Benjamin Koetz

European Space Agency

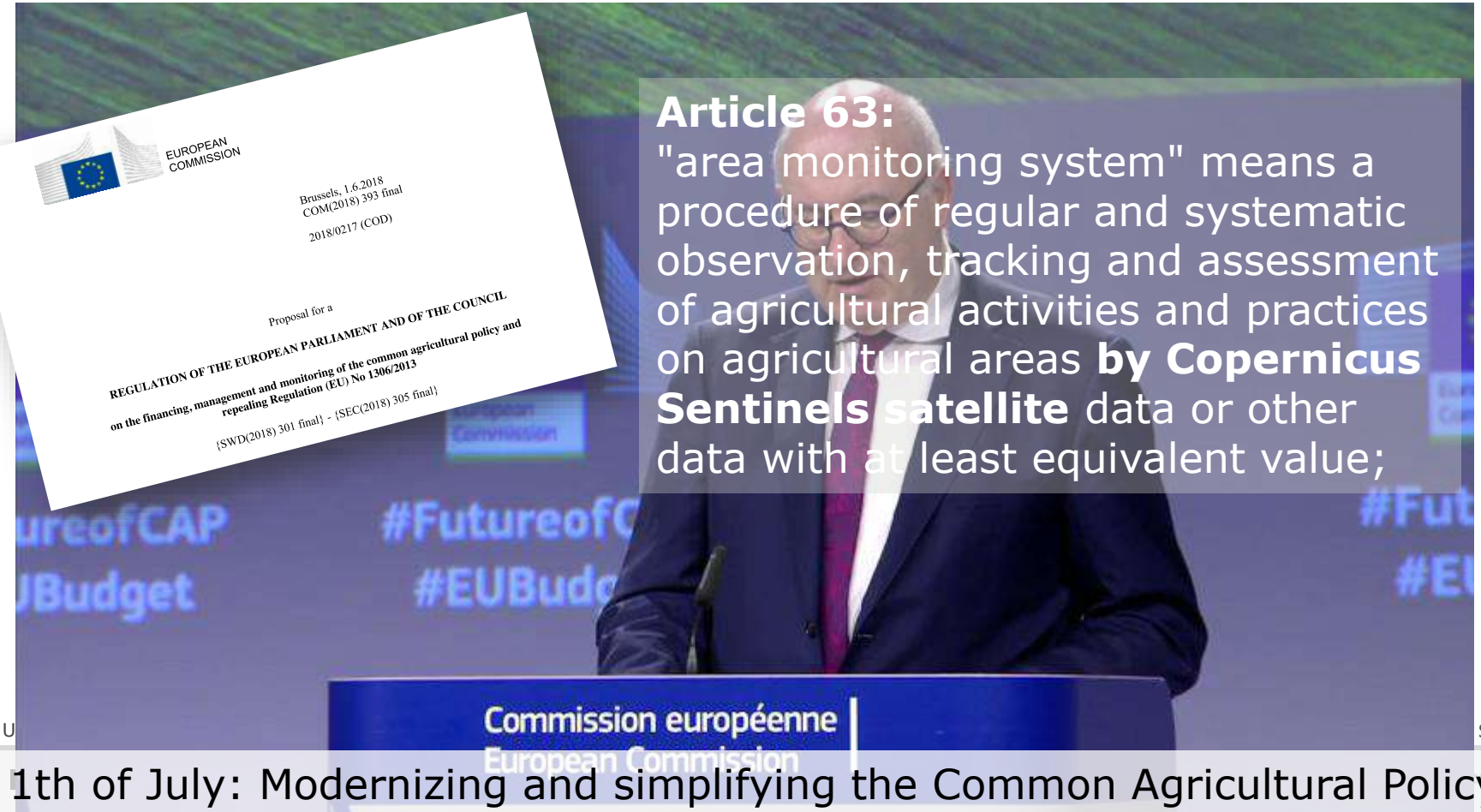
sen4cap
common agricultural policy

Sentinels for CAP monitoring approach

Benjamin Koetz & Sen4CAP team

European Space Agency, Earth Observation Directorate

Uptake of Copernicus within the CAP 2020



Article 63:
"area monitoring system" means a procedure of regular and systematic observation, tracking and assessment of agricultural activities and practices on agricultural areas **by Copernicus Sentinels satellite** data or other data with at least equivalent value;

1th of July: Modernizing and simplifying the Common Agricultural Policy

CAP Monitoring Approach – Technology meets Policy

sen4cap

common agricultural policy

esa European Commission Copernicus

Sen4CAP Objectives:

- **Provide evidence** how Sentinel derived information can support the modernization and simplification of the CAP **in the post 2020 timeframe**
- Provide **validated algorithms**, **products**, **workflows** and **best practices** for agriculture monitoring relevant for the management of the CAP

Sen4CAP – Expertise, Technology & Collaboration

Paying Agencies & Farmers

Steering Committee

DG-Agri, JRC, DG-Grow

EO Experts

UCL Université catholique de Louvain · e-geos · gisat · SINERGISE

Copernicus

Open Source

sen4cap common agricultural policy

Cloud Technology (DIAS)

Continuous Monitoring

Validated Performance

National Demonstration

Innovative Practices

CAP2020 Reform

Sen4CAP Pilot Countries

User Requirements and Engagement

1. Analysis existing **recommendations** of a range **PA workshops** and from the **CzechAgri pilot study**
2. Survey of the **6 pilot PA** involved in the project **questionnaire** + **interviews**
3. Dedicated **User Requirement Workshop** for consolidating requirements
4. **1st Evidence presentation** to the Committee for Direct Payments, March 2018
5. Participation to the **Common Technical Specifications** process (led by JRC)

Panta Rhei
EUROPEAN AGRICULTURE PAYING AGENCIES PLATFORM

From Satellites to Compliance - IACS use cases

Use case
Crop diversification
Permanent grassland identification
EFA-Land lying fallow
EFA-Catch crops
EFA-Nitrogen-fixing crops
Land abandonment
Interactive visualization
LPIS update
Claimless system

Prototyping – Development & Testing at EU level

Use Cases w/ Paying Agencies

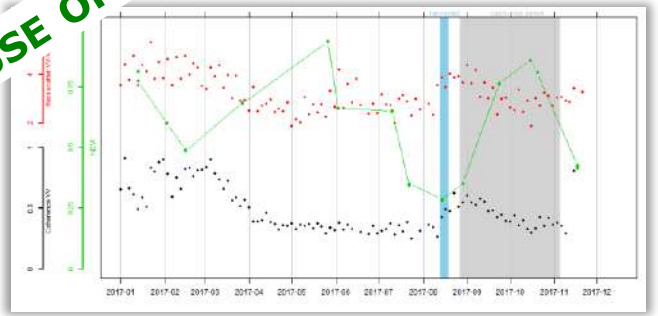
Identify Sentinel-based markers for CAP Monitoring

- Crop type mapping
- Vegetation growing indicator
- Grassland mowing detection
- Agricultural practices monitoring

Crop type information & vegetation growing indicators

FULL USE OF SENTINEL TIME SERIES

Number of detected mowing

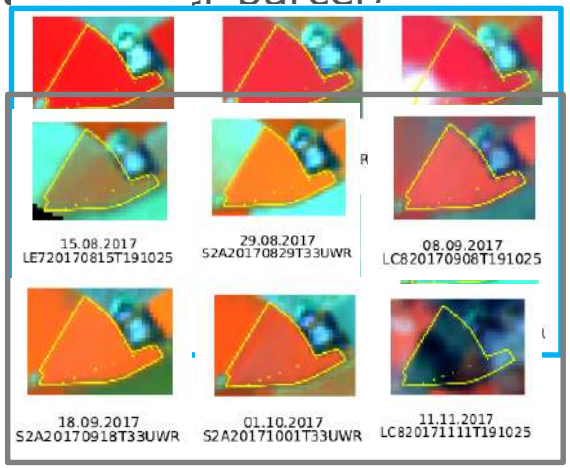


Monitoring of Agricultural Practices

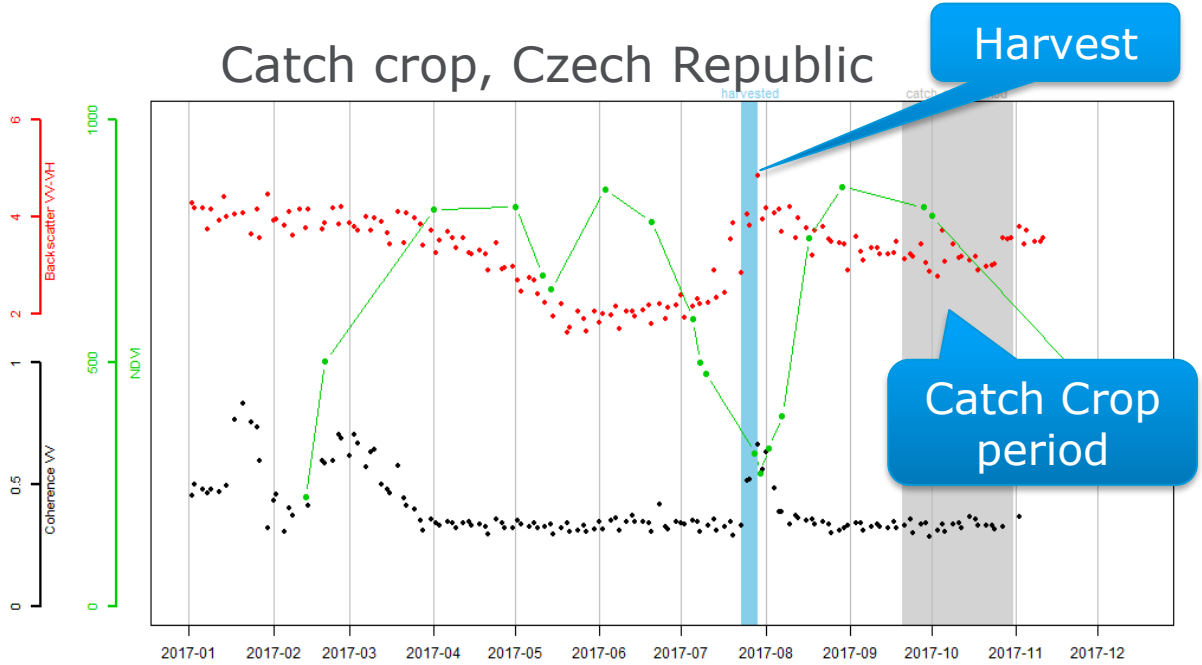
- IACS use case: Ecological Focal Area compliancy (5% area for farms >15ha)
  - based on S1&2 time series – 5 markers tracing crop activities

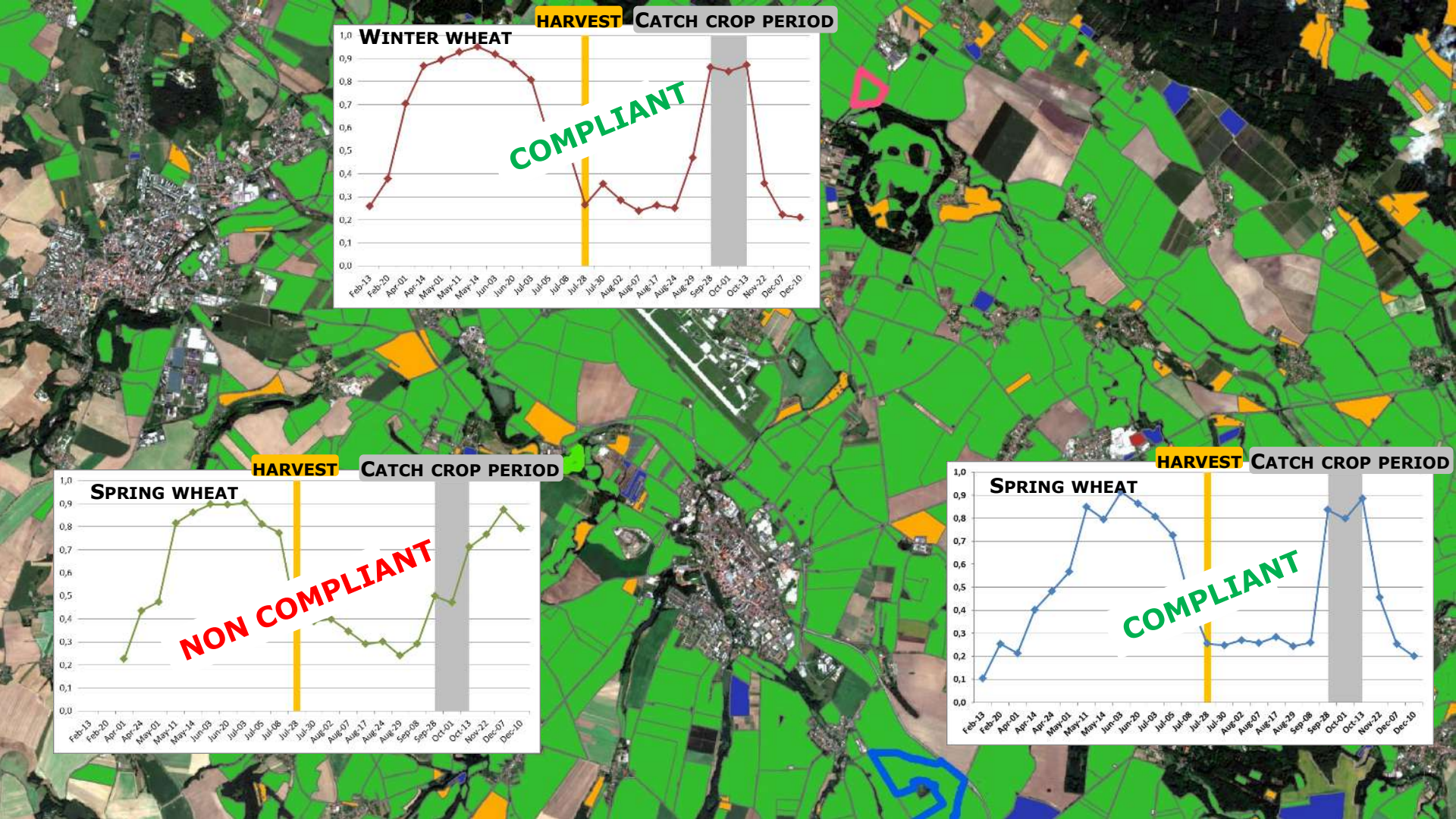
Outputs (per parcel)

- Harvest + Visual check
-
-
-



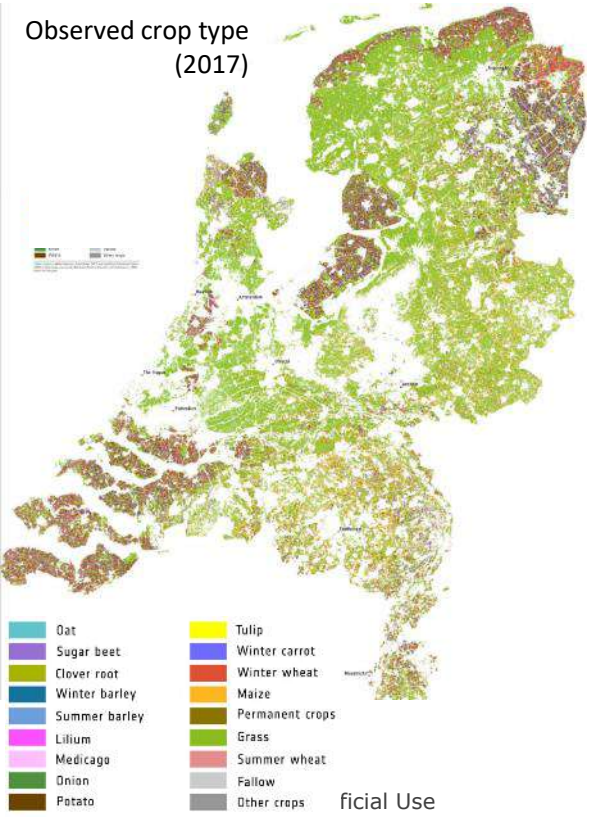
Winter Catch Crop – Visual check

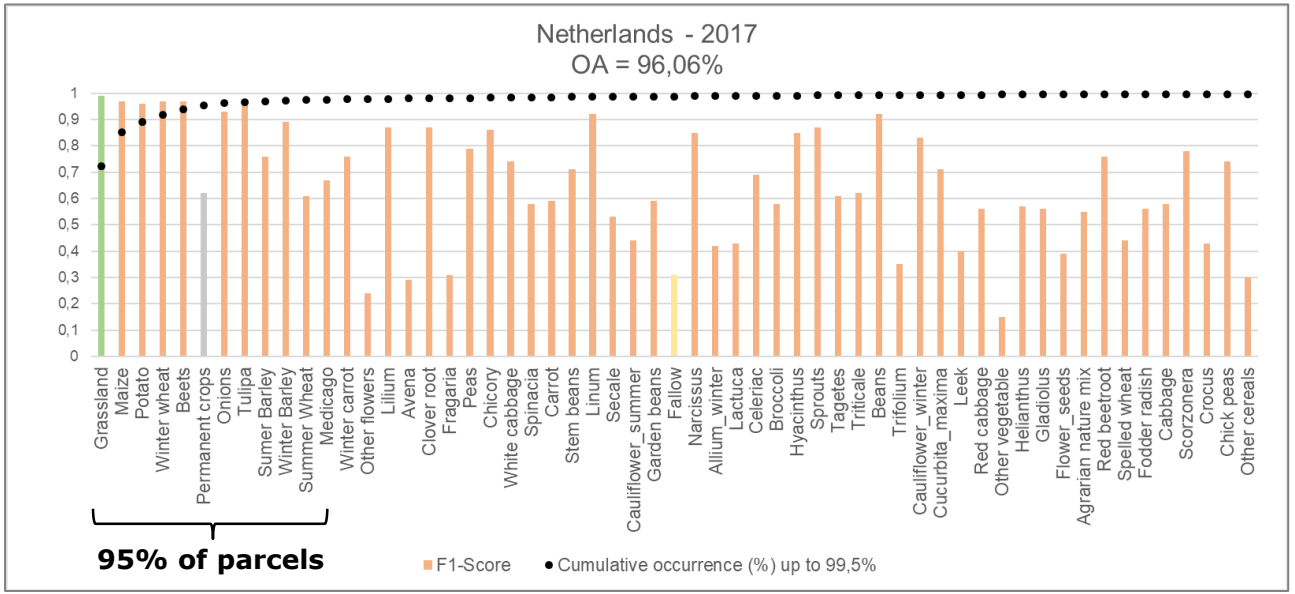



HARVEST
CATCH CROP PERIOD
WINTER WHEAT
COMPLIANT
HARVEST
CATCH CROP PERIOD
SPRING WHEAT
NON COMPLIANT
HARVEST
CATCH CROP PERIOD
SPRING WHEAT
COMPLIANT

Crop type mapping for crop diversification monitoring
Netherlands

Observed crop type (2017)

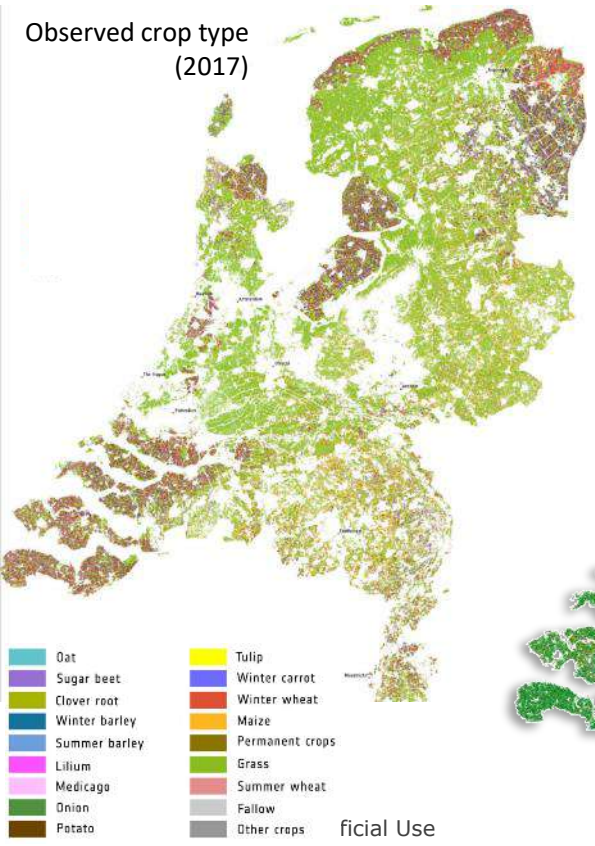




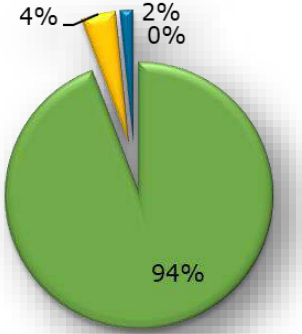
Full Resolution Visualization Online:
http://www.esa.int/spaceinimages/Images/2018/05/Crop_map

Crop Diversification Monitoring - Netherlands

Observed crop type (2017)

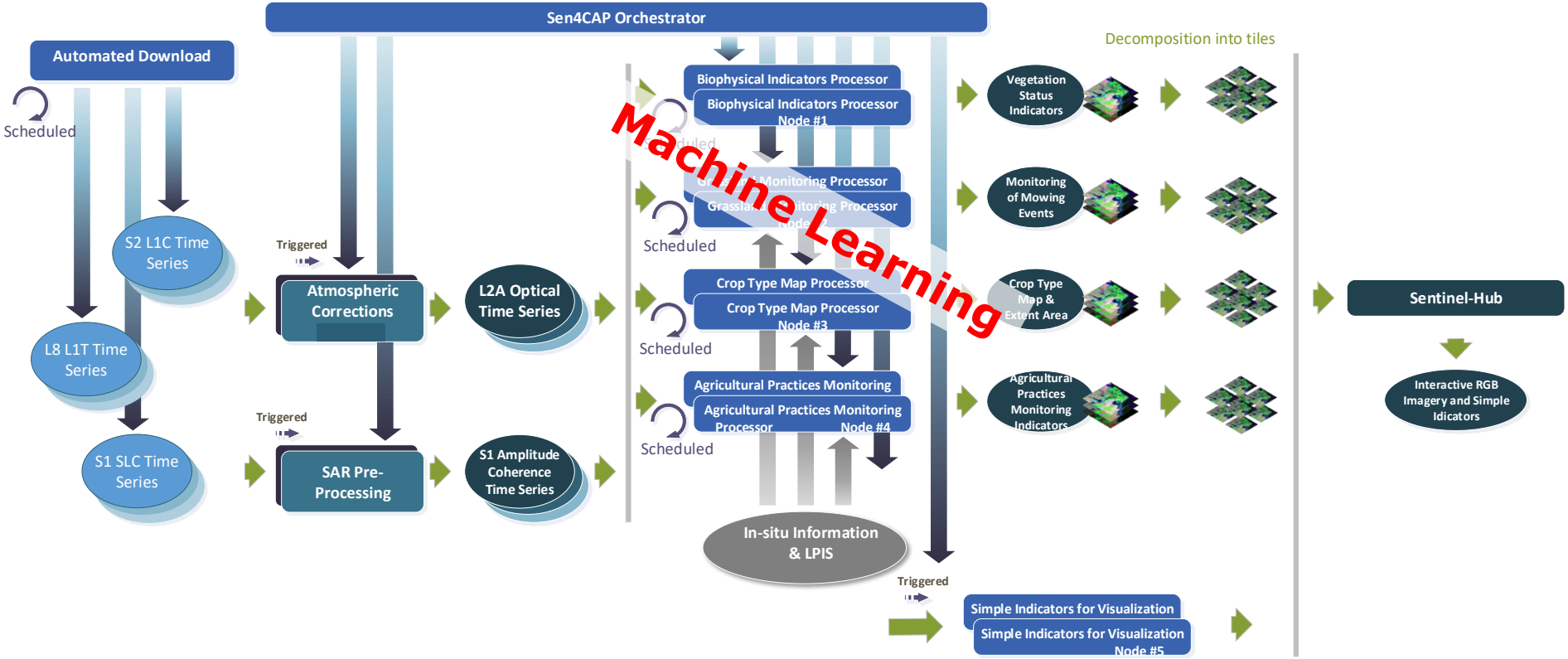


Confidence indicator of agreement (2017)



- High confidence in agreement
- Average confidence in agreement
- Weak confidence in agreement
- High confidence in disagreement

Design of Sen4CAP processing system

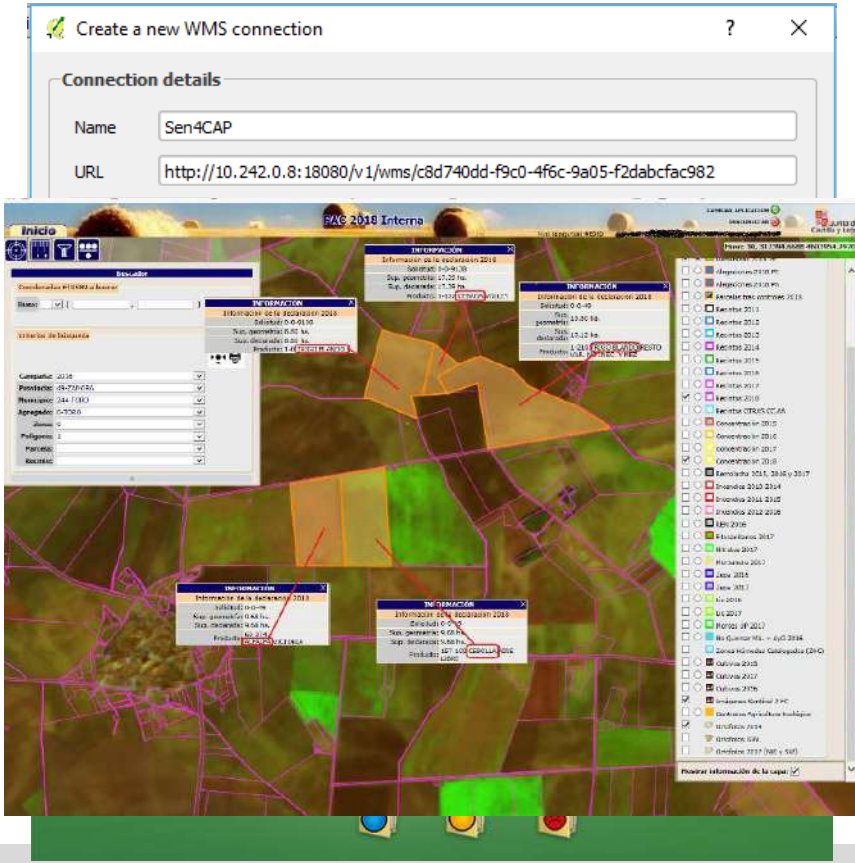


Towards uptake by Paying Agencies

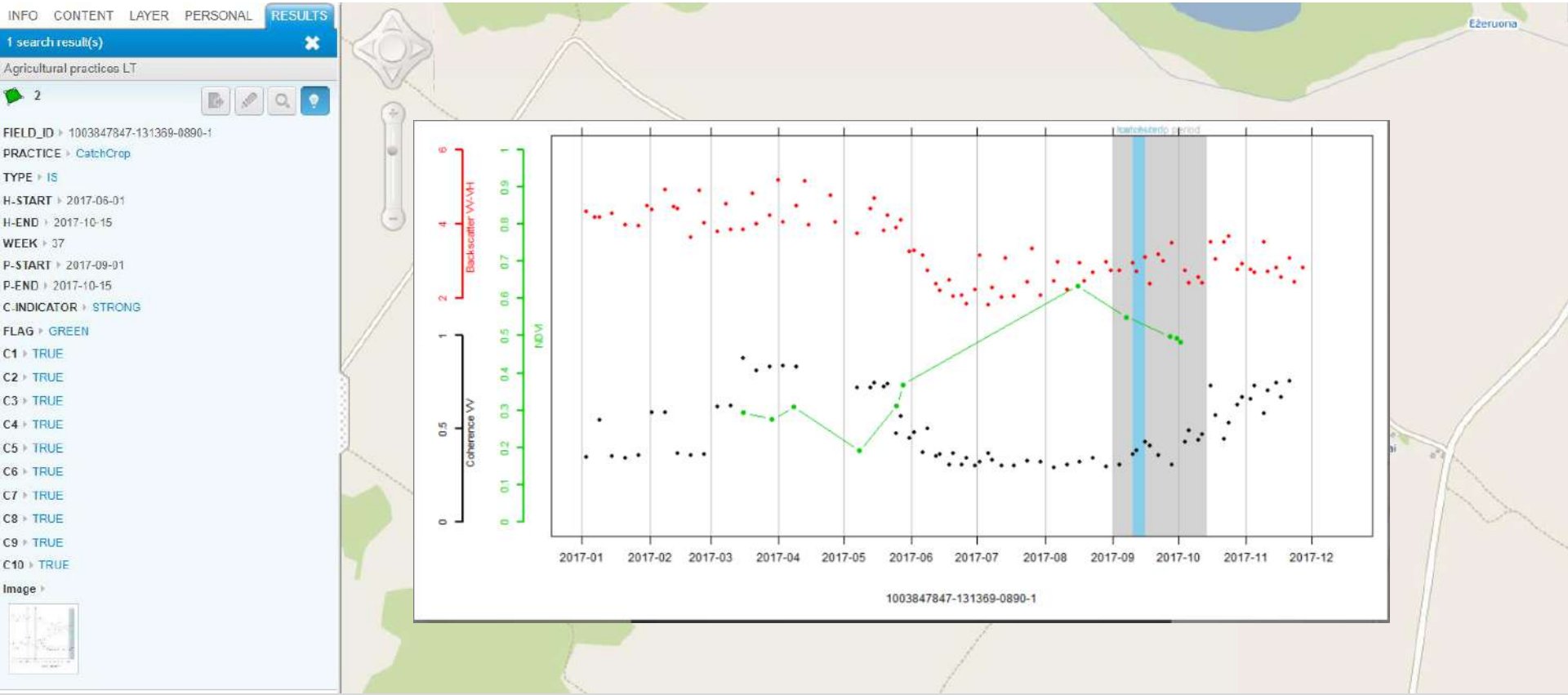
Integration of S1 & S2 images, EO products & markers in PA's environment

WMS providing RGB imagery and simple indicators

- Easily integrated in PAs environment
- S1, S2 & L8 images
- Vegetation Indicators (NDVI, LAI, Fcover, FAPAR)
- Time filtering
- Configurable visualization
- Reprojection to local coordinate systems
- Customizable by country



Visualisation tool – Compliancy at parcel/farm level

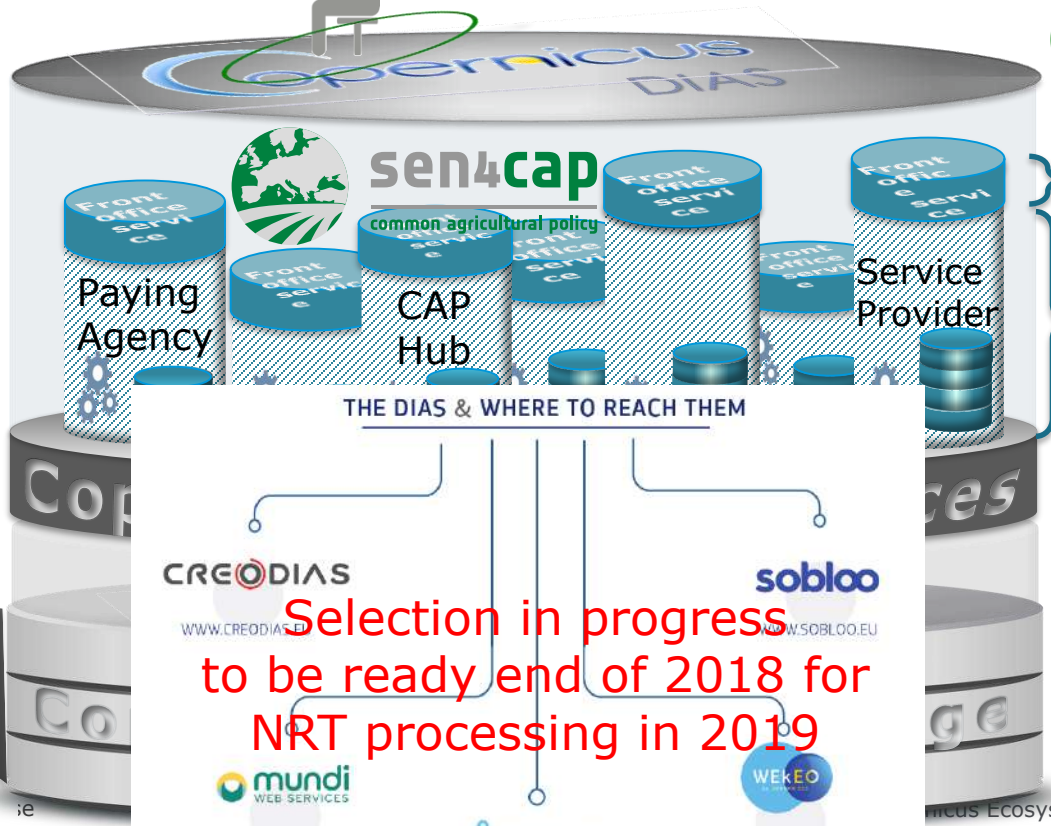


From National to European scale (indicative)

	Czech Republic	Italy	Europe
Input EO data (2016-2019)	26 TB	128 TB	3 PB
Output L2 data (2016-2019)	31 TB	137 TB	4 PB
Output L3 data (2016-2019)	14 TB	50 TB	1.5 PB
Pre-processing resources (ongoing)	16 cores, 90 GB	48 cores, 230 GB	1000 cores, 6 TB
Products & distribution resources (ongoing)	28 cores, 72 GB	62 cores, 144 GB	1000 cores, 3 TB

DIAS – Possible Sen4CAP Cloud Implementation

End user: User of the third-parties services (Paying Agencies)



Selection in progress
to be ready end of 2018 for
NRT processing in 2019

Sen4CAP: An European Effort to prepare for CAP2020

- Open & operational Sentinel time series enable CAP monitoring approach
- Integration in PA operations for IACS implementation essential
- Sen4CAP tools support automated, E2E monitoring at large scale
- Cloud computing on DIAS will allow for national to European up-scaling
- Open source approach for direct and customizable uptake & sharing

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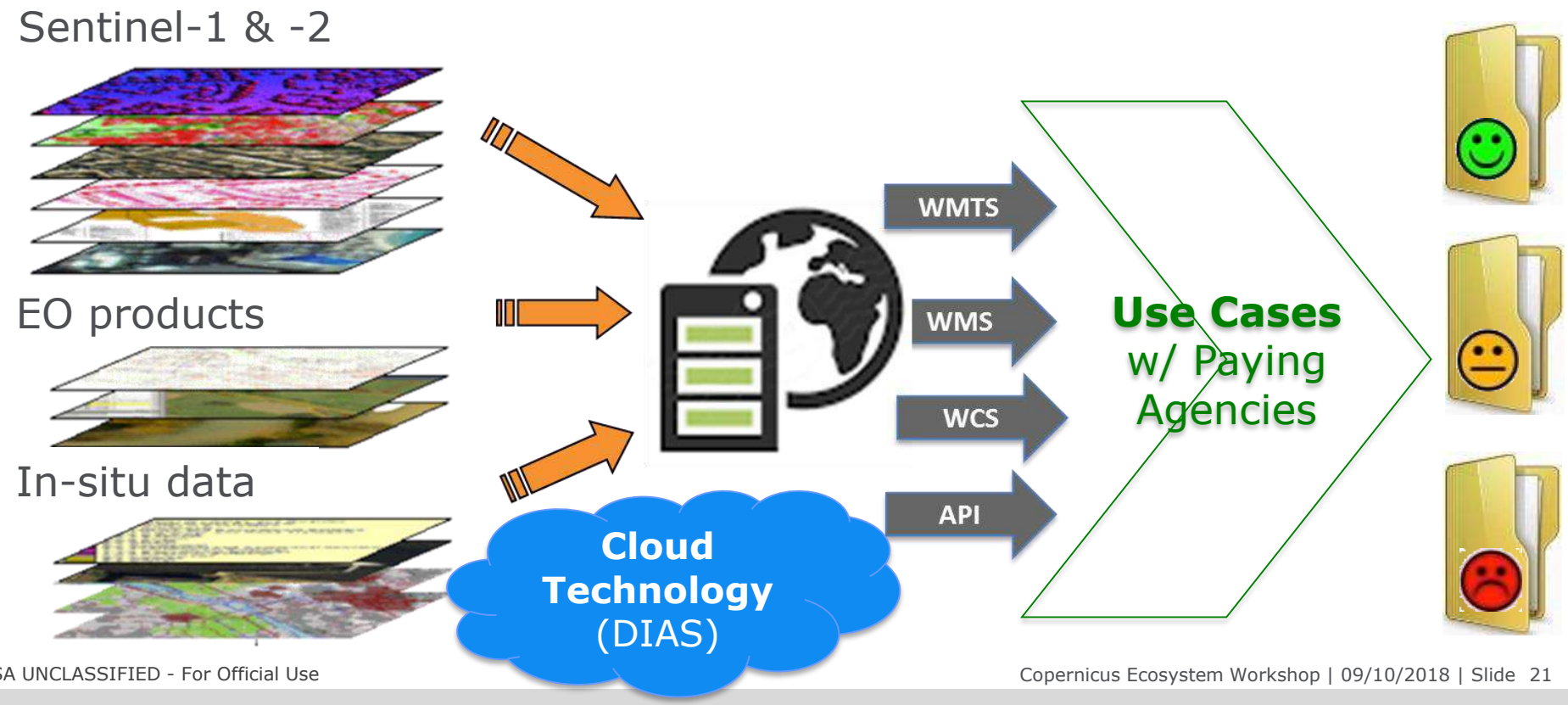
2018/19: National Demonstrations

http://esa-sen4cap.org

Backup

From Satellites to Compliance Decision



2018 in situ data collection

- Subsidy applications for 2018

- On-The-Spot-Check (OTSC) data

Farmers interview for grassland mowing and agri. practices

- Interactions by e-mails
- 250 to 500 fields surveyed by practice (grassland, crop harvest, catch crops, nitrogen fixing crops, fallow land)

ID	Unique parcel ID	Area	MOWING 1											
			Mowing						Additional Information					
			FROM	(+/- days)	TO	(+/- days)	Extension (parcel area %)	Mowing practice	Drying	Baling	Bales of hay on the parcel	Removal of bales	Other
1	XXXX													
1	Comment													
2	XXXX													
2	Comment													

ID	Unique parcel ID	Area	Main crop	EFA type	Seedbed preparation for main crop		Sowing of main crop		Harvest of main crop		Handling of main crop residues	
					FROM	TO	FROM	TO	FROM	TO	FROM	TO
1	XXXX											
1				Comment								
2	XXXX											
2				Comment								

Developing & Testing at EU level

- **National S1 & S2 coverage for pilot countries** – Pre-processing of 100TB/year

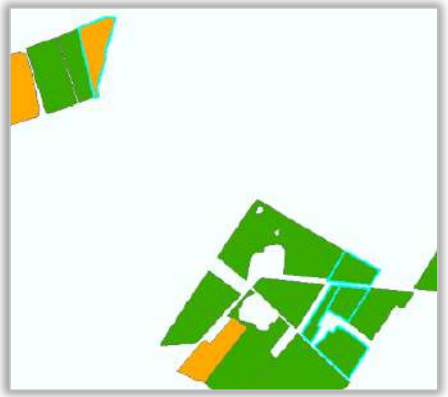
Romania: 238.397 km²
S2: 2.4 TB + 6.9 TB

Netherlands: 41.543 km²
S1: 1220 scenes ≈ 6.7 TB

- **In-situ data sets shared by Paying Agencies**
  - LPIS/IACS datasets, subsidy applications, physical inspections, CwRS
- **Sampling heterogeneous EU agricultural landscape:**
  - LPIS types: Cadastral (IT, ES), Physical Block (NL, LI, RO), Farmers Block (CZ)
  - Field sizes: Minimum: RO & IT 72-85% < 1ha, Maximum: CZ 66% > 1ha
  - Landscape & climate: wide geographical range
- **➔ Algorithm Development, Benchmarking & 1st Validation**

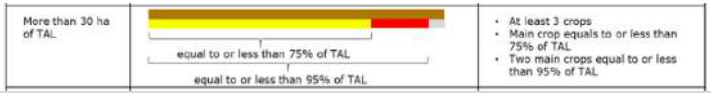
Crop diversification monitoring at Holding Level
Lithuania

Crop type mapping for crop diversification monitoring - Lithuania



Compliance indicator of agreement at parcel-level

- High confidence in agreement
- Average confidence in agreement
- Weak confidence in agreement
- High confidence in disagreement



VALDA	Area	Conformity	CT_decl	CT_pred_1	Status	C_Indic
100476xxxx	15676	0	Lupin	Beans	Assessed	Insufficient evidence
100476xxxx	15102	0	Grassland & Meadows	Grassland & Meadows	Assessed	Compliant
100476xxxx	8927	1	Grassland & Meadows	Grassland & Meadows	Assessed	Compliant
100476xxxx	10731	0	Oats	Oats	Assessed	Compliant
100476xxxx	6177	1	Spring barley	Spring barleay	Assessed	Compliant

56,6 ha

4 crops

Grassland & meadows	42%
Lupin	28%
Oats	19%
Spring barleay	11%

✓

Compliant at holding-level

Available information:

- ✓ Total area of arable land at the farm-level
- ✓ Number of crops at the farm-level
- ✓ Proportions of the main crops

Sen4CAP project: Main Goals and Activities

- **Identify & specify EO products** suitable to increase the efficiency, traceability & reducing the costs of the IACS
- Develop **algorithms (ATBDs) along with open source code** for agricultural EO products based on Sentinel-1 & -2
- **Demonstrate and validate the agricultural EO products** up to national scale
- Assess **the utility of Sentinel products within IACS procedures** at EU and national level for a range of Paying Agencies representative for the heterogeneous agricultural practices, parcel sizes, landscape & climate in the EU
- Prepare and **facilitate the transfer of developed EO algorithms** and services to the national Paying Agencies
- Demonstrate benefits of **cloud computing capabilities**

SEN4CAP – Time Planning & Status