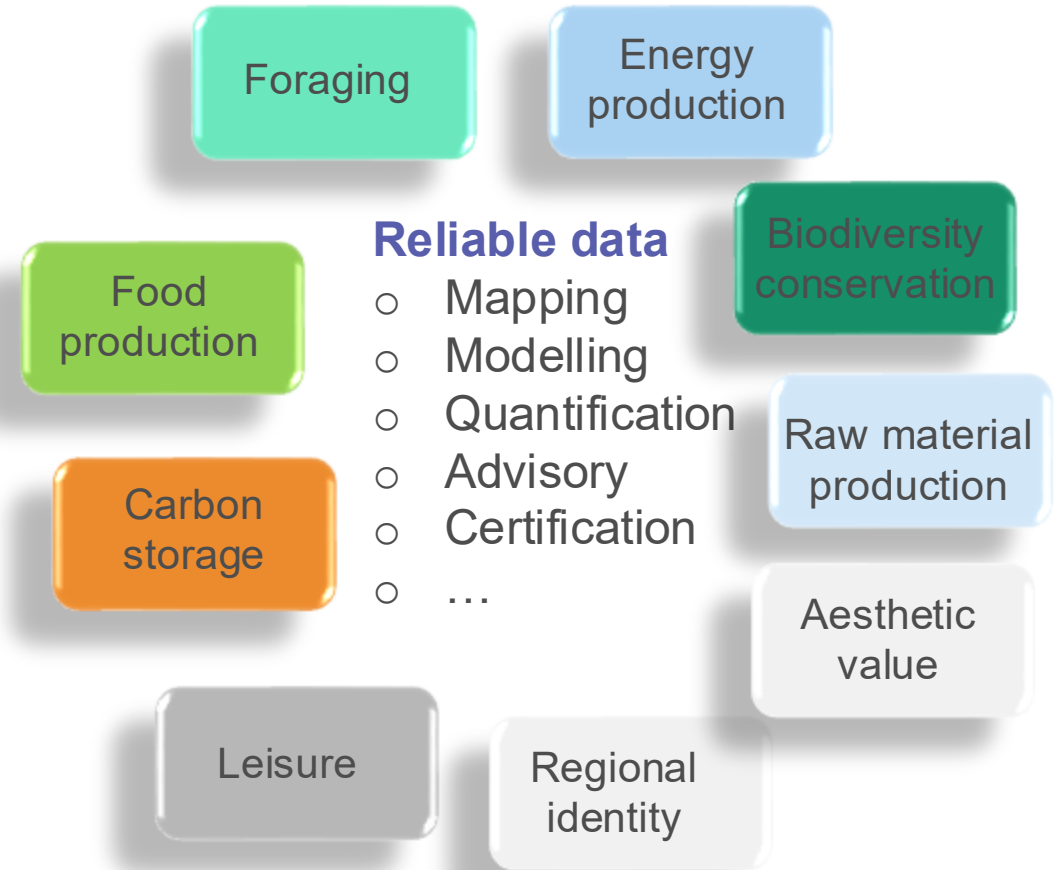
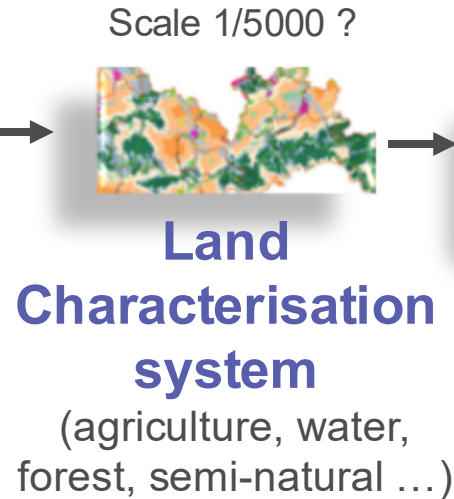
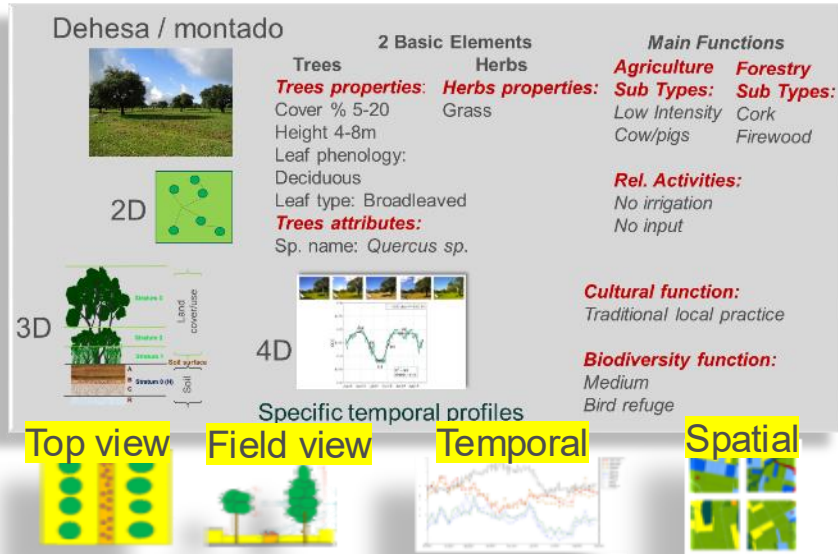


photo © creator Dall-e OpenAI

**Land Cover
Land Use
Activity
Services**

Toward an EU harmonized Land Unit characterisation system?

Taking a “**management unit**” (≈parcel)
and collect the set of
“**stable**” factual bio-physical characteristics



Objective general descriptors: **community independent**

Adhering to ISO 19144-2/3/4 standards

Supported by R&D and Earth Observation

Protocols for data collection (Sentinel, drones, geotagged photo, ...)

Protocols for data description and registration

Ensure long term provision of EO data (e.g. Sentinel Opt. and Radar ...)

Identify new, supplementary EO needs (e.g. Thermal Infra Red, Laser ...)

Solutions for policies shaping the future of rural areas

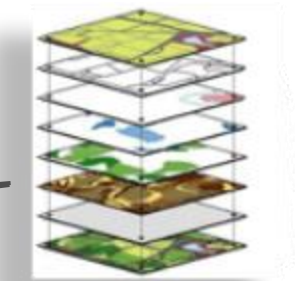


Universe of discourse

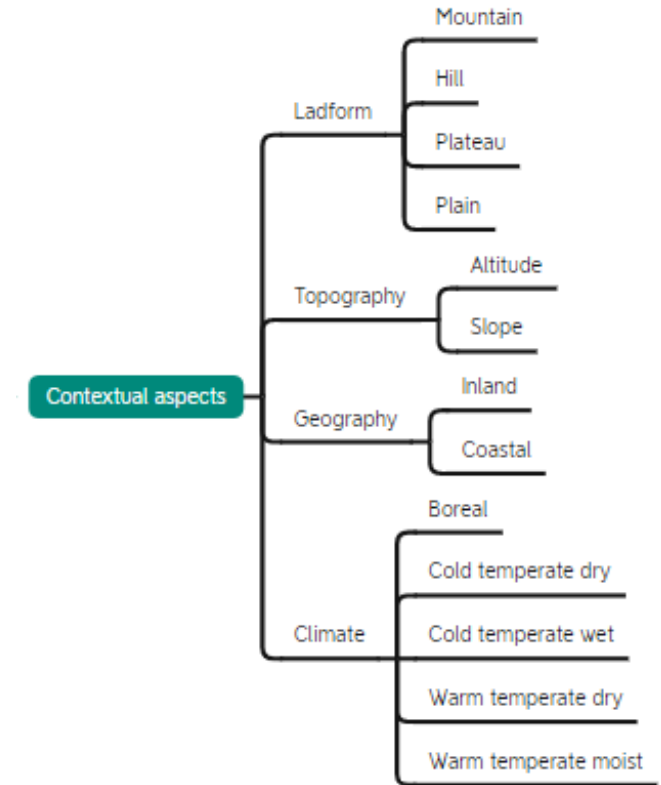
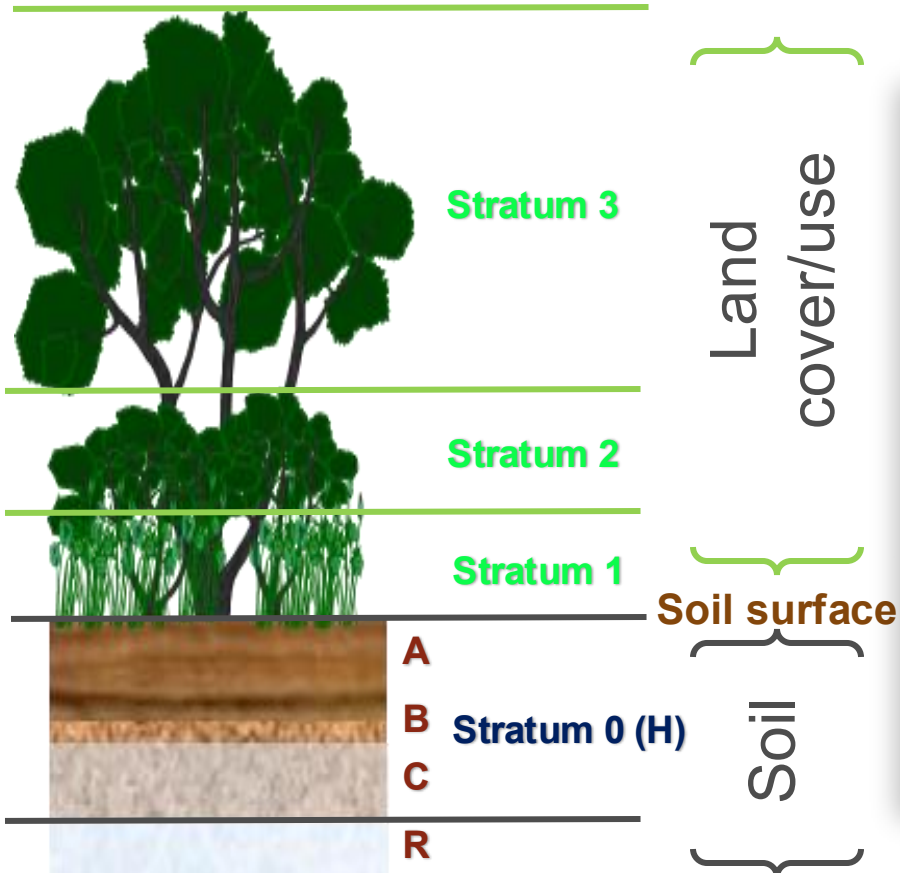
Initiating with LCLU description (areas covered by **LPIS/GSA**)

Adding soil and **contextual** (topo, climate ...) descriptions ←

Extend areas (fill agriculture land gaps, forest ...) ←



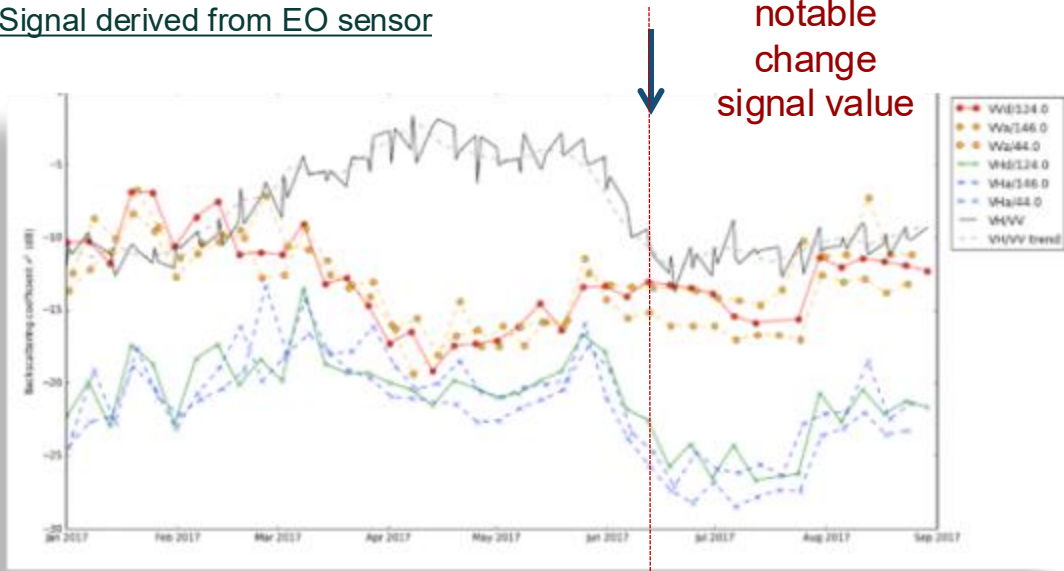
Others layers



Instantiation of Land Cover/Use descriptors

Support of monitoring

Signal derived from EO sensor



Land phenomenon



land cover event
(Harvest)

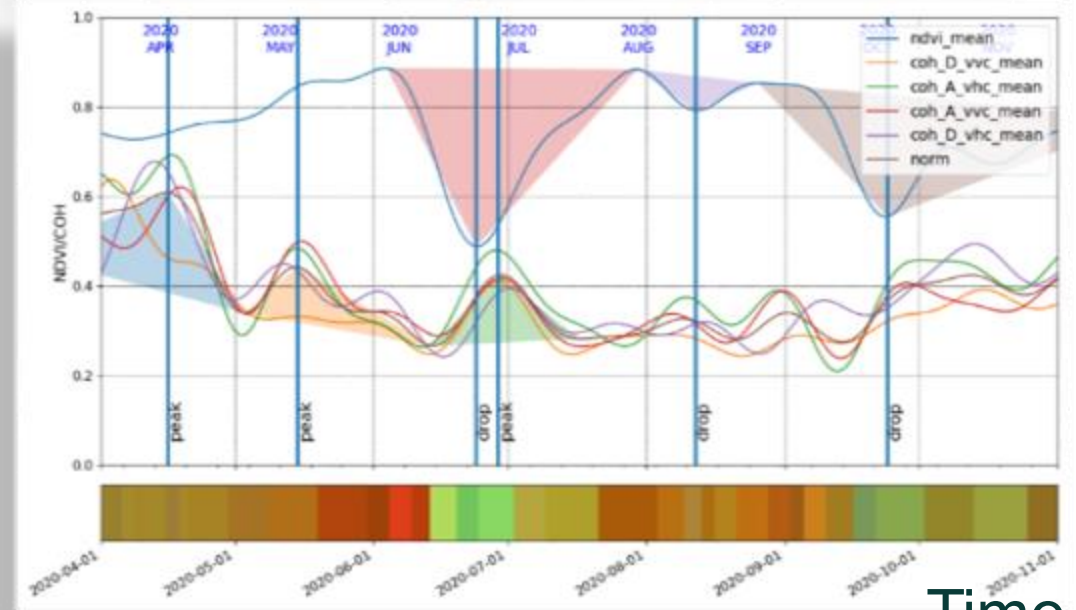
Antonio di Gregorio, "Land Cover Classification System - Classification concepts and user manual", FAO-UNEP, 2005

Time

Arable land
Cereals

Average harvesting period: 30/06 – 15/07

Framework for mowing detection using Sentinel data

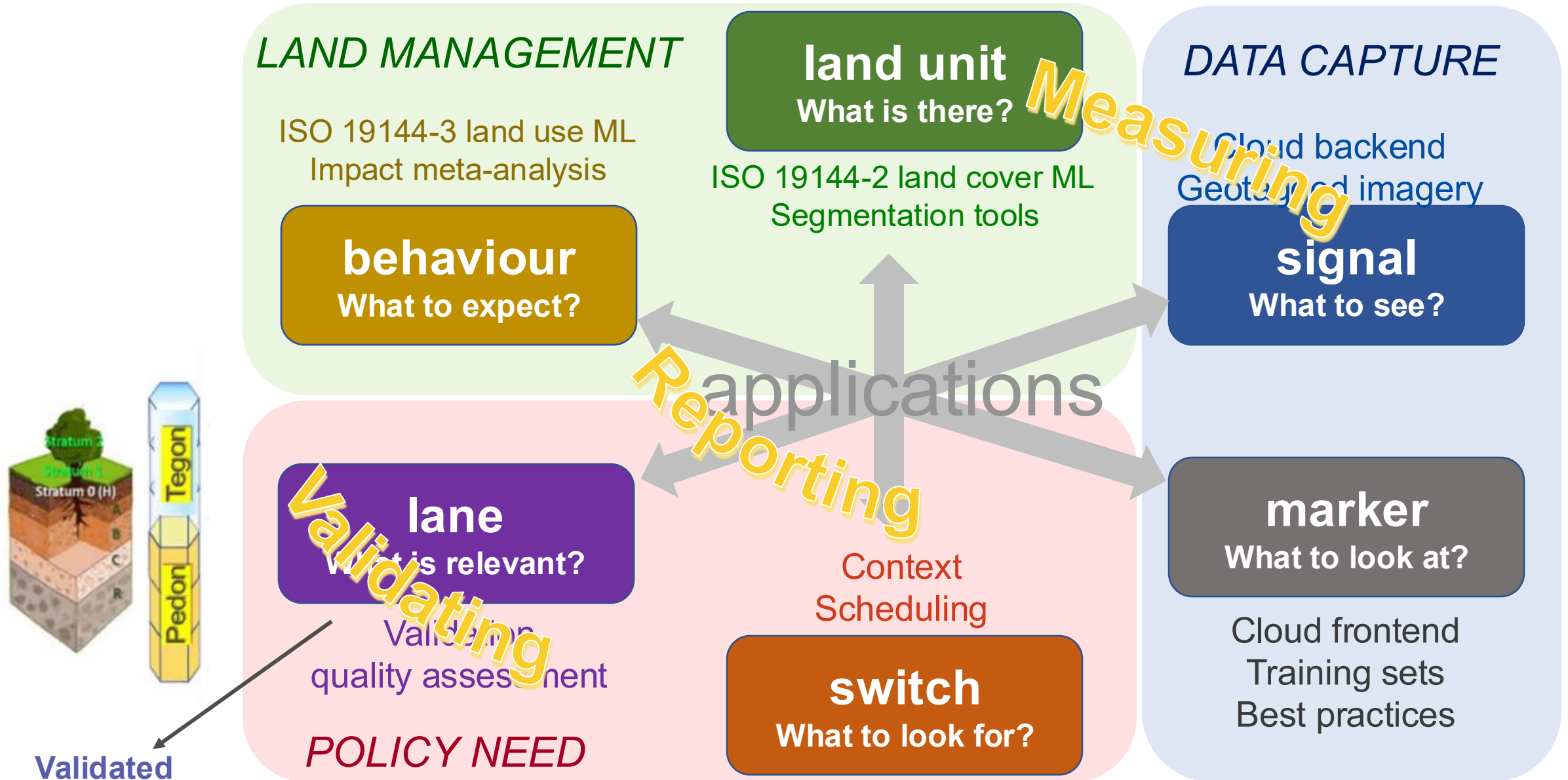


Time

Permanent grassland
Hay meadow 100% grass cover
2 mowing events / year (July – October)

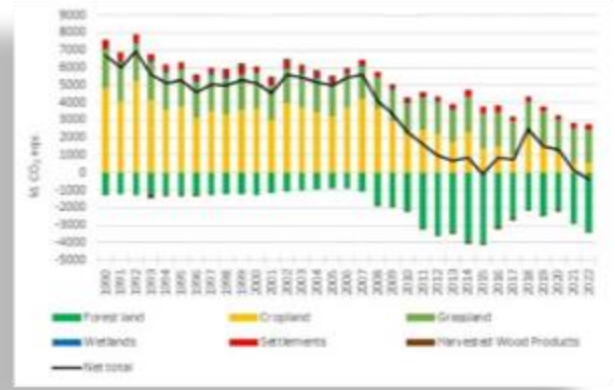
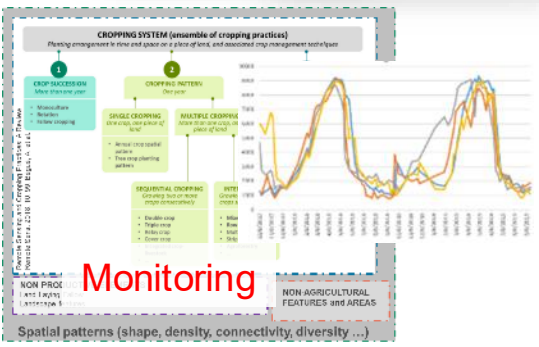
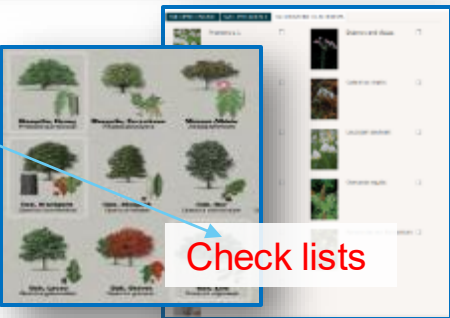
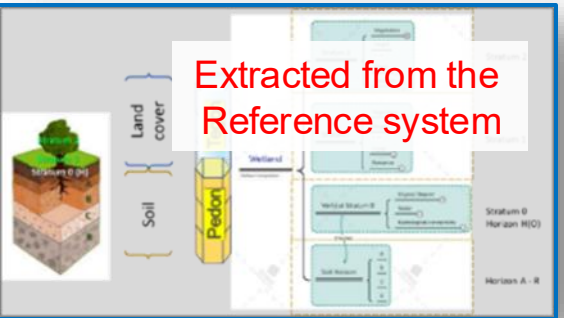


Monitoring process based on MRV concept

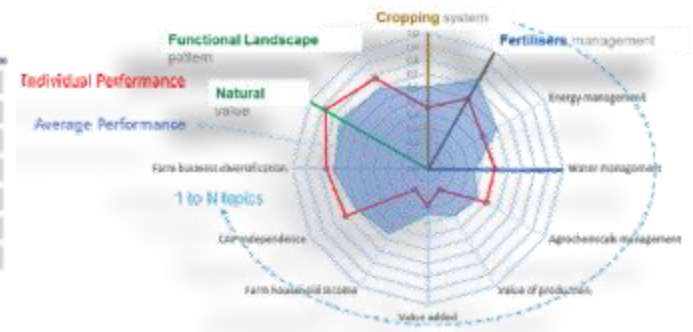


reliable inputs for different purposes e.g. LULUCF

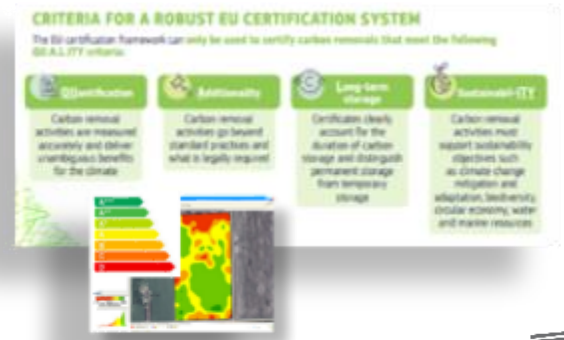
Contribution to reporting, benchmarking, certification systems



E.g. LULUCF reporting



E.g. Farm performance



E.g. Carbon removal



Main messages

- Tools, methods and protocols developed in the frame of CAP support can be of use also for LULUCF
 - Repository of LU/LC information (LPIS/GSA)
 - Management of land activities (Monitoring)
- Sentinel is the basis and complemented by other solutions
- Whole concept embedded in a MRV framework

- Trend to extend the IACS concept to the whole EU rural areas
 - Sound management of rural areas (National & Regional Partnership Plans)
 - One shop-stop for CAP and Non-CAP policies
 - LULUCF, Nature Restoration Law ...

Any questions?

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