Welcome to the 5th webinar

The webinar will last around 1h

The slides will be available on the Sen4CAP website in the coming 48 hrs (http://esa-sen4cap.org/)

Presenters:

Sophie Bontemps & Philippe Malcorps from *UCLouvain*
Lubos Kucera from *GISAT*

Justina Vitkute from the *Danish Agricultural Agency*

Members of the consortium available to answer your questions

Webinar outline

- Sen4CAP overview
- System evolution
    - Version 1.3 and next releases until the end of the project
    - New processor on tillage detection
- Sen4CAP experiment by Denmark
- How organizing the user support on the mid-term?
- Next events // Questions & Answers

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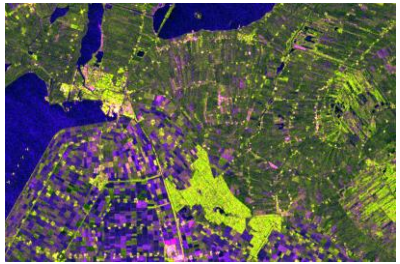
Sentinel-derived **markers** and **products** assessed through selected **use cases**

Large dataset of metrics and crop markers from
Sentinel-1, Sentinel-2
and Landsat8
processed along the season for each parcel and stored in a database



Products

- Crop type mapping
- Growing vegetation indicators
- Grassland mowing detection
- Agricultural practices monitoring

Use Cases w/ Paying Agencies

Use cases
Crop diversification
Perm. grassland monitoring
EFA-Land lying fallow
EFA-Catch crops
EFA-Nitrogen-fixing crops
Land abandonment
Interactive visualization

And many more!

From prototyping to NRT national demonstrations

Design and prototyping
2017 agri season – local sites

Use cases selection

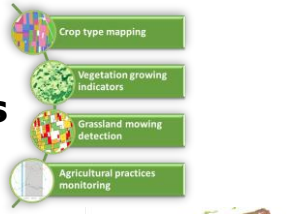
Products Specifications

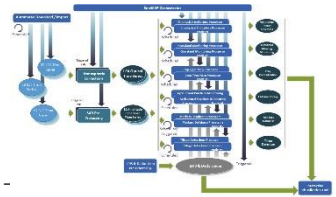
Benchmarked Methods

Algo & System design

Prototype products

Validation





Demonstration and validation
2018, 2019 & 2020 agri seasons – national NRT

Use cases demonstration

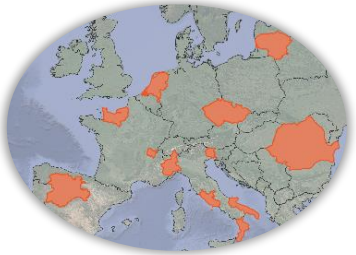
National scale

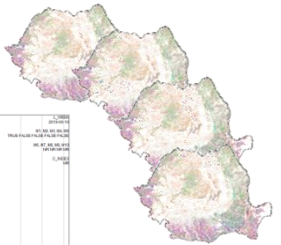
Continuous monitoring

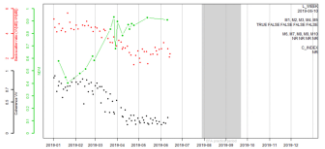
Validation & Fitness-to-use assessment

Capacity building and training

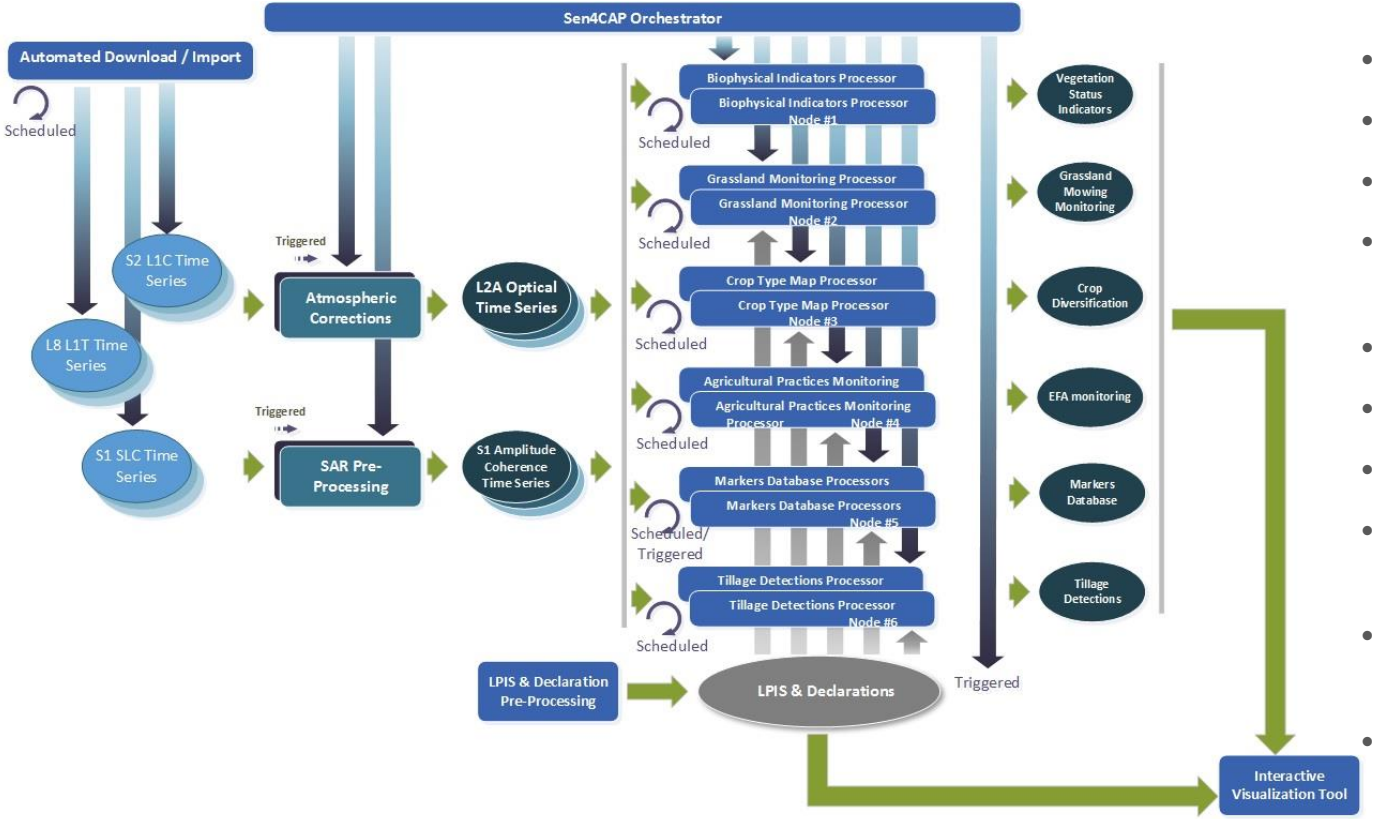
System qualification







Sen4CAP system



- Sentinel-1 & Sentinel-2
- Object-based
- Markers DB
- User-friendly & API interfaces
- Open source
- Automated
- Modular
- Demonstrated at national scale
- NRT or off-line production
- Locally or in the cloud

Sen4CAP is free and open source
Based on open source existing software

Under GNU-GPL License

Based on **Orfeo ToolBox** framework

Cluster-ready architecture for distributed processing

Integration of **SNAP** tools and processing chains

Operational system required : **CentOS7** (GNU/LINUX)

PostgreSQL and **PostGIS** implementation

Sen4CAP system : simple parametrization and subsidy application upload

Before the monitoring period | Monitoring period

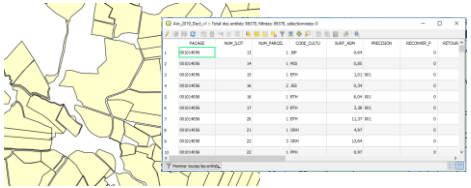
System initialization

Start of the season → **End of the season...**

Sen4CAP system : main parameters settings

Area of Interest	Shapefile to be uploaded
Monitoring period	Start and end dates to be defined
S1+S2 / S1+S2+L8	L8 to be selected

Subsidy application

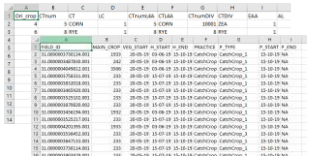


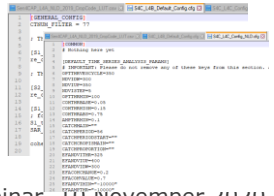
Upload data

Sen4CAP system : data from PA

Subsidy application (shp)	Subsidy application layer (shapefile)
Tables and config files (csv)	L4A crop code LUT L4B config file L4C config file + agri practices tables

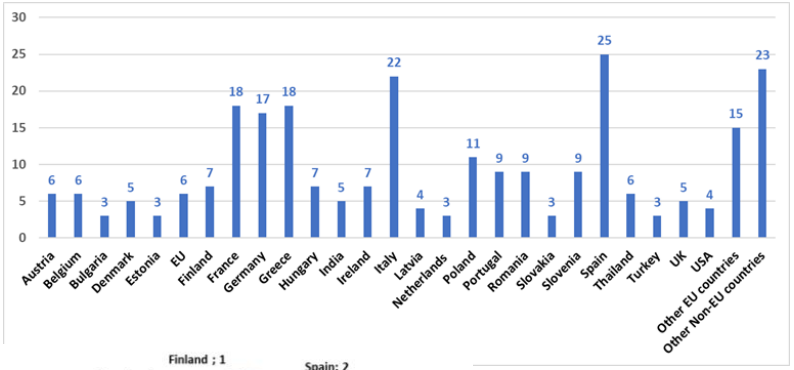
Tables and config files

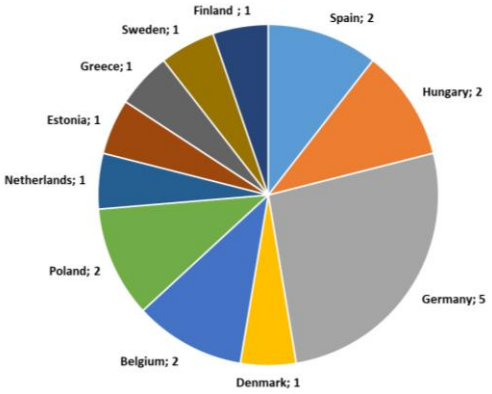




User community & Support

260 downloads since November 2019

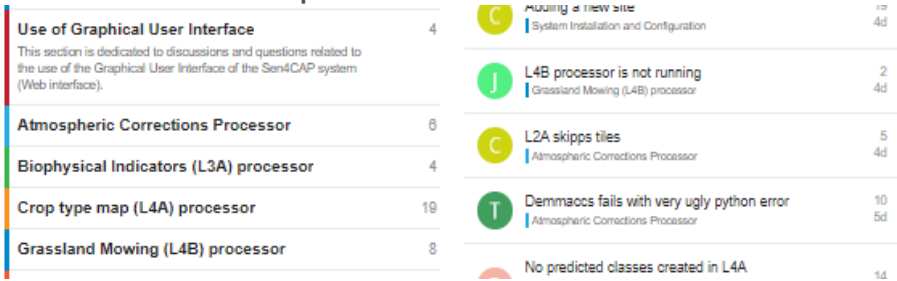




20+ Paying Agencies accessing **test Virtual Machines** on CREODIAS

Online forum

492 posts – 52 users



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

Webinars and Q&A sessions
Hands-on & online trainings
All ressources online

http://esa-sen4cap.org/content/presentations

Webinar outline

- Sen4CAP overview
- **System evolution**
  - **Version 1.3 and next releases until the end of the project**
  - New processor on tillage detection
- Sen4CAP experiment by Denmark
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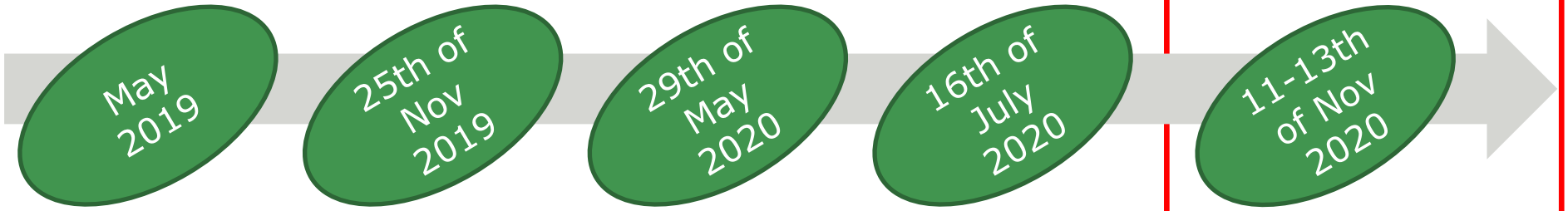
Version 1.3 released on the 11-13th of Nov 2020



BETA version

Only available for the PAs

Version 1.0 release candidate

Open-source

Possibility for the PAs to access a test machine with the system

Version 1.1

1st consolidated version

Big evolutions:

- Corrections in the advanced processors
- Sen2Cor L2A compatible
- Move of the system database to a docker container
- …

=> 2 Q&A sessions organized end of June

Version 1.2

Mainly corrections, adaptations and improvements based on project and user's experience

Version 1.3

Mainly corrections, adaptations and improvements based on project and user's experience

What are the **changes** in version 1.3?

=> Added, changed and fixed features specific to each version are listed in change log file

- Changed and fixed (no added features)
  - Fixed **SLURM startup** issues
  - **Sen4CAP services** corrections:
    - Evolutions in SciHub and USGS (only valid until Dec 2020) queries and also in plugins for ASF, AWS and Creodias
    - Corrections in the S1 pre-processing chain
    - Enable HTTPS
    - Other optimizations (products filtering by intersection with site in import, thread usage when fetch_mode is SymLink or Check, save WGS84 extent in database for S1 L2 products)
  - Corrections in the **L4A crop type processor**:
    - Fixed classification script crash in the presence of updated R dependencies
    - Fixed classification script crash on some input data
    - Fixed possible crash when no S1 data is available
  - Corrections and new configuration for **L4B grassland mowing detection processor**
  - Updates to the upgrade script **to handle some timeouts** during upgrades from 1.1
  - Fixed errors in the **importing declarations** script (with declarations in WGS84)
  - Corrections in processing to use **last day from the season**

1. It is my first installation of the system

- ✓ Download the Sen4CAP distribution, SRTM and SWBD datasets and GIPP files, from the Sen4CAP website
- ✓ Follow the installation procedure described in the System User Manual (section 3) or in the « System installation » presentation:
  - Create user accounts on the data provider platforms
  - System download
  - MAJA download and installation
  - System installation
  - Configure data provider accounts
  - Configure data sources

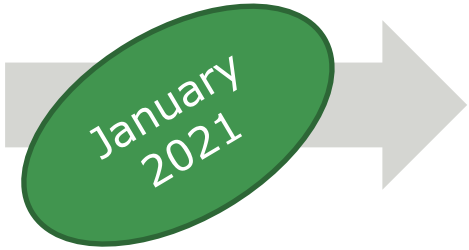
2. I have already installed my system

- ✓ Download only the Sen4CAP distribution, from the Sen4CAP website
- ✓ Follow the steps described in the System User Manual (section 3.3.2):
  - Copy the Sen4CAP distribution on the machine where the system is installed
  - Run the « update.sh » script

NOTE: you can update your system even if you have already processed or are still processing data for a site and season:

- Data download and S1/S2/L8 preprocessing will be stopped during the update but triggered again when it is finished – everything is automatic
- L3B and L4x processors will be stopped during the update but not triggered again when it is finished. **You will have to relaunch them** manually after the update

Version 2.0 released on January 2021



Version 2.0

Big evolutions:
- Markers database
- Tillage processor
- Dockerization
- …

- Added
  - **Markers database** presented during the last webinar
  - **Tillage processor** presented today
  - **Docker containers** for Sen4CAP components (processors, Sen4CAP services, website, utilities, orchestrator)
  - Support for **MAJA 4.2.1**
  - **New DEM integration** (ASTER DEM) for European Northern countries
- Changed
  - DBus replaced with a HTTP communication interface
- Fixed
  - Some **database concurrency corrections** for the L2A launcher script

Version 3.0 released on April 2021

Version 3.0

Big evolution: new web interface

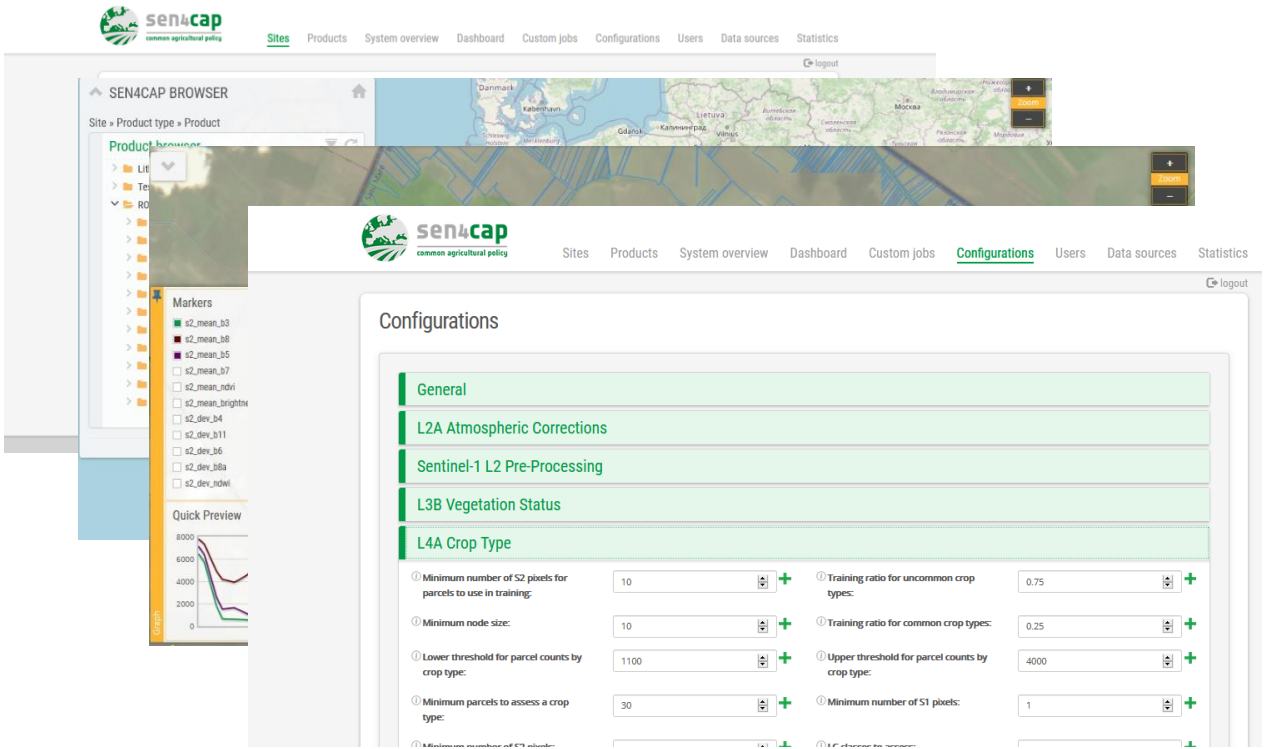
- Added
  - **New web interface** fully implemented in HTML5 and JavaScript (no server-side rendering)
  - **Visualization of parcels and markers** in the web interface
  - **Improved raster visualization** in the web interface
  - **Web interface configurator**
  - **Secured Sen4CAP services** via HTTPS and authentication tokens usage

Version 3.0 released on April 2021

April 2021

Version 3.0

Big evolution: new web interface



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Introduction

- Tilling and ploughing - Sen4CAP implementation (EO data response)
  - No difference is considered at a physical level (i.e. the land is lying undisturbed and then is suddenly disturbed)
  - Tillage is used as a single term that covers all the physical and temporal variability of tilling & ploughing practices

- Two pilot countries – Lithuania, Spain (Castilla y Leon)
  - Assessment of farming practices relevant to tillage - information when the tillage is usually applied, in which frequency, what is the parcel cover before and after the tillage (bare soil vs. vegetation cover), do parcels stay unmanaged for some time before and after the tillage, …

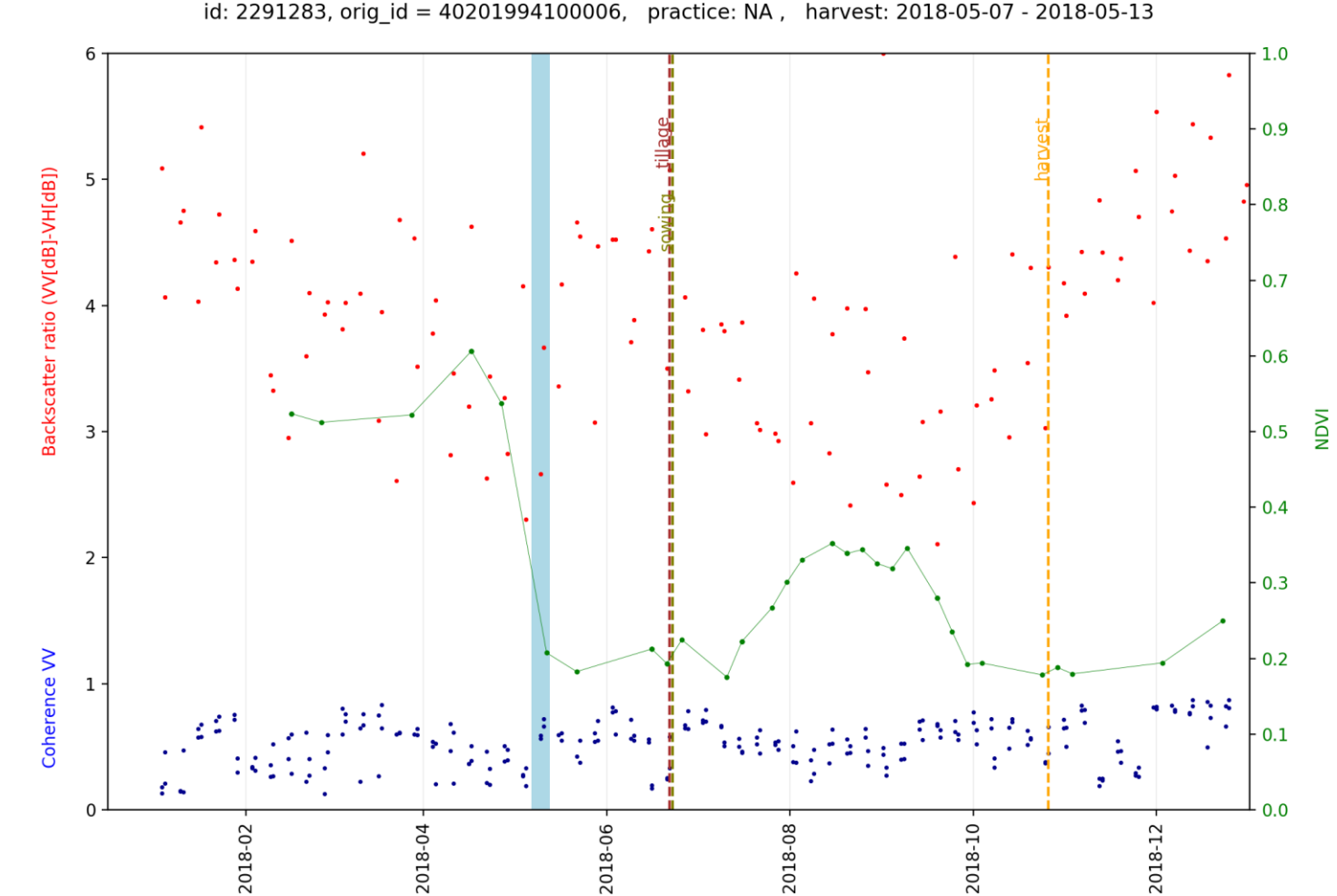
Tillage detection processor - concept

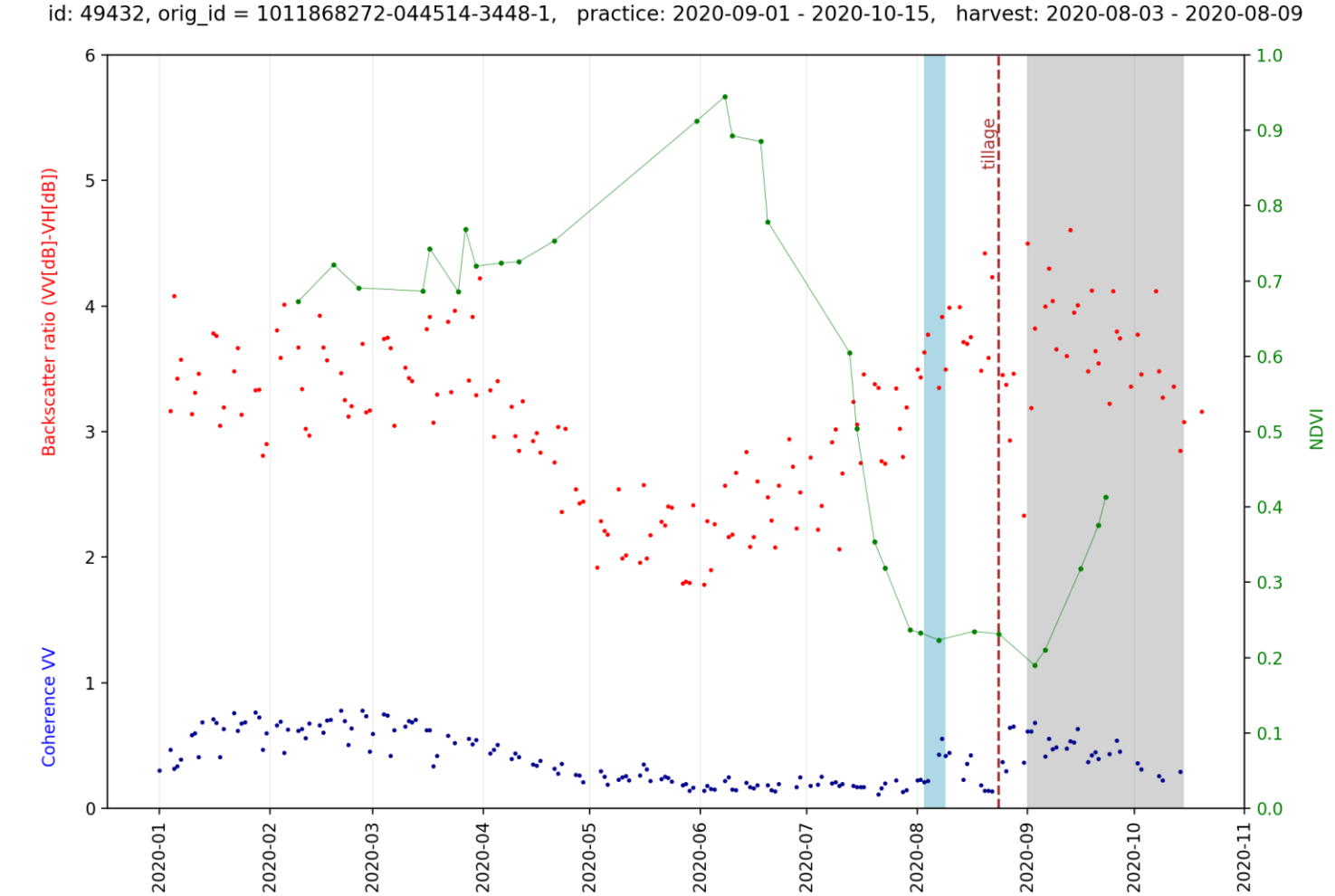
- Same approach as agricultural practices monitoring (automated analysis of EO based temporal profiles)
- Focus on tillage applied after the harvest of the main crop
- Generic solution (no country specific tailoring)
- Continuous monitoring concept (weekly evaluation as for harvest detection)
- Use of „harvest" markers

Tillage detection processor - methodology

- Use of „harvest" markers (M1 – M5) + detection of harvest as pre-condition
- At a purely theoretical-level:
  - (1) NDVI should remain low throughout this process
  - (2) The backscatter ratio should remain high/increasing throughout this process
  - (3) Coherence should increase during/after harvest, decrease after ploughing/tilling and finally increase again to a stable condition

MARKERS FOR HARVEST		
M1	Presence of vegetation in the main vegetation season	High values of NDVI
M2	Loss of vegetation	Break in NDVI (decrease)
M3	Loss of vegetation	Break in backscatter ratio (increase)
M4	Low/no vegetation	High values of backscatter ratio
M5	Low/no vegetation (stable conditions)	Break in VV Coherence (increase) or high values of VV Coherence


id: 2291283, orig_id = 40201994100006, practice: NA , harvest: 2018-05-07 - 2018-05-13
Backscatter ratio (VV[dB]-VH[dB])
Coherence VV
NDVI
sowing
tillage
harvest
2018-02
2018-04
2018-06
2018-08
2018-10
2018-12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Backscatter ratio (VV[dB]-VH[dB])
Coherence VV
NDVI
tillage
0
1
2
3
4
5
6
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
2020-01
2020-02
2020-03
2020-04
2020-05
2020-06
2020-07
2020-08
2020-09
2020-10
2020-11

Tillage detection – benchmarking

- Two concepts tested and validated in Lithuania and Spain (Castilla y Leon)
  - Concept no. 1: Use of markers M1 + M3 + M4 + M5
  - Concept no. 2: Use of markers M1 + M5 (no backscatter markers)

- Conclusion
  - High rate of tillage detection
  - Detection accuracy within the interval of +/-2 weeks from 50% to 75%
  - Concept no. 2 selected for implementation

Tillage detection – open issues

- Multiple drops for coherence marker - more activities occur after the harvest (e.g. harvest residuals management) –> the detector likely detects the first one

- Consistency and reliability of reference data
- False detections (parcels with no tillage after harvest)
- Parametrization (thresholds) for marker M5
- Wider set of reference parcels to be prepared

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Ministry of Environment
and Food of Denmark
The Danish
Agricultural Agency

Sen4CAP: Results of Maize Harvest Analysis (2019)

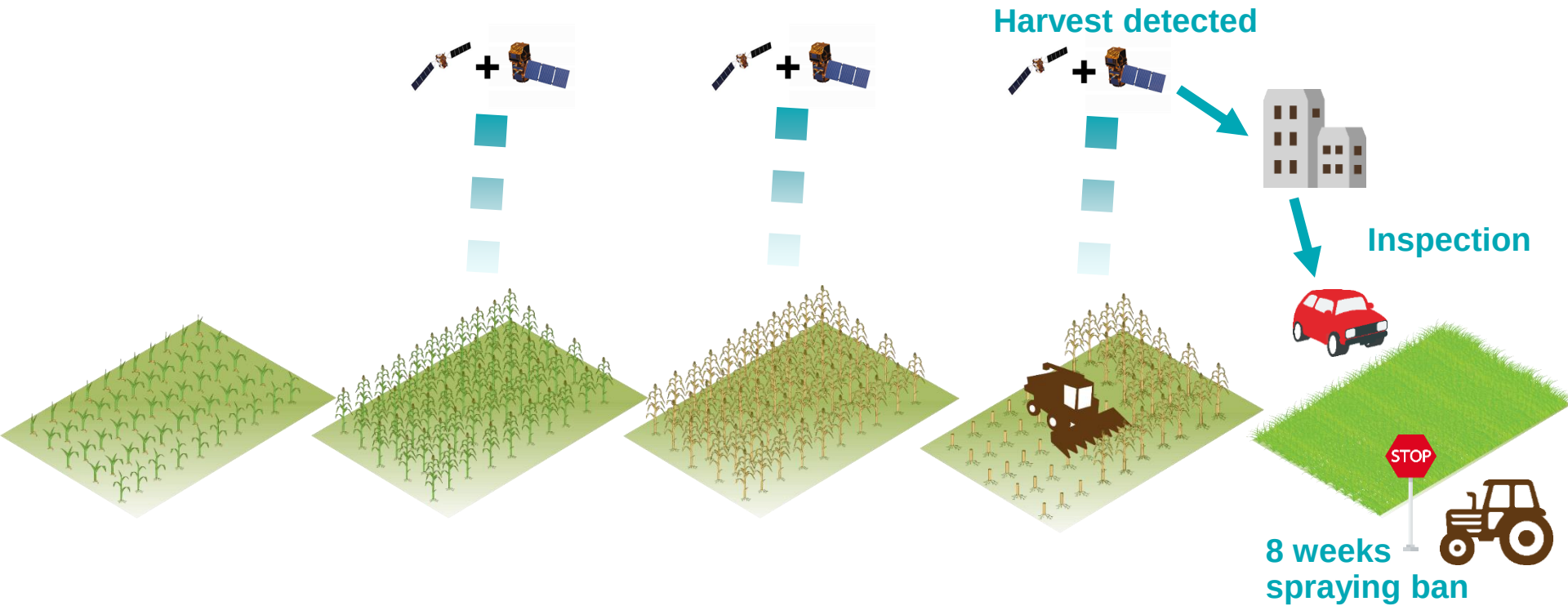
10 November 2020

Contents

- Introduction
- Data for Quality Assessment
- Results
- Quality Assessment of the Results
- Conclusions

Introduction (I)

How results of the maize harvest are used by the DAA?



Introduction (II)

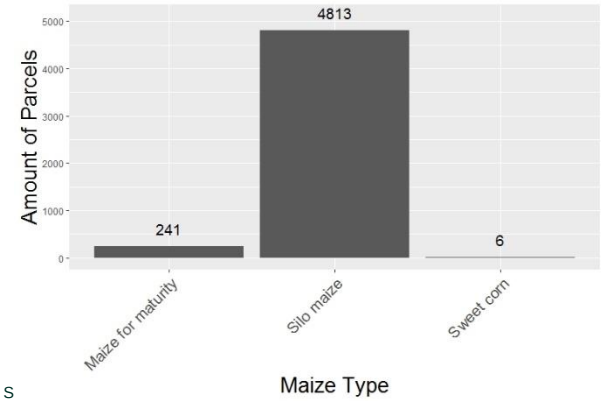
Area of interest: Sentinel-2 tile (VNH);

Input: parcels, declared with maize crop codes;

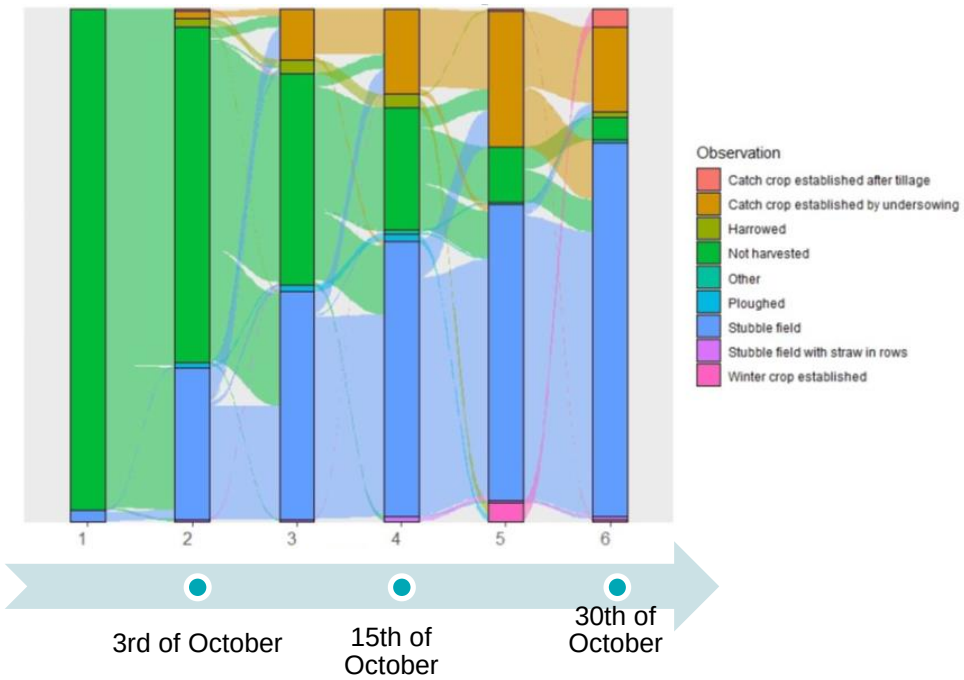
Used module: L4C (EFA-practices);

Analysis was run three times in the season:
3rd, 15th & 30th of October

In total, 5060 maize parcels analyzed (1/6 of maize parcels in 2019).



Data for Quality Assessment (I)



Road side observations:
- Parcels, which were revisited six times during the maize harvest period;

- 223 parcels in total;

- Nine observation categories

Three observations were used for quality assessment:

1) 3rd of October (trip 2),
2) 15th of October (trip 4),
3) 30th of October (Trip 6)

Observations used to asses ”End of season” accuracy.

Results (I)

MARKERS FOR HARVEST		
M1	M1: Presence of vegetation in the main vegetation season (pre-requisite)	High values of NDVI
M2	M2: Loss of vegetation	Break in NDVI (decrease)
M3	Loss of vegetation	Break in backscatter ratio (increase)
M4	Low/no vegetation	High values of backscatter ratio
M5	Low/no vegetation (stable conditions)	Break in VV Coherence (increase) or high values of VV Coherence

M1	M2	M3	M4	M5	H_WEEK	H_W_START	H_W_END	H_W_S1
TRU	TRUE	FALS	TRUE	TRUE	40	2019-09-30	2019-10-06	2019-09-30
TRU	TRUE	FALS	TRUE	TRUE	40	2019-09-30	2019-10-06	2019-09-30
TRU	TRUE	FALS	TRUE	TRUE	41	2019-10-07	2019-10-13	2019-10-07

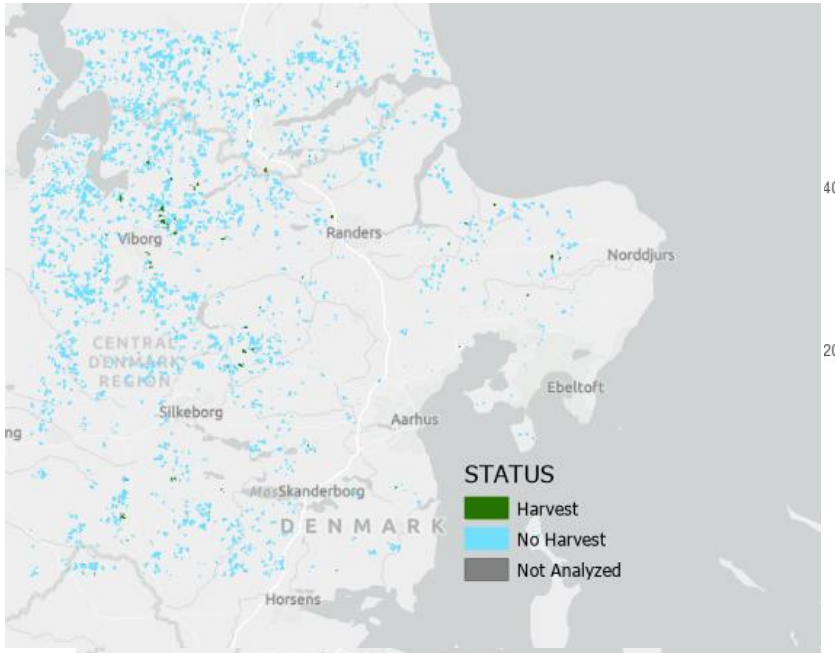
Results (II)

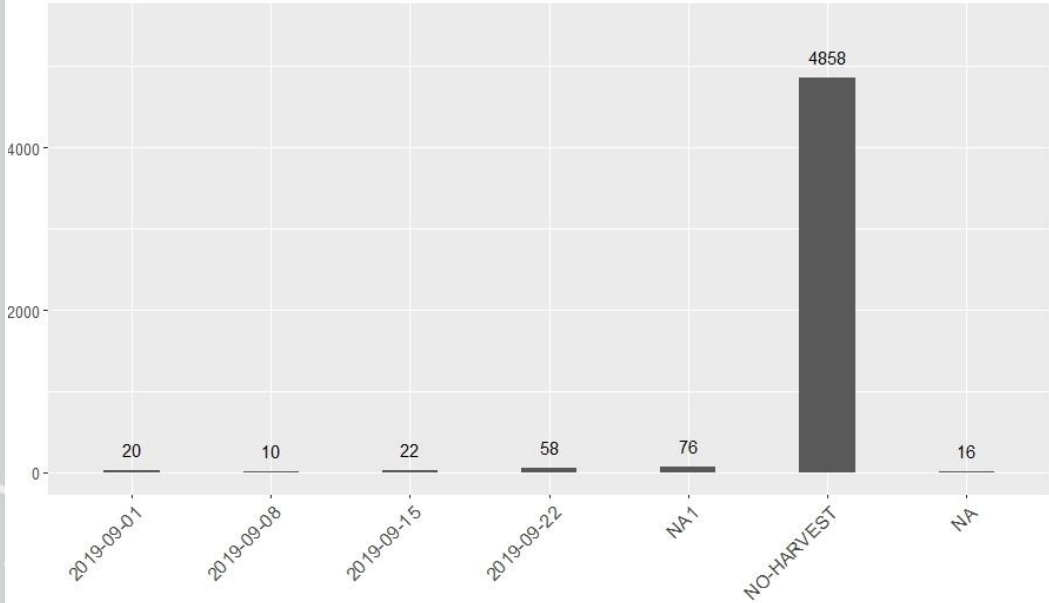
…based on Sentinel-1 & 2

3rd of October

15th of October

30th of October





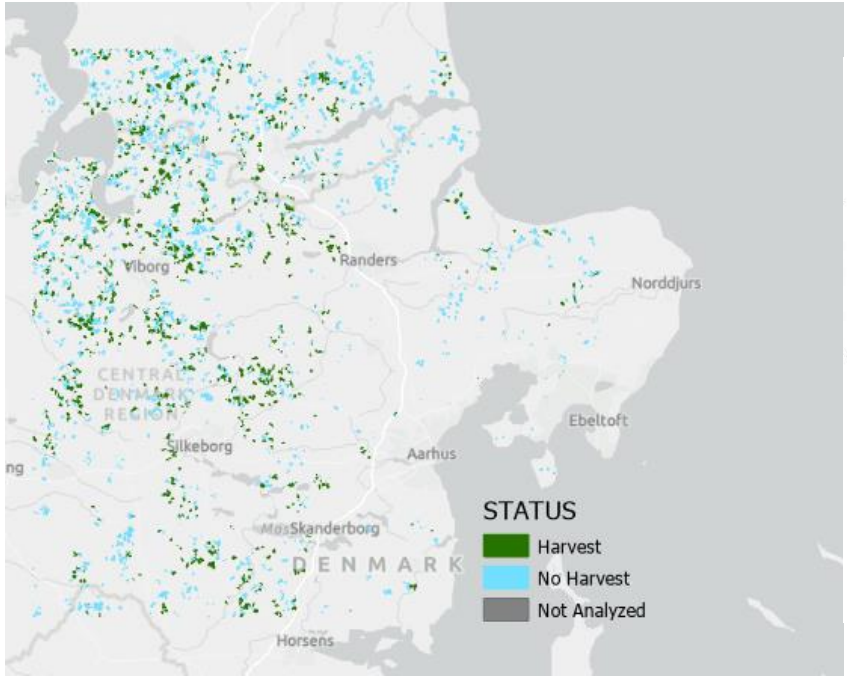
Results (III)

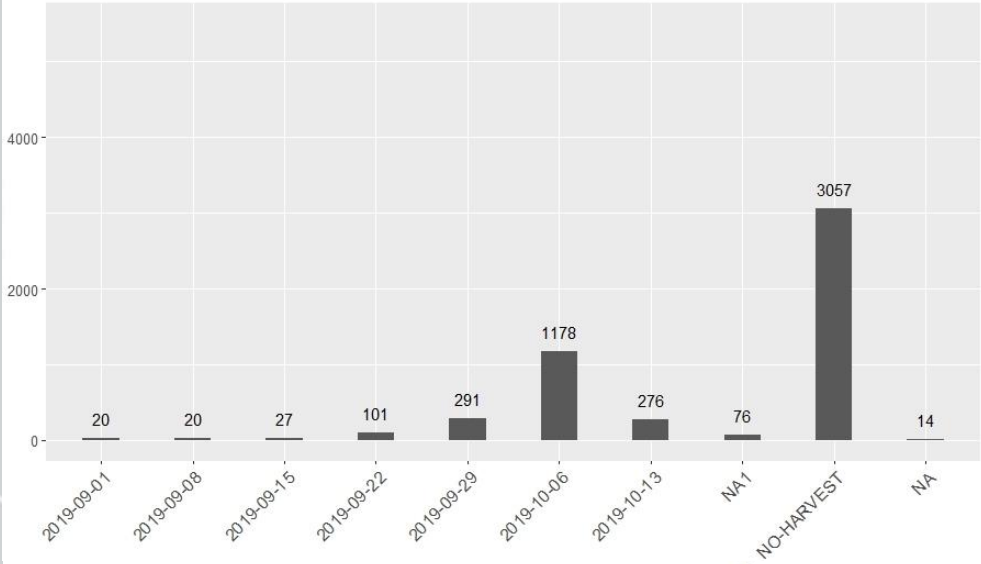
…based on Sentinel-1 & 2

3rd of October

15th of October

30th of October





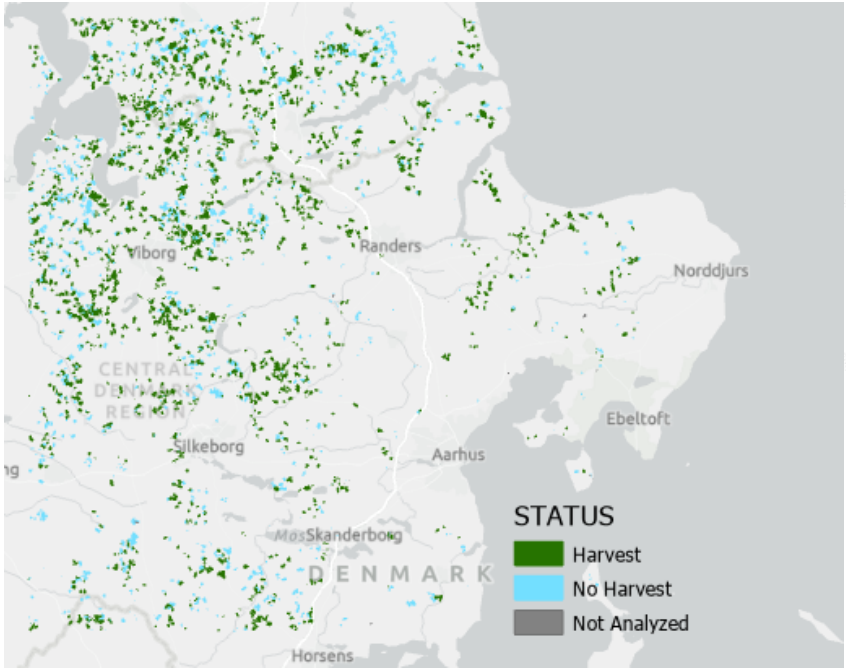
Results (IV)
30-10-2019

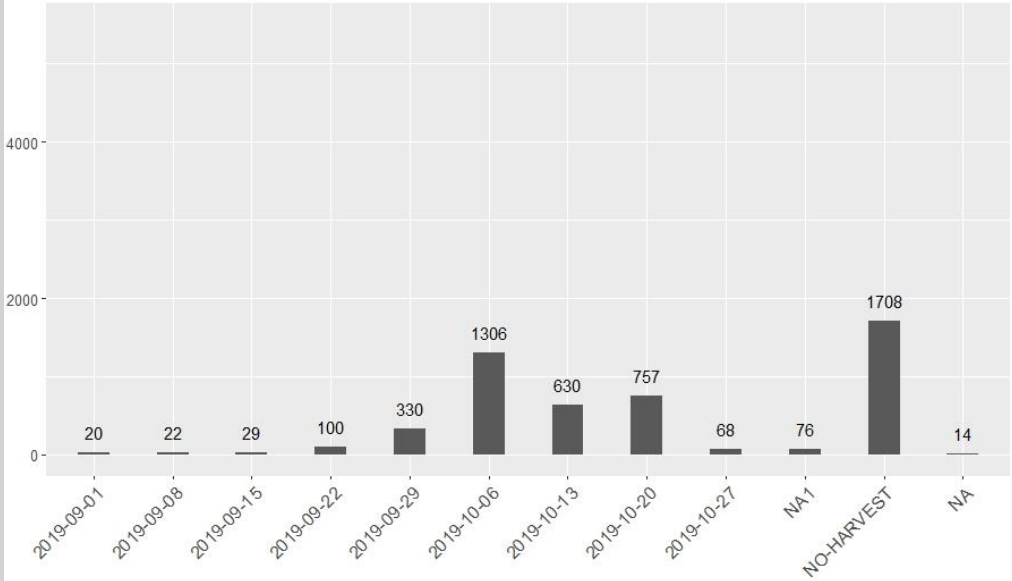
…based on Sentinel-1 & 2

3rd of October

15th of October

30th of October





Quality Assessment of the Results (I)

3rd of October

15th of October

30th of October

…based on Sentinel-1

		Sen4CAP			
		Harvest	No harvest	Total	Producer´s accuracy
Road side observations	Harvest	26	51	77	**34%**
	No harvest	34	112	146	**77%**
	Total	60	163	223	
User´s accuracy		**43%**	**69%**		

…based on Sentinel-1 & 2

		Sen4CAP			
		Harvest	No harvest	Total	Producer´s accuracy
Road side observations	Harvest	0	77	77	**0%**
	No harvest	0	146	146	**100%**
	Total	0	223	223	
User´s accuracy		**0%**	**65%**		

Quality Assessment of the Results (II)

3rd of October | **15th of October** | 30th of October

…based on Sentinel-1

		Sen4CAP			
		Harvest	No harvest	Total	**Producer´s accuracy**
Road side observations	Harvest	133	37	170	**78%**
	No harvest	15	38	53	**72%**
	Total	148	75	223	
User´s accuracy		**90%**	**51%**		

…based on Sentinel-1 & 2

		Sen4CAP			
		Harvest	No harvest	Total	**Producer´s accuracy**
Road side observations	Harvest	110	60	170	**65%**
	No harvest	0	53	53	**100%**
	Total	110	113	223	
User´s accuracy		**100%**	**47%**		

Quality Assessment of the Results (III)

3rd of October

15th of October

30th of October

…based on Sentinel-1

Road side observations	Sen4CAP: Harvest	Sen4CAP: No harvest	Sen4CAP: Total	Producer´s accuracy
Harvest	207	6	213	**97%**
No harvest	4	6	10	**60%**
Total	211	12	223	
User´s accuracy	**98%**	**50%**		

…based on Sentinel-1 & 2

Road side observations	Sen4CAP: Harvest	Sen4CAP: No harvest	Sen4CAP: Total	Producer´s accuracy
Harvest	158	55	213	**74%**
No harvest	0	10	10	**100%**
Total	158	65	223	
User´s accuracy	**100%**	**15%**		

Conclusions

The analyzed 1/6 of maize parcels in Denmark has showed that by using Sen4CAP, maize harvest can be predicted with high user´s and producer´s accuracies (”End of the Season”).

These were varying, depending on the type of the results (based only on data from Sentinel-1 or both Sentinel-1 & 2),as well as, dependent on the timestep, when the analysis was run - higher accuracy of the harvest later in the season.

The detection of no harvest was much less accurate.

Would still need to look at how precise the harvest is being predicted (how the predicted harvest week covers the exact maize harvest date). Also, eventually run on bigger area of interest, as the size of the area of interest might have an impact on the results.

Webinar outline

- Sen4CAP overview
- System evolution
    - Version 1.3 and next releases until the end of the project
    - New processor on tillage detection
- Sen4CAP experiment by Denmark
- **How organizing the user support on the mid-term?**
- Next events // Questions & Answers

Sen4CAP on the mid-term

- Sen4CAP project will last until March 2021
- **As a brainstorming** … two kinds of support to be continued:
  1) Tool (modules evolution, fixing bugs, new modules integration)
     - ✓ System maintenace ensured by ESA Agricultural Virtual Lab
     - ✓ Relying on H2020 projects like NIVA
     - ✓ GitHub collaboration
  2) User community
     - ✓ Continuing webinars and support on forum (Sen4CAP specific & Agricultural Virtual Laboratory framework)
     - ✓ Progressive integration of these activities in a network of Paying Agencies?

Do you have this kind of network / market place? Are you interested? How putting it in place?

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Next events

- **System 1.3** released on this week; **11-12-13 November 2020**
- **Q&A session** for System 1.3 on **1st December**
- Next **webinar** on **12 January 2021**
- **Your questions ???**


Thank you for your attention
and your contribution
sen4cap
common agricultural policy