

Good Practice Workshop, 'Improving data-management and information systems for the purpose of CAP evaluation', 16-17 March 2021



# Sen4CAP Open Source System to Support the CAP Reform Using Sentinel-1 and -2 for Continuous Near Real Time Agriculture Practices Monitoring

Bontemps S., Defourny P., Bajec K., Cara C., de Vendictis L., Kucera L., Malcorps P., Milcinski G., Nicola L., Rossi L., Sciarretta C., Slacikova J., Tutunaru F., Udriou C., Zavagli M, Koetz B.



**sen4cap**  
common agricultural policy



SINERGISE



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European Space Agency

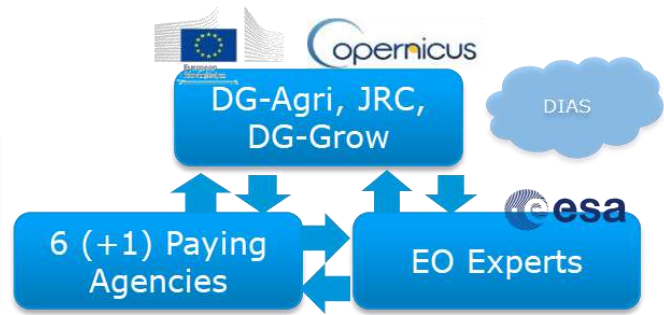
# CAP monitoring approach – Technology meets Policy



- 2+ day revisit
- No cloud impact
- very dense time series



- 3+ day revisit
- 10-m resolution
- per-parcel monitoring



## sen4cap Objectives

common agricultural policy

- 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 – Use case and user-driven approach

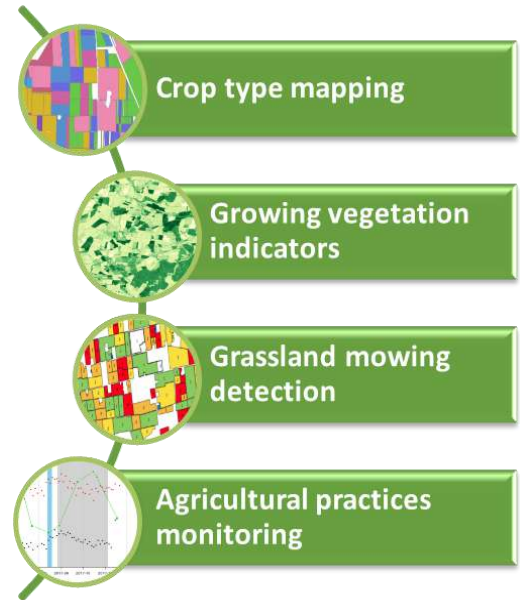
1st User Workshop, Brussels, July 2017



Direct Payment Committee, Brussels, March 2018

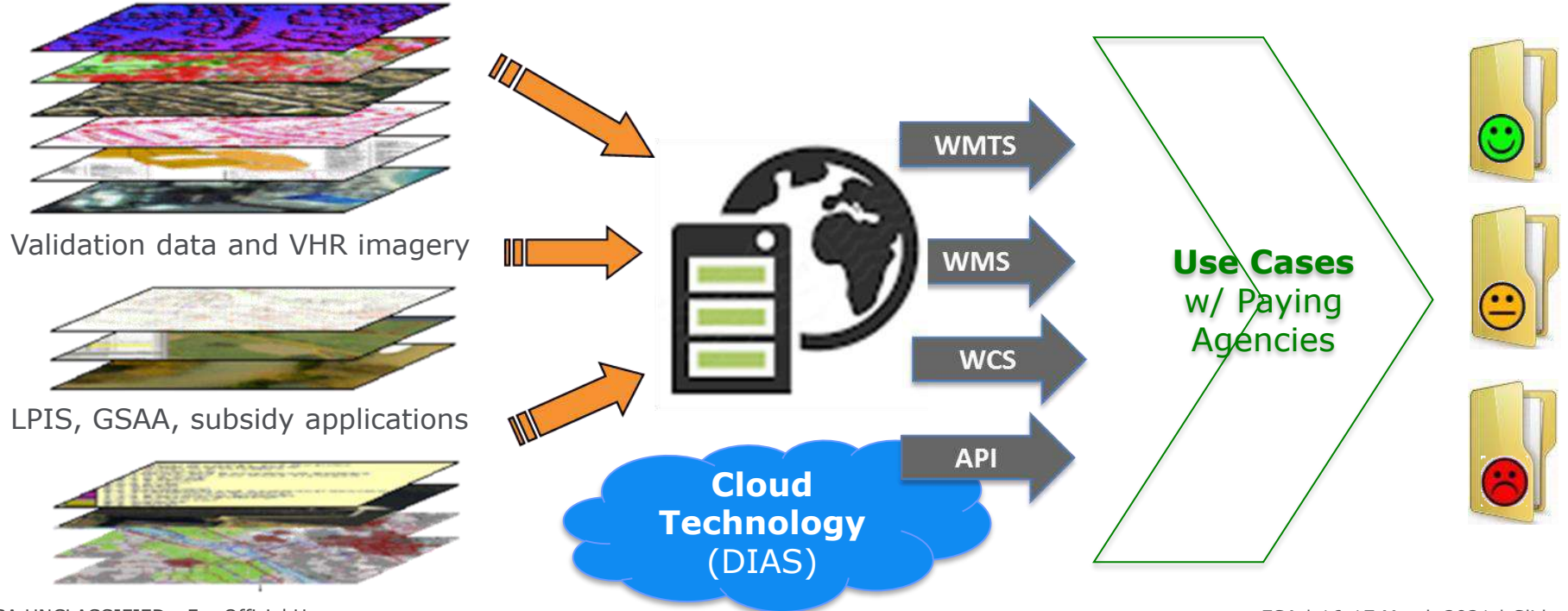


- Use case
- Crop diversification
- Permanent grassland identification
- EFA-Land lying fallow
- EFA-Catch crops
- EFA-Nitrogen-fixing crops
- Interactive visualization
- ... keeping in mind much more



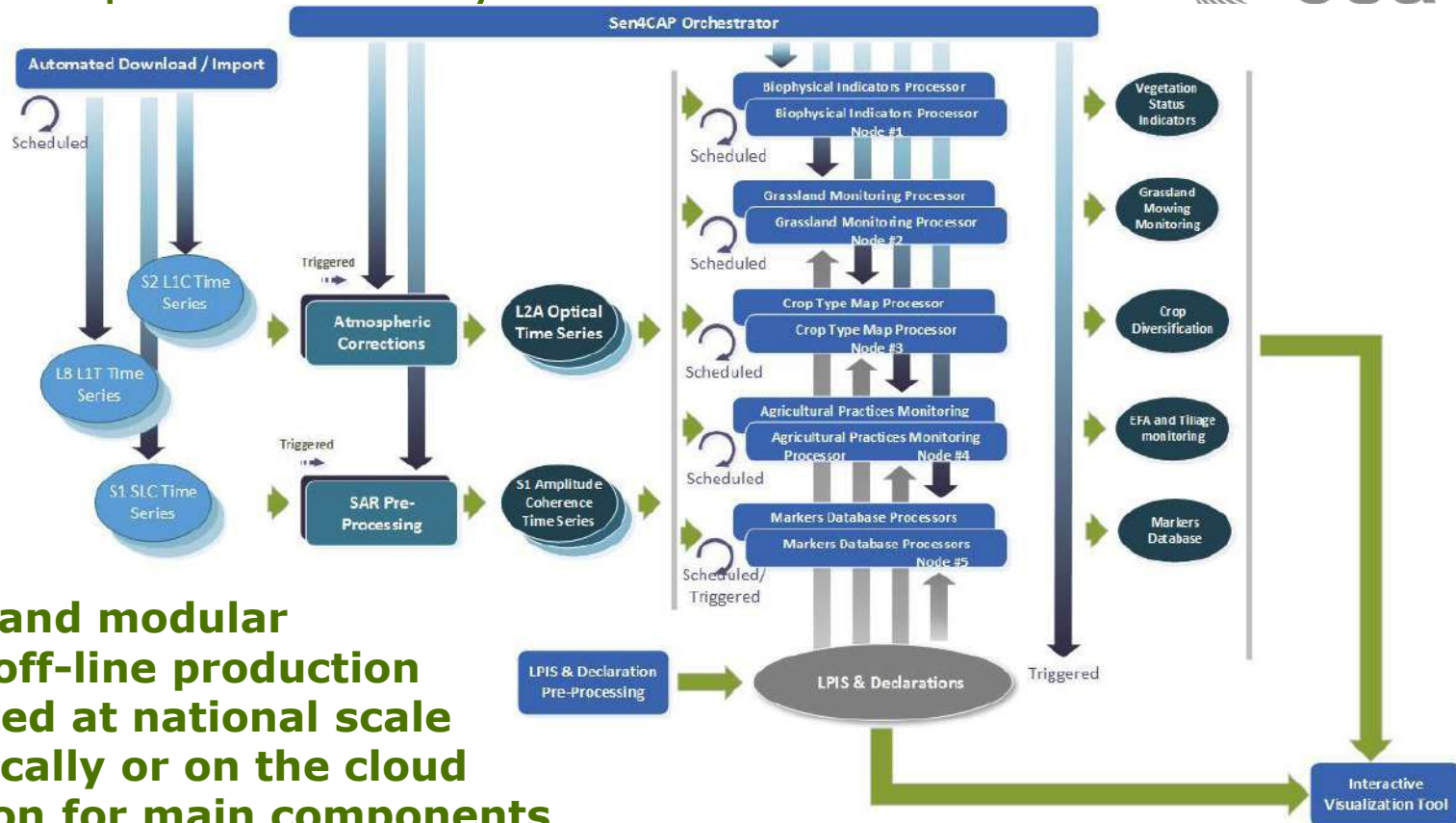
# Combining and organising different data sources to support compliance decision

Sentinel-1 & -2



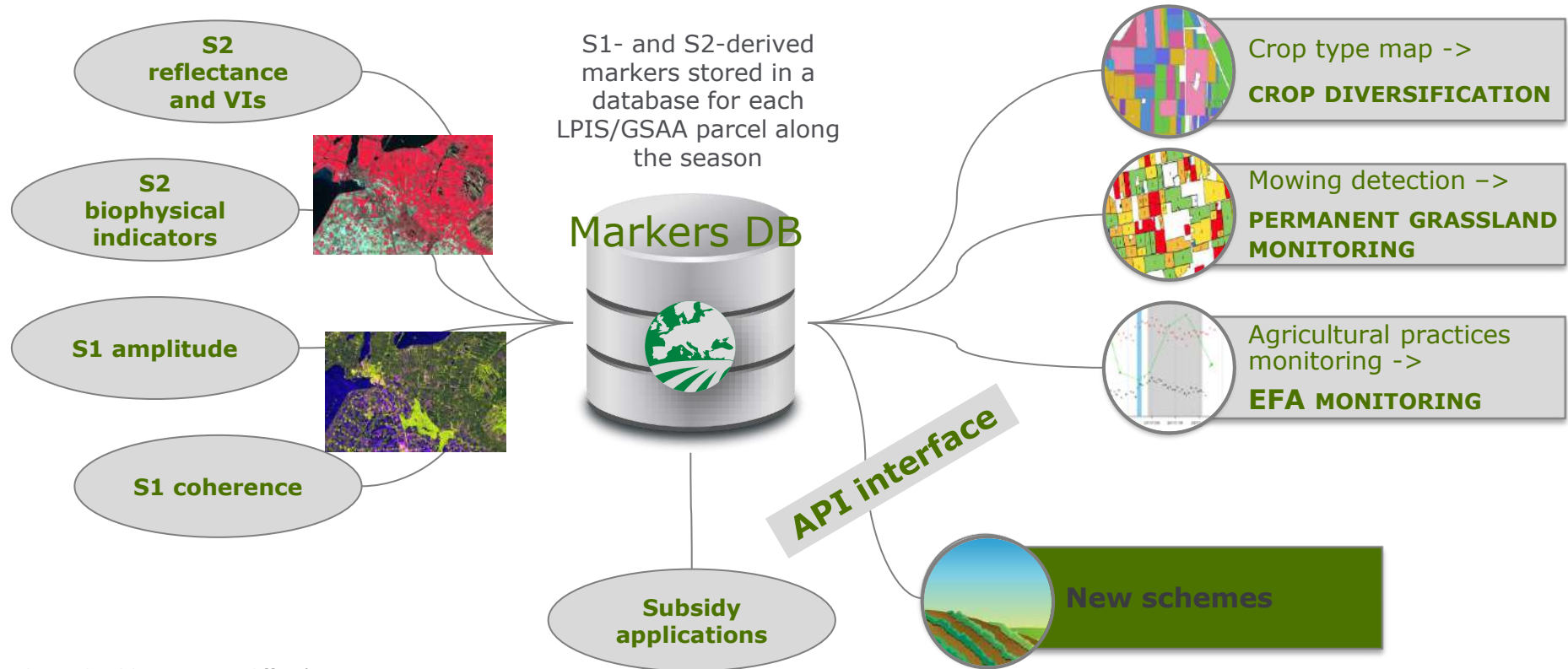
# Sen4CAP – An open-source system

**Version 2.0 delivered on 8 Feb. 2021**



- ❖ Automated and modular
- ❖ For NRT or off-line production
- ❖ Demonstrated at national scale
- ❖ Operated locally or on the cloud
- ❖ Dockerization for main components

# Markers and products assessed through selected use cases but available for many other applications





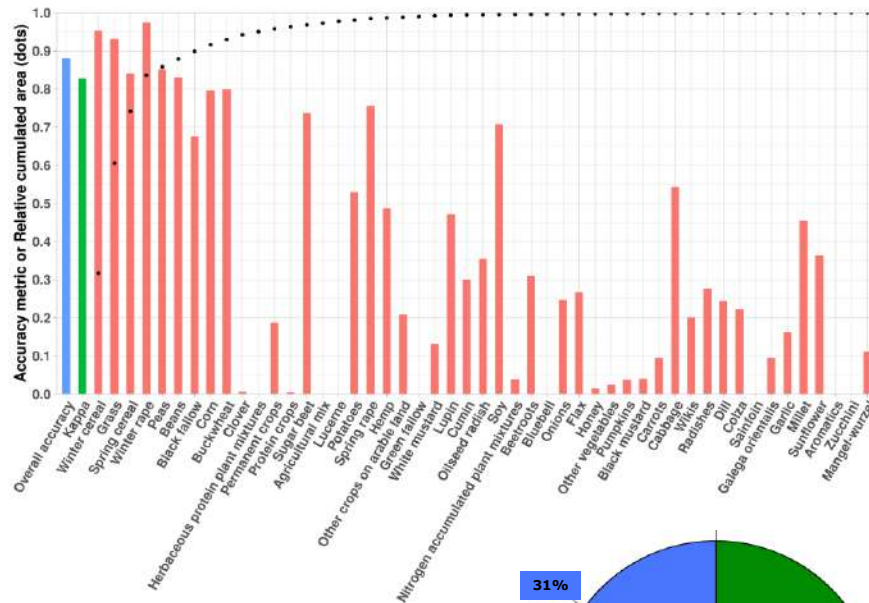
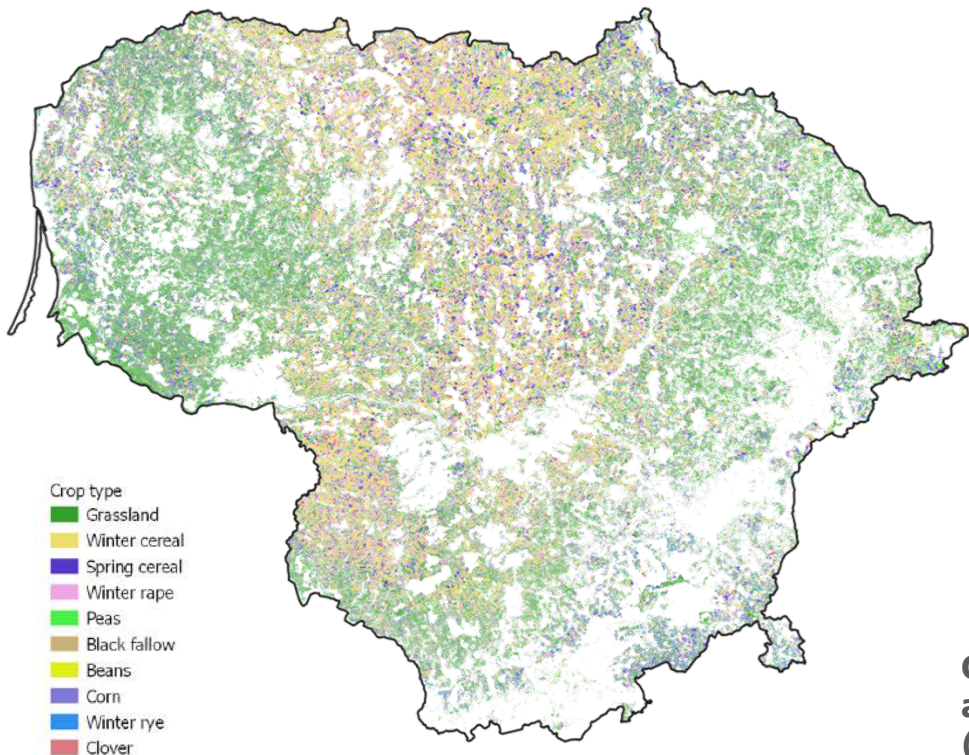
# National crop type map over Lithuania

Jan-Jul, > 100 crop types



OA = 88% (2019 and 2020)

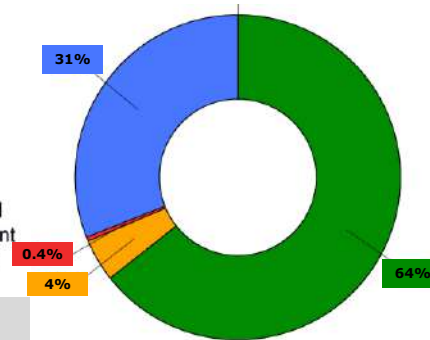
Good performance for the 9 main crops ( $\approx 92\%$  area)



## Crop diversification assessment (holding level)

Compliance

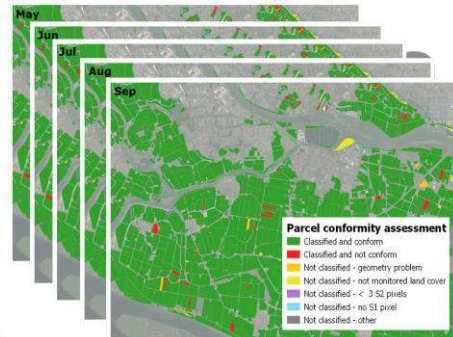
- Not\_required
- Not\_compliant
- Missing\_info
- Compliant



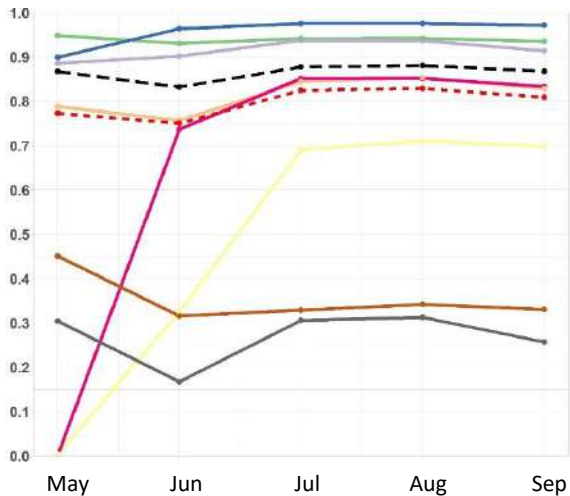
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# High accuracy achieved from May/June



## Lithuania

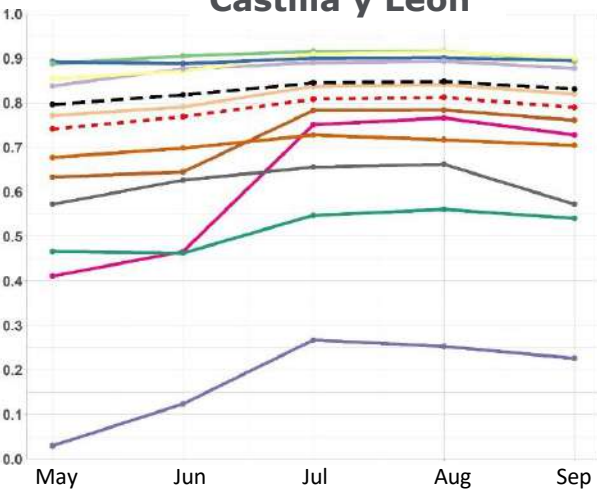


- Classes**
- Overall accuracy
  - Kappa
  - BARLEY
  - WHEAT
  - FALLOW LAND
  - VINEYARD
  - PEAS
  - SUNFLOWER
  - GRASSLAND
  - RYE
  - COMMON VETCH
  - ALFALFA
  - OAT

## Metrics

- F-score
- Kappa
- Overall accuracy

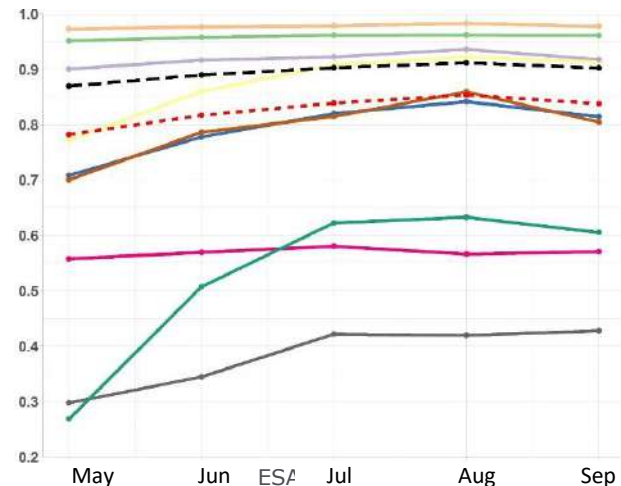
## Spain, Castilla y Leon



## Classes

- Overall accuracy
- Kappa
- Grassland
- Winter wheat
- Winter rapeseed
- Maize
- Spring barely
- Lucerne
- Winter barely
- Clover
- Oat

## Czech Republic



- Classes**
- Overall accuracy
  - Kappa
  - Grass
  - Winter cereal
  - Spring cereal
  - Black fallow
  - Winter rape
  - Peas
  - Permanent crops
  - Other crops on arable land

EU Official Use

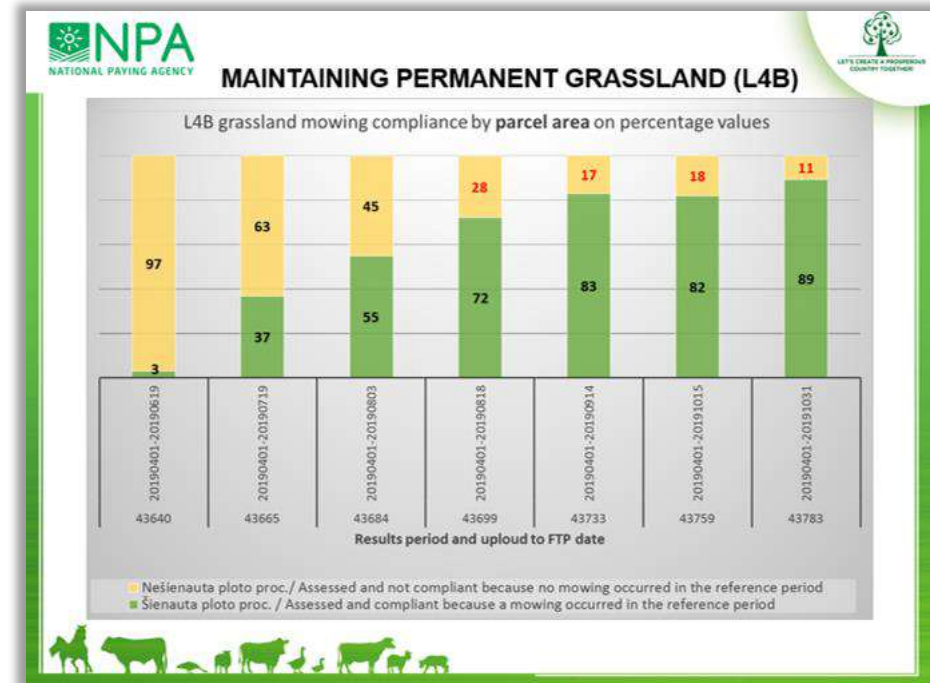




# Mowing detection over all grassland parcels supporting the monitoring of permanent grassland



- ✓ Number of mowing events (0 to 4)
- ✓ For each mowing event:
  - Temporal interval in which the mowing event occurred
  - Confidence level
  - Satellite mission used for detection (S1, S2 or both)
  - Compliancy level



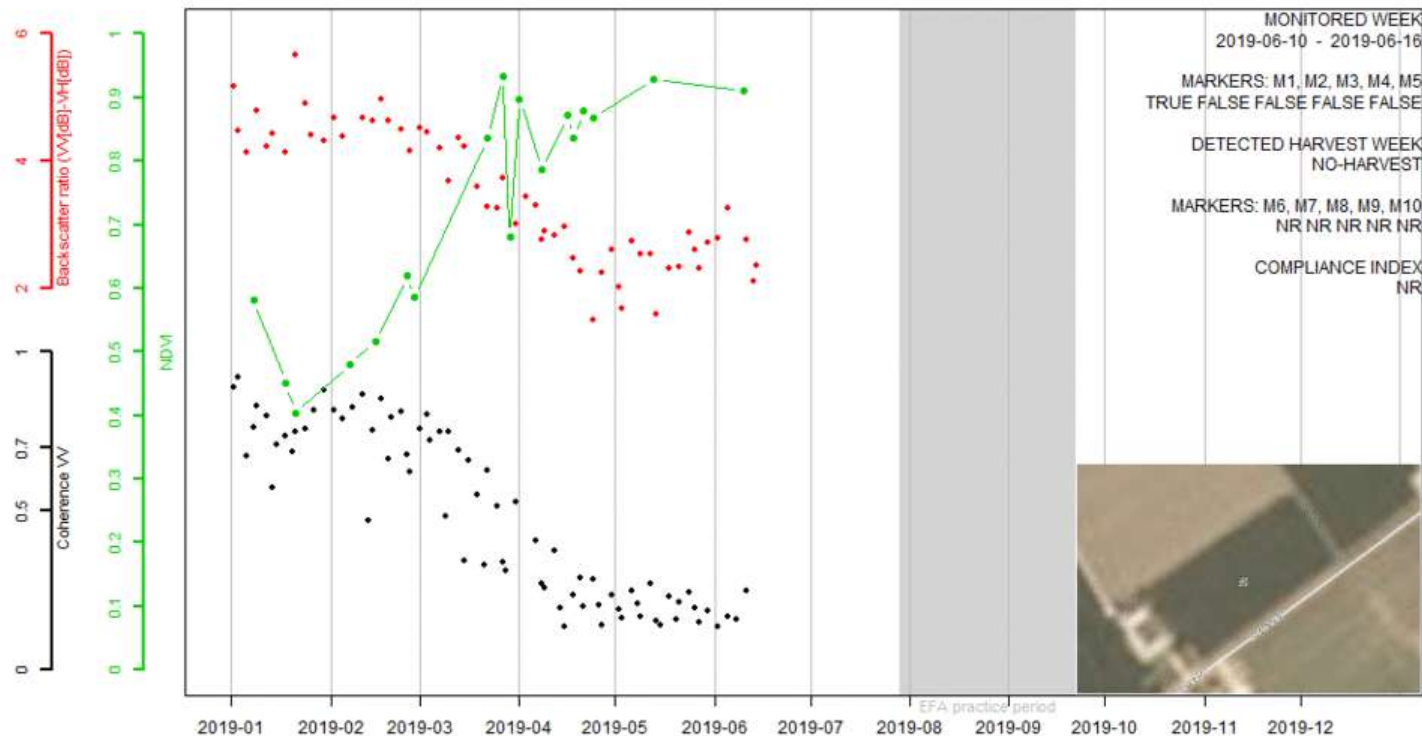
Source: Lithuania NPA – Sen4CAP Steering Committee 2019

# Environmental Focus Area agricultural practices

## Harvest and catch crop monitoring + tillage



E.g. Netherlands 2019 (parcel with winter wheat, 2.5 ha)



# Validation and fitness-to-use assessment

## 1) Farmers information

- ✓ interviews conducted by PAs for grassland mowing and EFA practices

Declared crop	Sow crop	Harvest crop	Sow catch-crop
Barley, summer-	17.4.2018	27.7.2018	20.8.2018

- ✓ photographs acquired by farmers to document parcel status



Geotagged photo  
(Lithuania, 2019)

- ✓ recorded data from GPS tracking of agro machinery (Castilla y Leon, 2020)

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## 2) Access granted to Planet data



7 May 2018



9 May 2018

ESA | 16-17 March 2021 | Slide 11



# 2020 uptake by Sen4CAP Pilot Countries

## Spain (Castilla y Leon)

Sen4CAP run in their own premises by the Paying Agency

## Netherlands – Italy

Sen4CAP operated by the Paying Agencies on CREODIAS with our support

+ details in the next session



## Czech Republic – Lithuania – Romania

Sen4CAP operated by the consortium

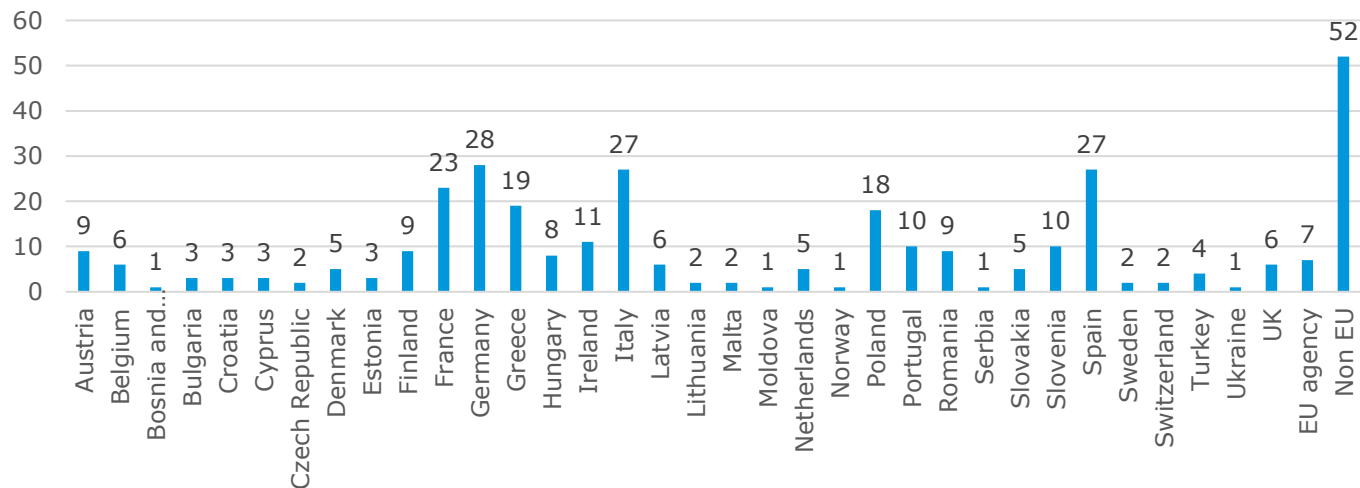
Better understanding of the **Sentinel added-value** for their future system

## France

Linking with NIVA

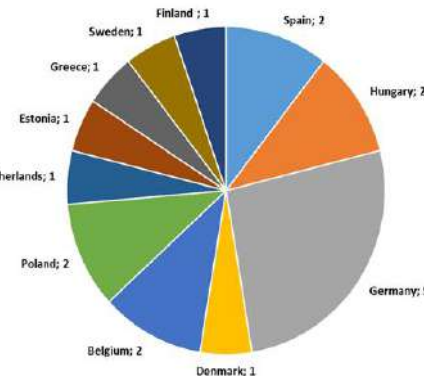
# In 2020, wide user uptake

- 330 downloads of the Sen4CAP system since November 2019



- 20+ Paying Agencies testing Virtual Machines on CREODIAS granted by the project to discover Sen4CAP and assess its fitness-to-use
- DIAS offering Sen4CAP as a service

**Denmark lessons learned in the next session**



# Capacity building & User support (1/2)

## Physical & online hands-on training



- Online training in Apr. 2020
- 100 + participants, 2 repeated sessions

➤ All resources available online

<http://esa-sen4cap.org/content/resources>



- Belgium (Jan. 2020): 44 participants from 20 different countries
- Methodologies + hands-on



Home About ▾ Data & Tools ▾ Resources ▾ News Fo

Technical documents

Presentation

Data

Videos

### Resources

The following Sen4CAP project related documents can be downloaded from this site:

- **Presentations** given at conferences or Sen4CAP trainings
- **Technical documents** to support the use of the Sen4CAP system and products
- **Data** - sample data for an easier start of using Sen4CAP system

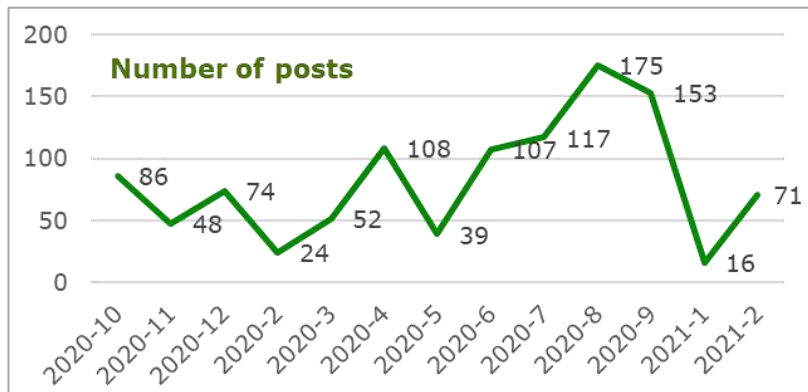


# Capacity building & User support (2/2)

## Online forum

<https://forum.esa-sen4cap.org/>

- 90 active users

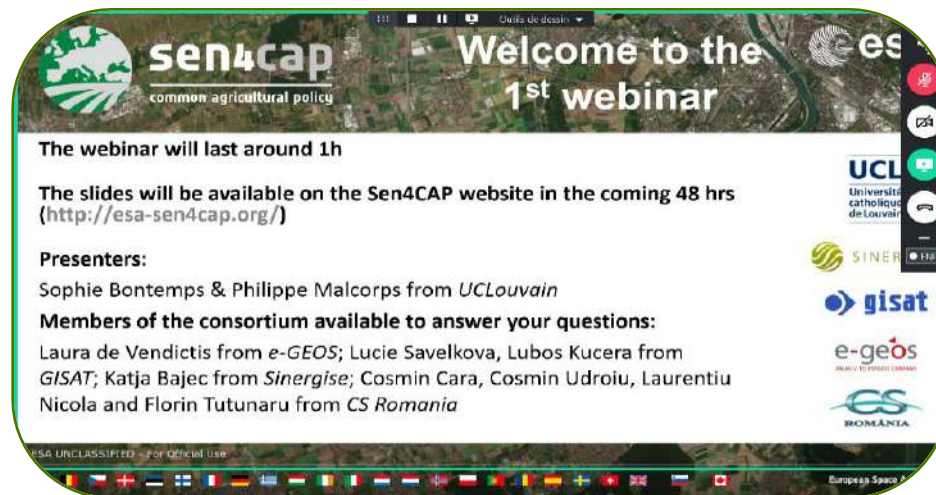


## Individualized support

## Frequently Asked Question webpage

## Regular webinars and Q&A sessions

- 60 to 150 participants each time
- External presenters



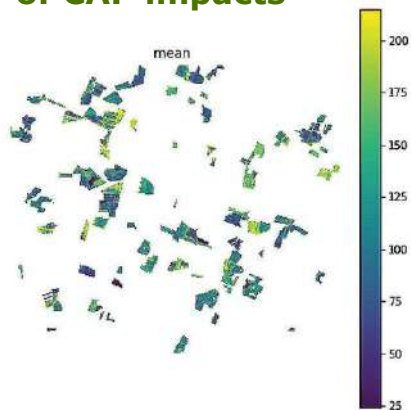
# Building links between Sen4CAP and other projects



- Sen4CAP in **NIVA**

E.g. using Sen4CAP markers and products for agri-environmental indicators – done by NIVA French partners (ASP, IGN, CESBIO, DYNAFOR, LBAE)

**=> Extending the use of Sentinel data and Sen4CAP to the 2<sup>nd</sup> pillar and the assessment of CAP impacts**



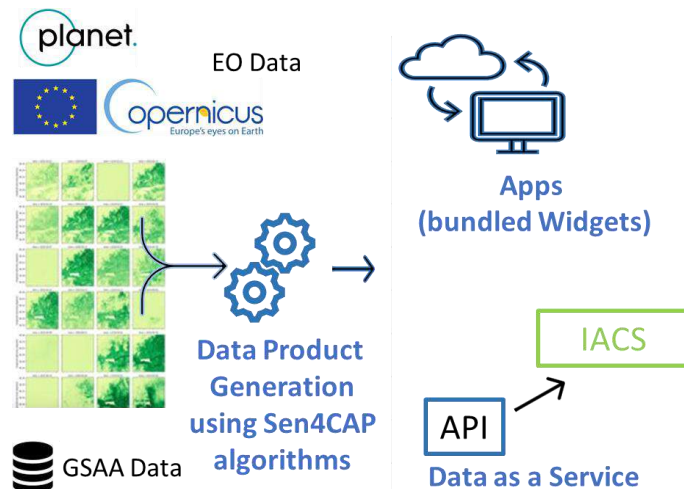
Mapping of net CO<sub>2</sub> fluxes on wheat plots carried out with the TIER-3 method (SAFY-CO<sub>2</sub> model) over southwestern France using Sentinel-2 and Venµs data.

Source: CESBIO in *Theia* bulletin 13 (Sep 2020)

- Sen4CAP as starting point in the ESA **EO-Widget project**

Integration of raw (Sen4CAP) EO products in the IACS cycle

Data as a service – as widgets



# Sen4CAP in RACE initiative from EC and ESA



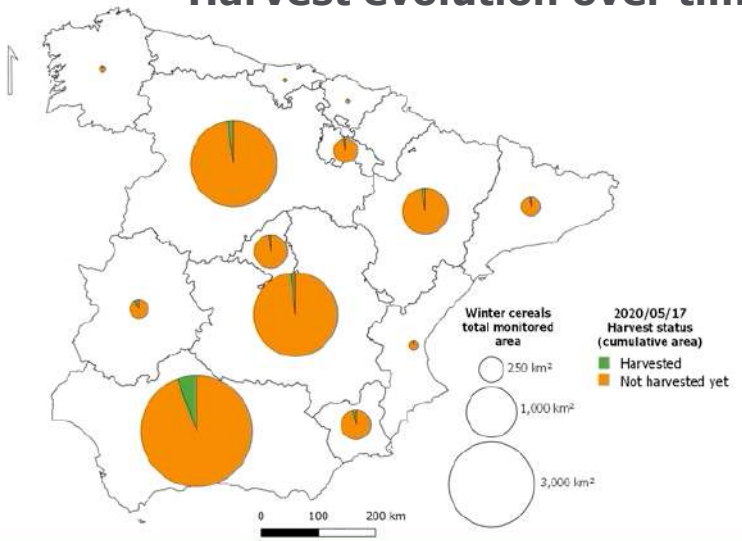
## Rapid Action Coronavirus Earth observation dashboard platform

### COVID19 impact on agricultural production

### Verification of delay or disruption of winter cereals harvesting in Spain

National coverage, running on DIAS, weekly monitoring of "harvest" markers

### Harvest evolution over time + Comparison with 2019



Castilla y Leon

HARVESTED AREA





# Concluding remarks



- Sen4CAP **open source system**, providing **markers** from Sentinel-1 and Sentinel-2 time series at the **parcel-level along the year**
    - ✓ Sentinel markers and EO **products usefulness assessed nation-wide** through selected use cases in 7 pilot countries (2018-2019-2020) - Dedicated effort on **validation data acquisition; farmers will be central**
    - ✓ Near-real time or off-line production; running on the cloud or locally
  - Sen4CAP as a **modular** system with a **markers database** open the floor for new applications supporting a more sustainable agriculture (CAP impacts assessments)
  - Wide uptake of the Sen4CAP modules and system
    - ✓ 330 downloads and 20+ Paying Agencies testing the system
    - ✓ Strong effort in **capacity building to support this uptake** (training, forum, webinars, etc.)
    - ✓ System maintenance will be ensured in the **ESA Agricultural Virtual Lab**
- => Long-term user support and tools maintenance are key conditions to allow technologies transfer (uptake is a long process that needs multiple changes)**



**Thank you for your attention  
and your contribution**



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