Welcome to your Sen4CAP training

The training session will last around 1h30

The slides will be made available on the Sen4CAP website after the training

Presenters:

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Website: http://esa-sen4cap.org/

Overview of the session

1) What is Sen4CAP?
    - Sen4CAP system and visualization tool
    - Subsidy application and auxiliary information preparation

2) System operation: first steps with the system (presentation and hands-on training using the system web interface)
    - Launch a site in the automatic mode
    - Prepare and upload parcels information
    - Launch additional jobs
    - Access system database

3) System installation: ICT requirements and procedure

4) Questions and answers

Overview of the session

1) **What is Sen4CAP?**
   - **Sen4CAP system and visualization tool**
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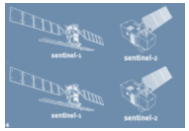
3) System installation: ICT requirements and procedure

4) Questions and answers

CAP monitoring approach – Technology meets Policy

sen4cap
common agricultural policy



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

2017 ag. season – local sites

Use cases & Algo development → Bench-marking → Validation

2018 ag. season – 6 national cases

Use case demo & training

2019 ag. season – 6 NRT national demo

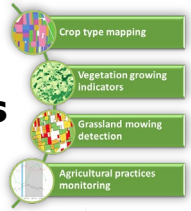
Validation & Assessment

From prototyping to NRT national demonstrations

Design and prototyping
2017 agri season – local sites

Demonstration and validation
2018 & 2019 agri seasons – national NRT

Use cases selection

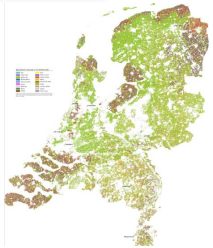


Products Specifications

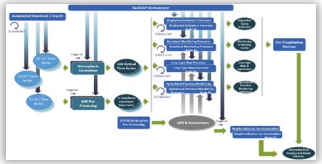
Benchmarked Methods

Algo & System design

Prototype products



Validation



Use Cases: Sentinels to support payment decisions

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

Use Cases
w/ Paying
Agencies

Use Cases: Sentinels to support payment decisions

Use case
Crop diversification
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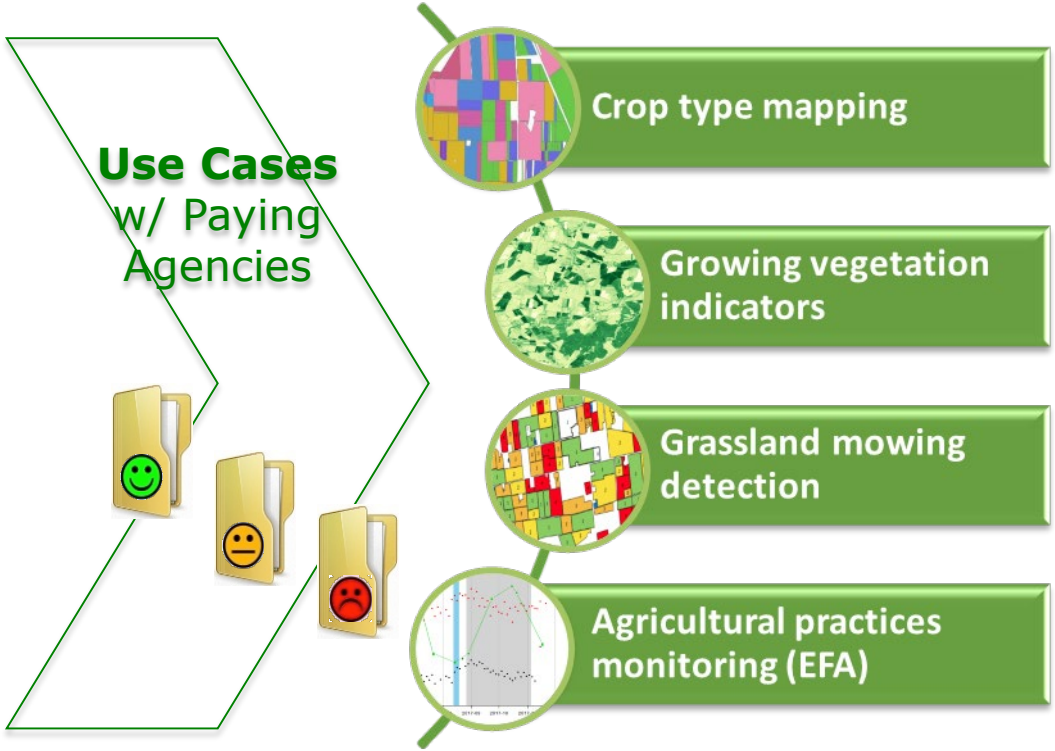
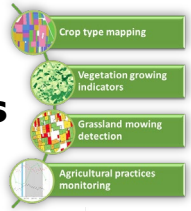


From prototyping to NRT national demonstrations

Design and prototyping
2017 agri season – local sites

Use cases selection



Products Specifications

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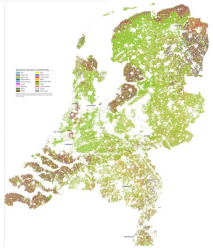
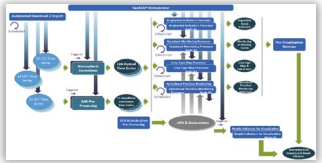


Prototype products

Validation



Demonstration and validation
2018 & 2019 agri seasons – national NRT

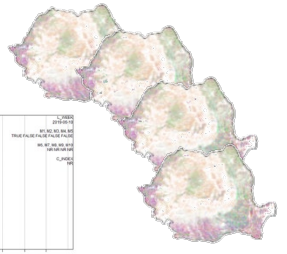
Use cases demonstration

National scale

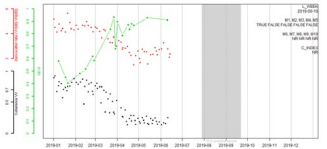
Continuous monitoring

Validation & Fitness-to-use assessment

Capacity building and training

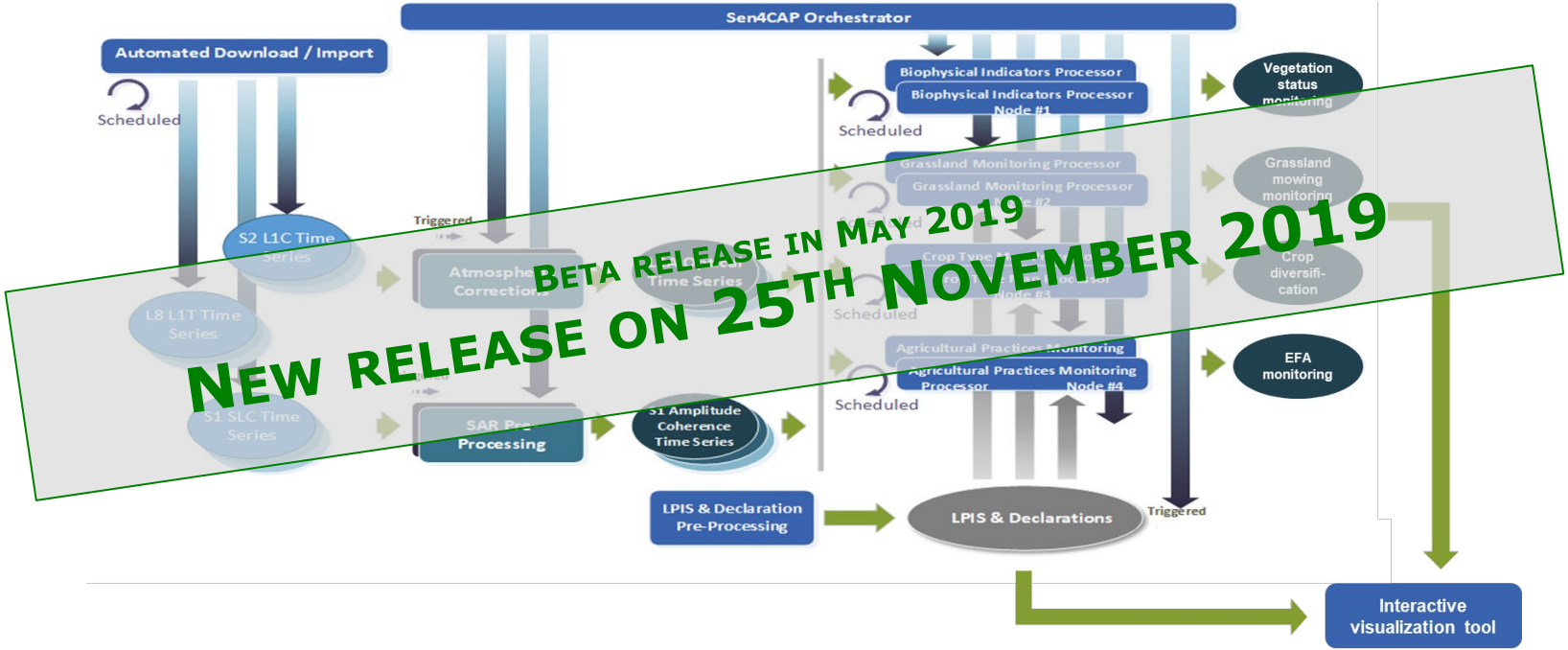


System qualification



Open source Sen4CAP system (v1.0)

Automated and **modular** system ingesting S1 and S2 time series, demonstrated at **national scale** for **NRT** or off-line production, locally or on 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

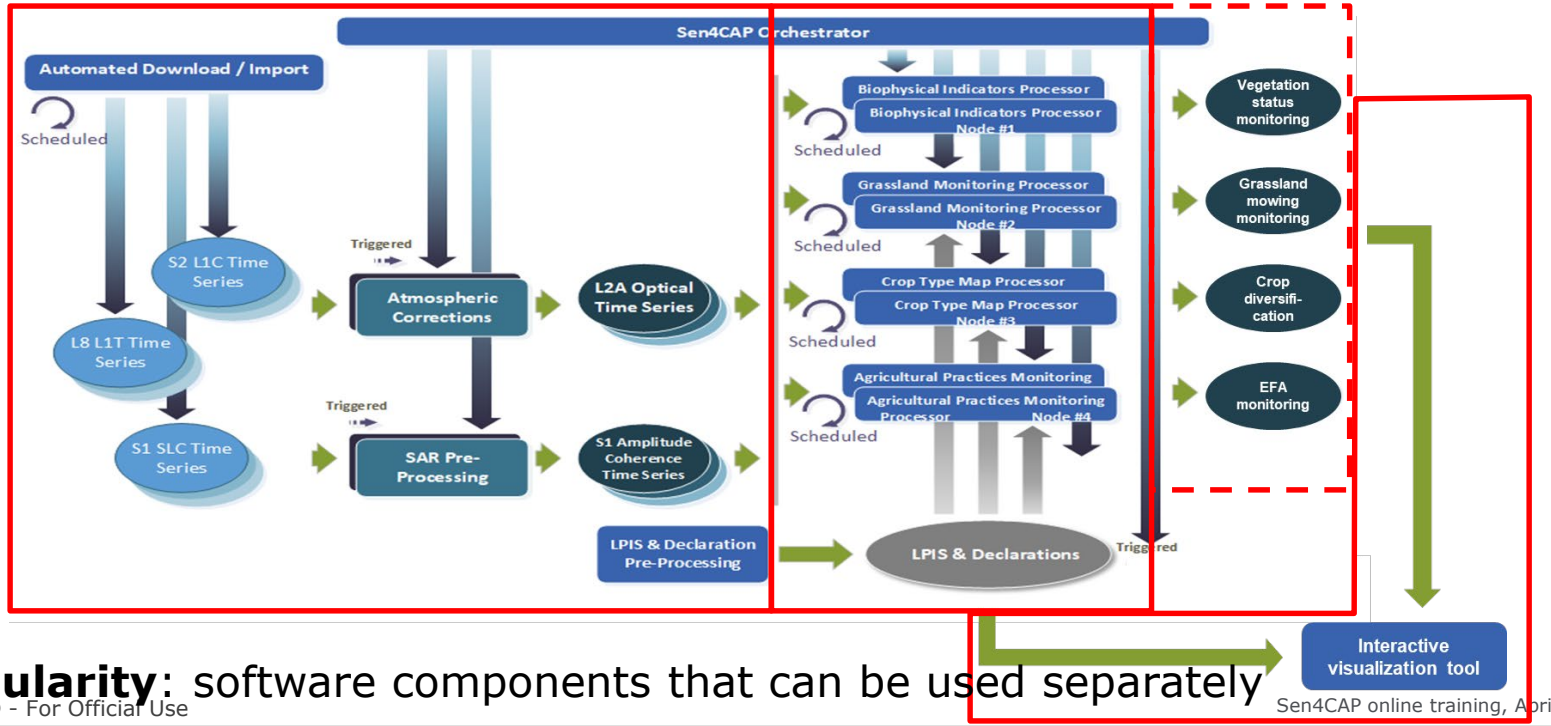
Integration of **SNAP** tools and processing chains

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

PostgreSQL and **PostGIS** implementation

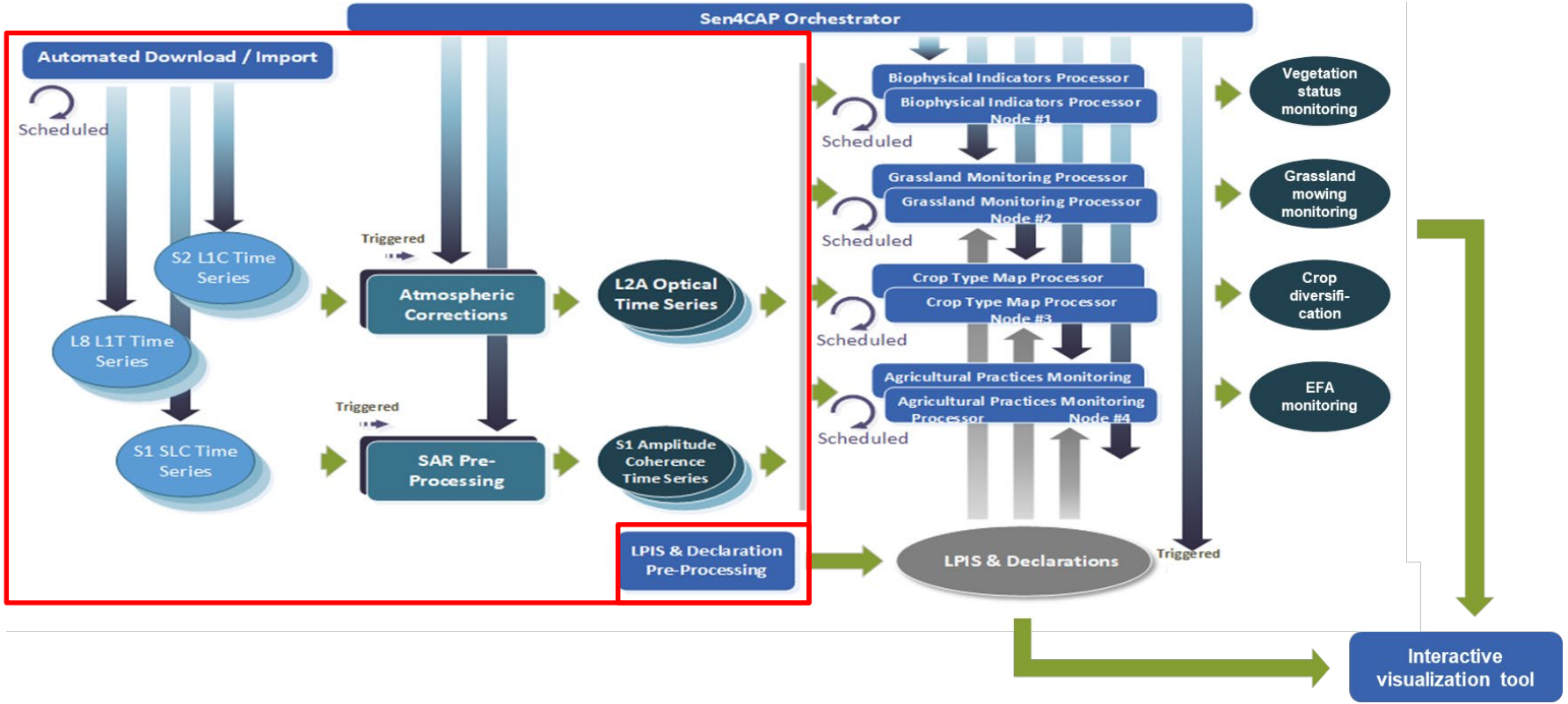
Open source Sen4CAP system (v1.0)

Automated mode: generate markers and products at the parcel-level along the season as Sentinel-1 and Sentinel-2 images are ingested => **Orchestrator concept**



High modularity: software components that can be used separately

Sen4CAP system – S1/S2 ingestion and pre-processing



Sentinel-2 pre-processing

- Correcting single-date Level-1C products from the effects of the atmosphere that reduce the quality of the images

- Level-2A products are systematically generated at the ground segment over Europe since March 2018 using Sen2COR processor

- Sen4CAP reads L2A Sen2COR products, but also proposes MAJA as alternative L2A pre-processing module

https://earth.esa.int/web/sentinel/user-guides/sentinel-2-msi/product-types/level-2a

S1 pre-processing: backscatter and coherence from S1 SLC Interferometric Wide images

- SAR backscatter (after calibration, sigma nought $\sigma 0$)

The **SAR backscattering** is a measure of the **outgoing radar signal that the target redirects directly back towards the radar antenna**. It is a measure of the reflective strength of a target. The normalised measure of the radar return from a distributed target is called the backscatter coefficient, or **sigma nought** (σ_0), and is defined as per unit area on the ground. In general, due to the high dynamic of the SAR backscatter coefficient, **the amplitude** = sqrt(σ_0) is preferred for visualization purposes.

- SAR Coherence

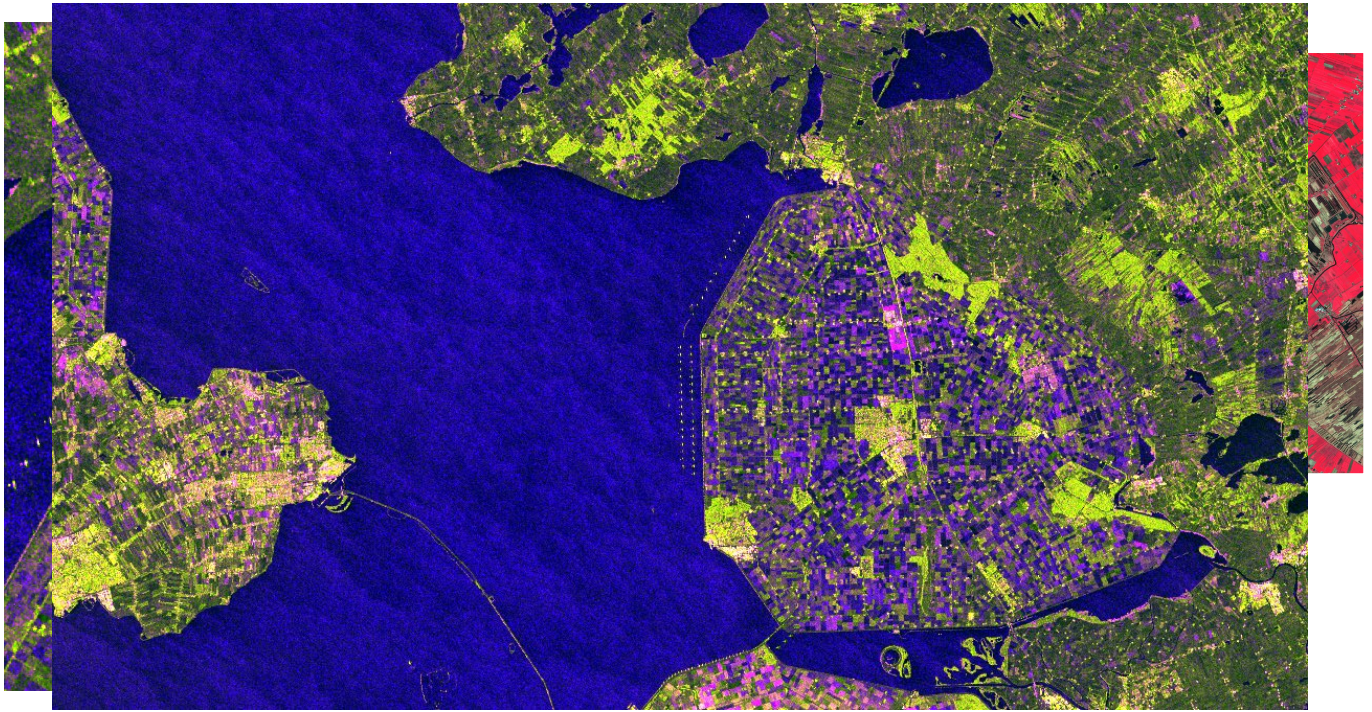
The coherence, which assume values in the range [0.0, 1.0], gives an **estimation of changes in the scene taking into account variation of the phase of the backscattered radar signal:** high coherence (close to 1.0) implies that the scene is steady (e.g. urban areas, bare soil, rocks and so on), low coherence indicates changes between the two acquisition dates.

The coherence is **calculated from a couple of SAR images acquired from the same** orbit (in order to have significant coherence values the images must be acquired with similar sight of view). The high revisit time of Sentinel-1 mission allows to calculate **short term coherence** from couples of images acquired one **6 days** from the other.

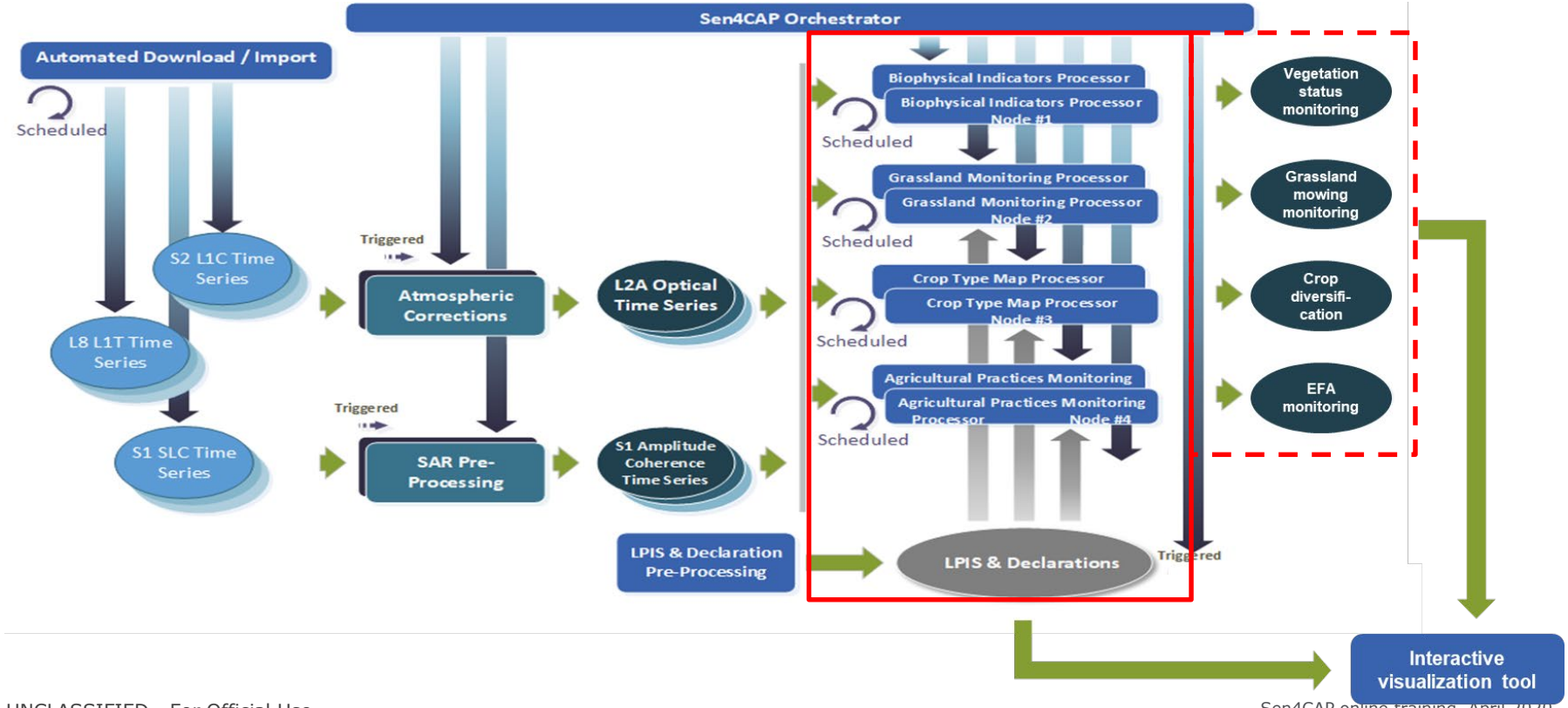
https://earth.esa.int/handbooks/asar/CNTR5-2.html

Sentinel-1 time series

Sentinel-1 backscatter in VV and VH polarization (weekly mosaics)

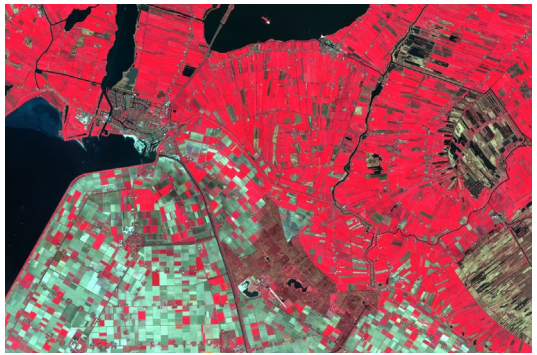


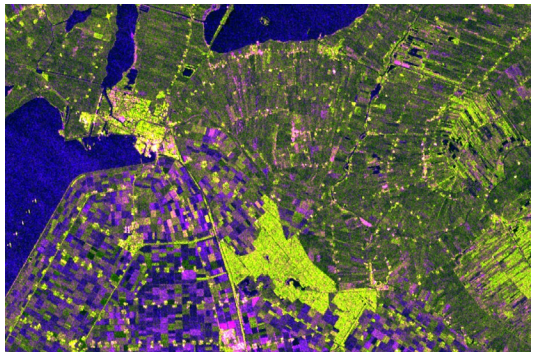
Sen4CAP system – Markers and Products



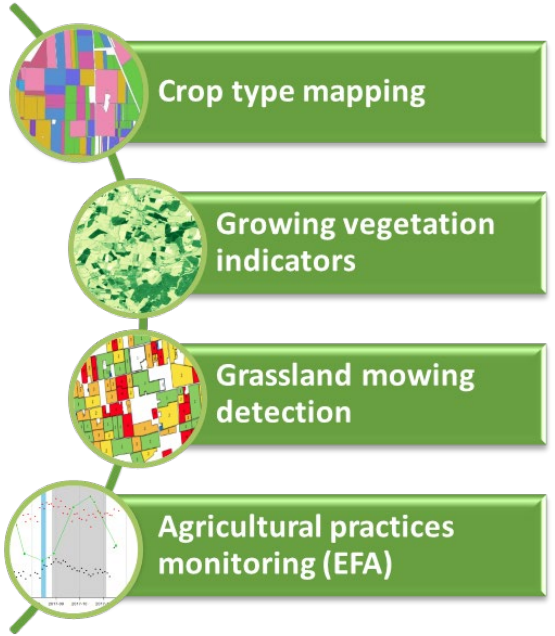
Large dataset of markers from S1 & S2 for a national coverage

Sen4CAP system to process in near-real time S1 and S2 full time series





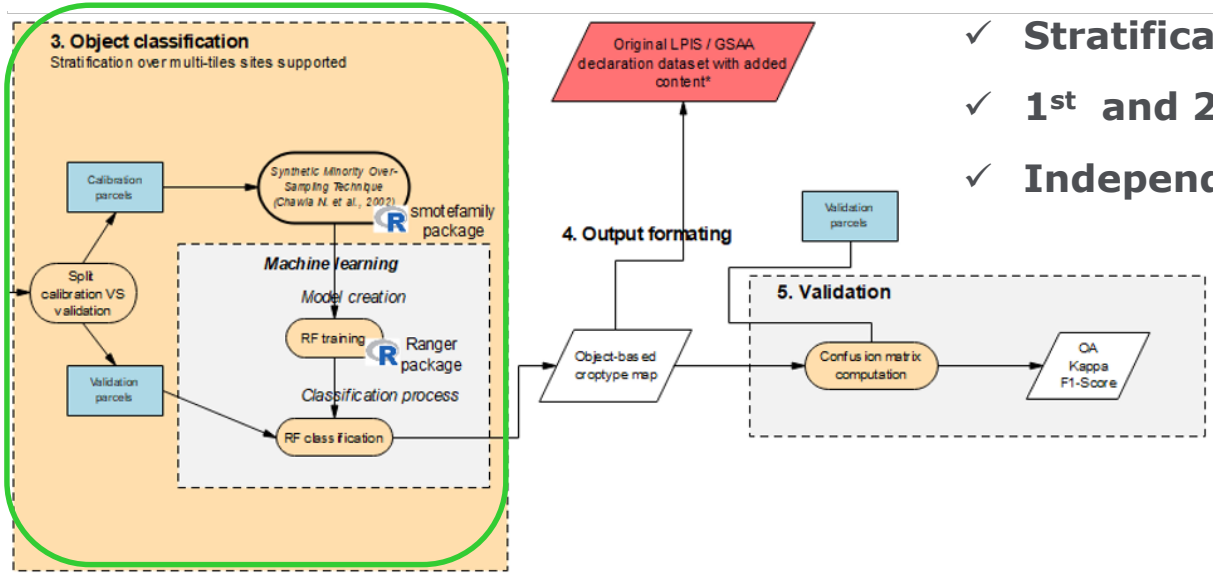
Metrics / markers stored for each LPIS/GSAA parcel



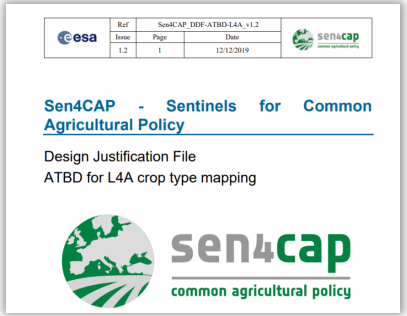
Crop type map – Fine-tuned Random Forest

Crop type mapping

Crop type classification



- ✓ **Optimized parcels selection for calibration**
- ✓ **Focus on minor crops**
- ✓ **Stratification**
- ✓ **1st and 2nd most probable crop types**
- ✓ **Independent validation**



esa | Ref: Sen4CAP_DDF-ATBD-L4A_v1.2 | Issue: 1.2 | Page: 1 | Date: 12/12/2019 | sen4cap

Sen4CAP - Sentinels for Common Agricultural Policy

Design Justification File
ATBD for L4A crop type mapping

sen4cap common agricultural policy

http://esa-sen4cap.org/content/technical-documents

S1 & S2 markers extraction

Crop type mapping

Sentinel-2

- Temporal resampling, with gap filling (every 10-day)
- 8 spectral values
  - 10m: green (B3), red (b4), NIR (B8)
  - 20m: red-edge (B5-6-7), SWIR1 (B11) and SWIR2 (B12)
- Computation of 3 spectral indices: NDVI, NDWI, brightness
- For all spectral bands and spectral indices: mean and standard deviation at the parcel-level

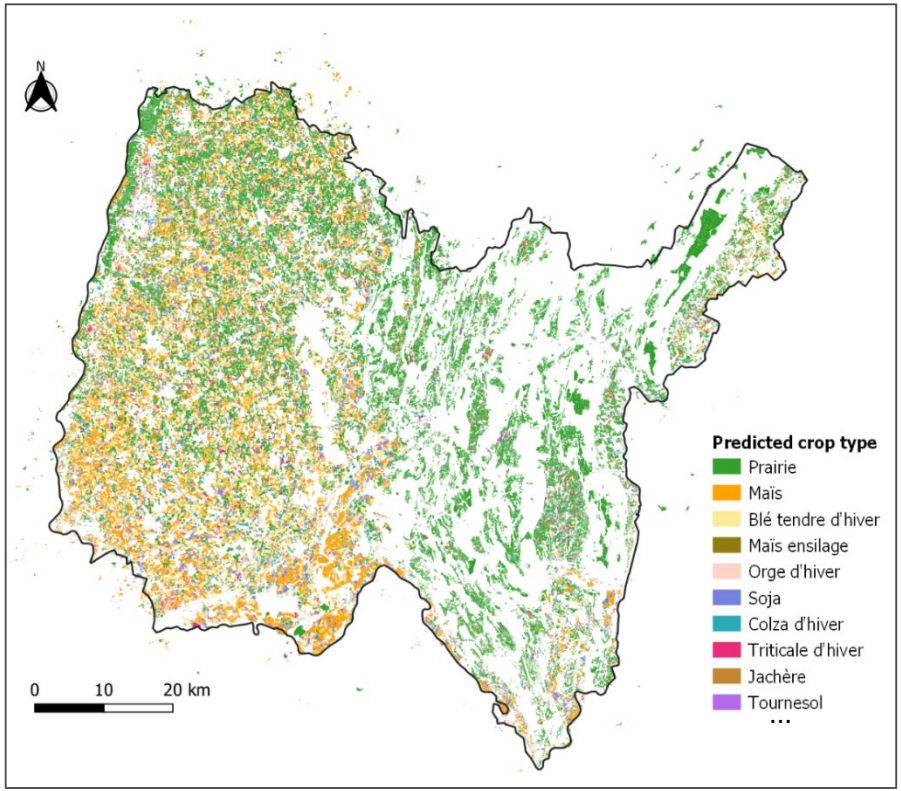
-> **22 metrics** by parcel every 10 days

Sentinel-1

- 10 indices every 6 days
  - coherence / amplitude in VV / VH + amplitude ratio
  - ascending / descending
- For these 10 indices: mean and standard deviation at the parcel-level
- Computation of temporal indicators
  - Whole period, 2 months, 1 month
  - Coefficient of variation
  - Quantile 10

-> **20 metrics** by parcel every 6 days + temporal markers

2019 Ain crop type map – End of July



Declared crop type

1st prediction and confidence level

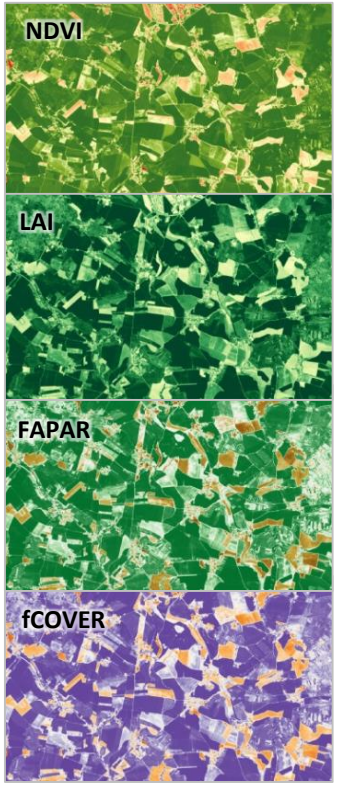
2nd prediction and confidence level

Sen4CAP_L4A_CropType_FR_AIN_20190101_20190731 :: Features Total: 86...

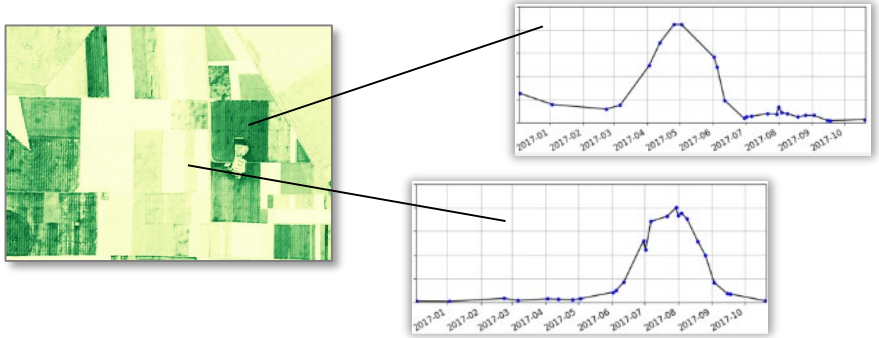
	CT_decl	CT_pred_1	CT_conf_1	CT_pred_2	CT_conf_2
52998	180	180	0.924	36	0.018
52999	36	36	0.719	256	0.119
53000	3000	3000	0.874	151	0.037
53001	180	180	0.482	3000	0.090
53002	256	256	0.611	180	0.132
53003	NULL	NULL		NULL	
53004	149	149	0.806	147	0.057
53005	180	180	0.957	36	0.009

Show All Features

Biophysical indicators – LAI, FAPAR, FCover retrieval using BV-Net approach

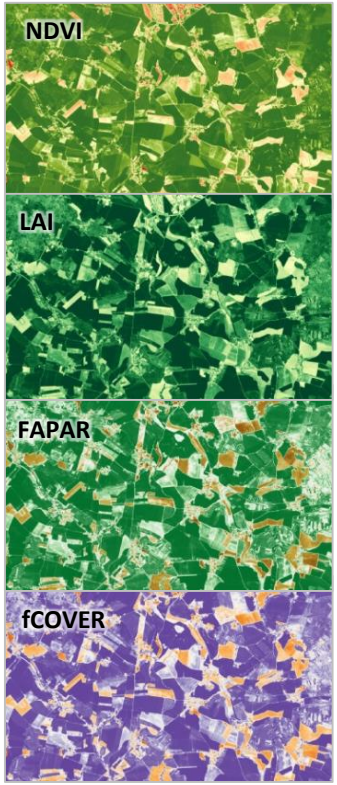


4 indicators about the evolution of the green vegetation corresponding to the vegetative development of the crop



Biophysical indicators – LAI, FAPAR, FCover retrieval using BV-Net approach

Growing vegetation indicators



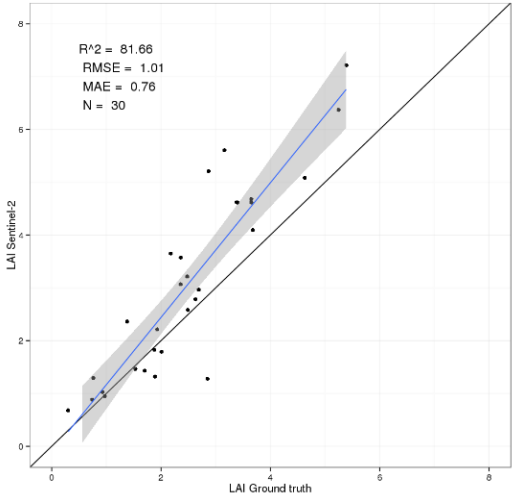
4 indicators about the evolution of the green vegetation corresponding to the vegetative development of the crop

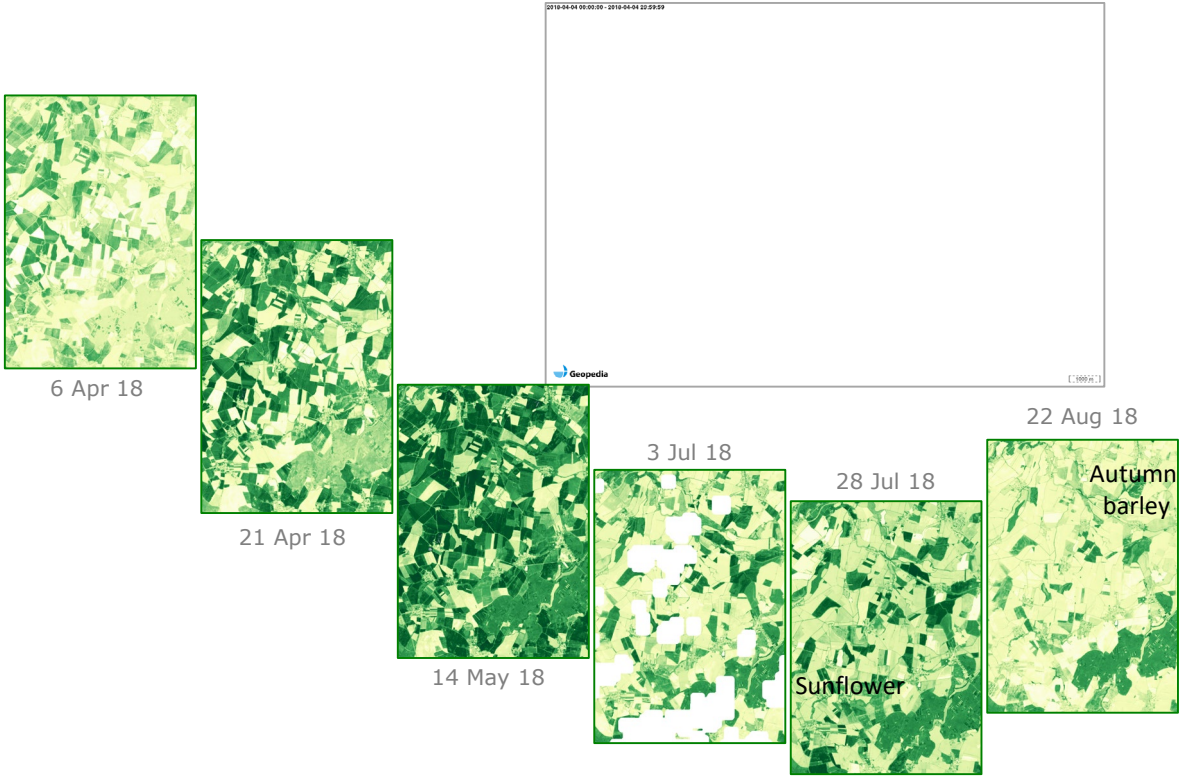
- Optical pre-processing for S2 (and L8)
- All spectral bands are used, except the blue one
- Acquisition of the geometry (sun zenith angle, view zenith angle, relative azimuth angle)
- BV-Net approach developed by Weiss et al. (2002) from INRA
  - PROSPECT&SAIL Radiative Transfer Model are used to simulate surface reflectance for a wide range of soils and vegetation
  - The simulations are used to train a Artificial Neural Network for each of the 3 targeted biophysical variables
  - The Neural Network is applied to real Sentinel-2 acquisitions
  - It does not require in situ data for calibration

LAI time series at 10-m

Belgium

30 fields (wheat and potatoes)





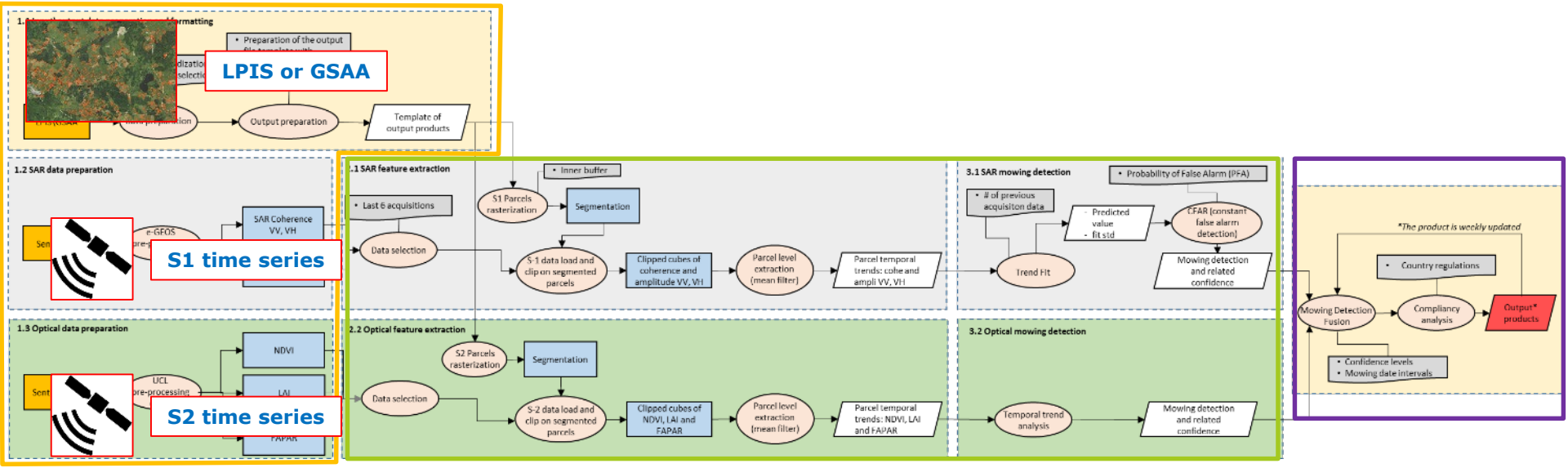
Grassland mowing detection from S1 and S2

Grassland mowing detection

Input data

S2 and S1 Detection algorithm

Detection fusion and compliancy assessment

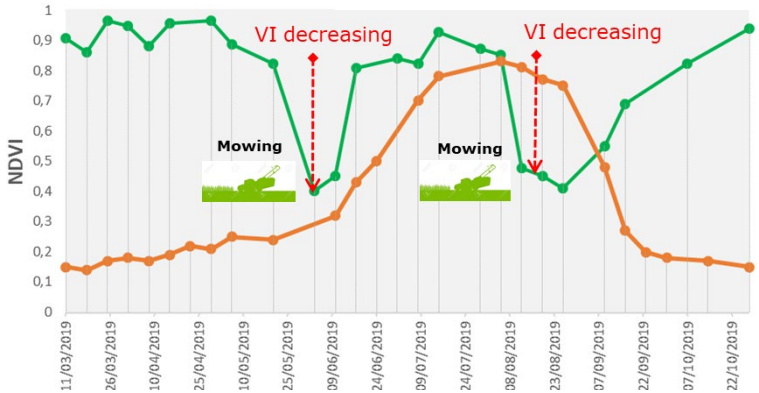


S1 & S2 time series analysis

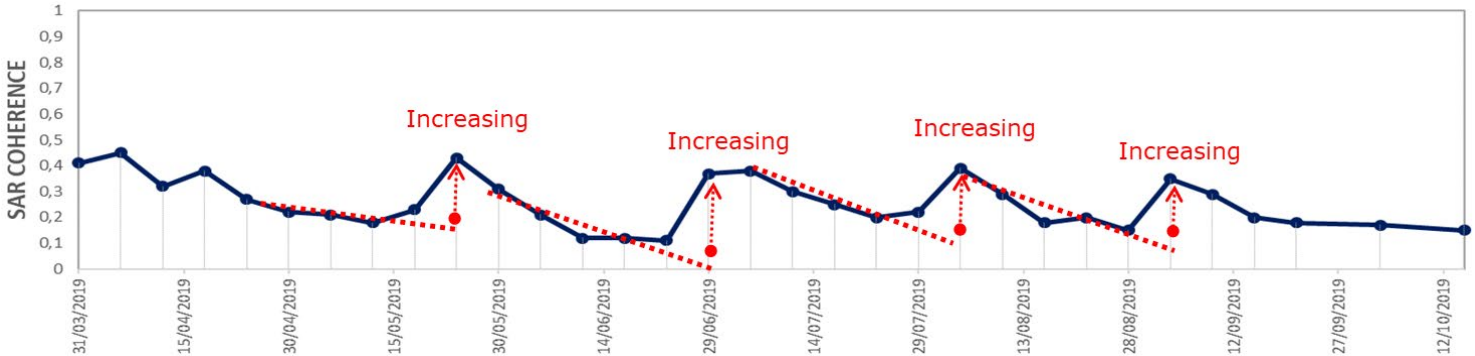
Grassland mowing detection

S2
NDVI, LAI, FAPAR

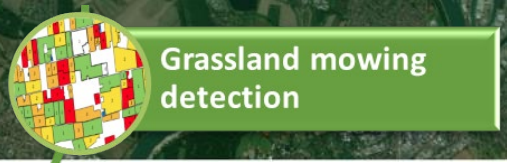
http://esa-sen4cap.org/content/technical-documents



S1
Coherence

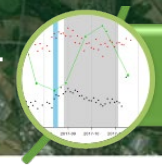


Grassland mowing product

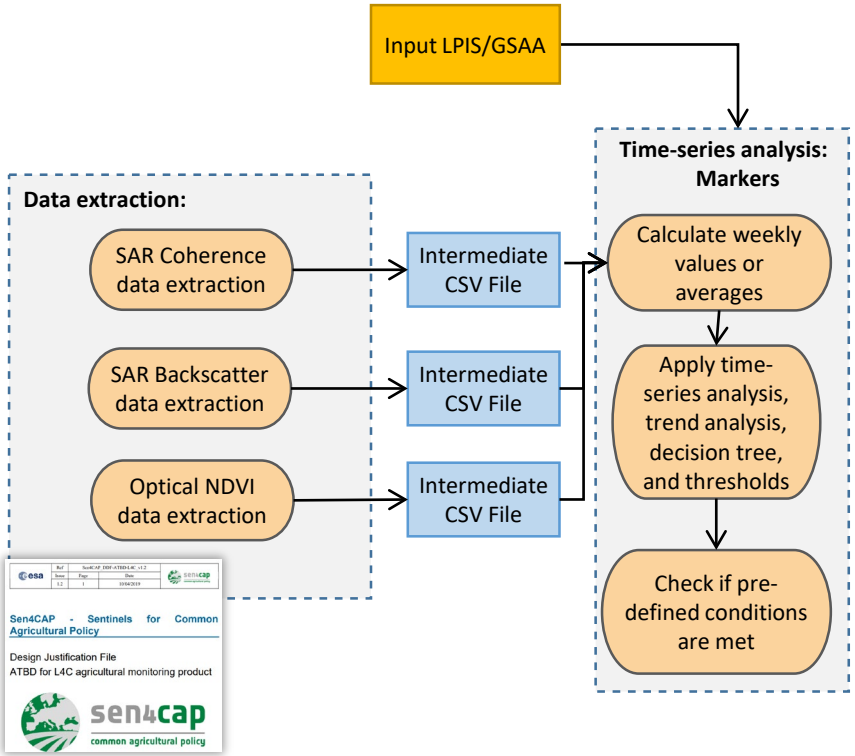


- Grassland mowing product contains, for each parcel, information about **number and temporal intervals of mowing events** detected

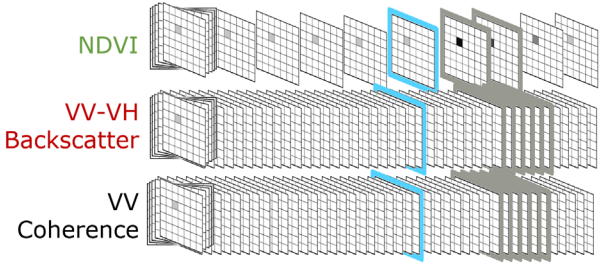
Agricultural practices monitoring from Sentinel-1 and Sentinel-2 markers analysis



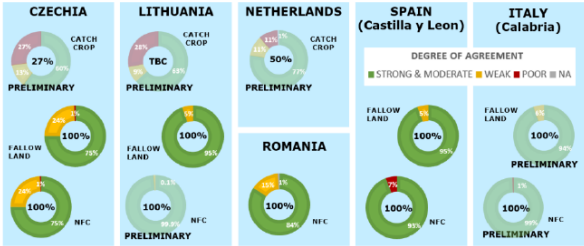
Agricultural practices monitoring (EFA)



- Analysing the dense S1 and S2/L8 time series per parcel

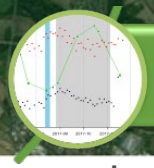


- Applying decision trees to determine the degree of compliancy of the declared agricultural practice



http://esa-sen4cap.org/content/technical-documents

Markers

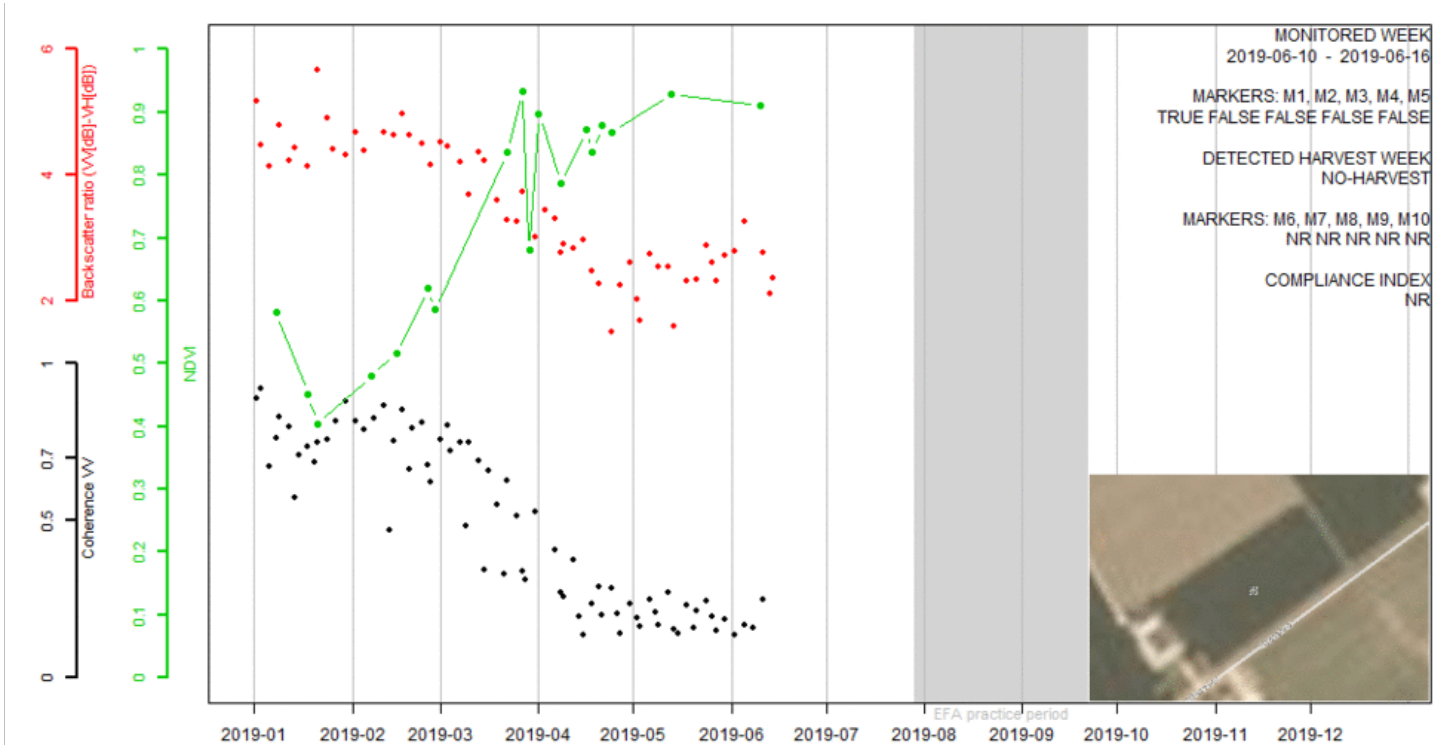


Agricultural practices monitoring (EFA)

- Related to vegetation state or vegetation change on a parcel

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
MARKERS FOR DECLARED PRATICES		
M6	**Presence of vegetation**	High values of NDVI
M7	**Growth of vegetation**	Break in NDVI (increase)
M8	**No loss of vegetation**	No break in NDVI (decrease)
M9	**No loss of vegetation**	No increase of the backscatter ratio
M10	**Presence of vegetation (dynamic conditions)**	No Break in VV Coherence (increase) and no high values of VV Coherence

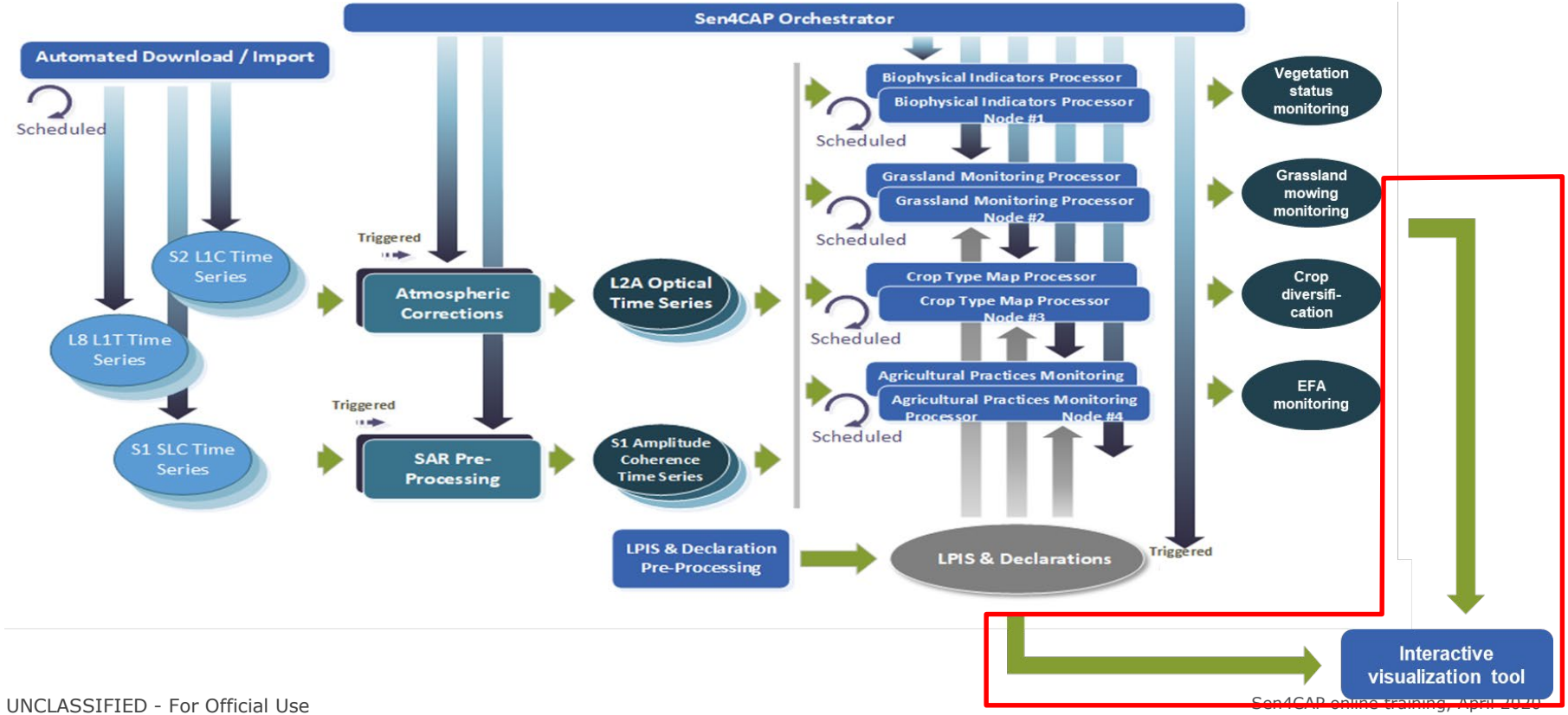
Monitoring of harvest/clearance of a parcel with winter wheat + catch crop (NLD)



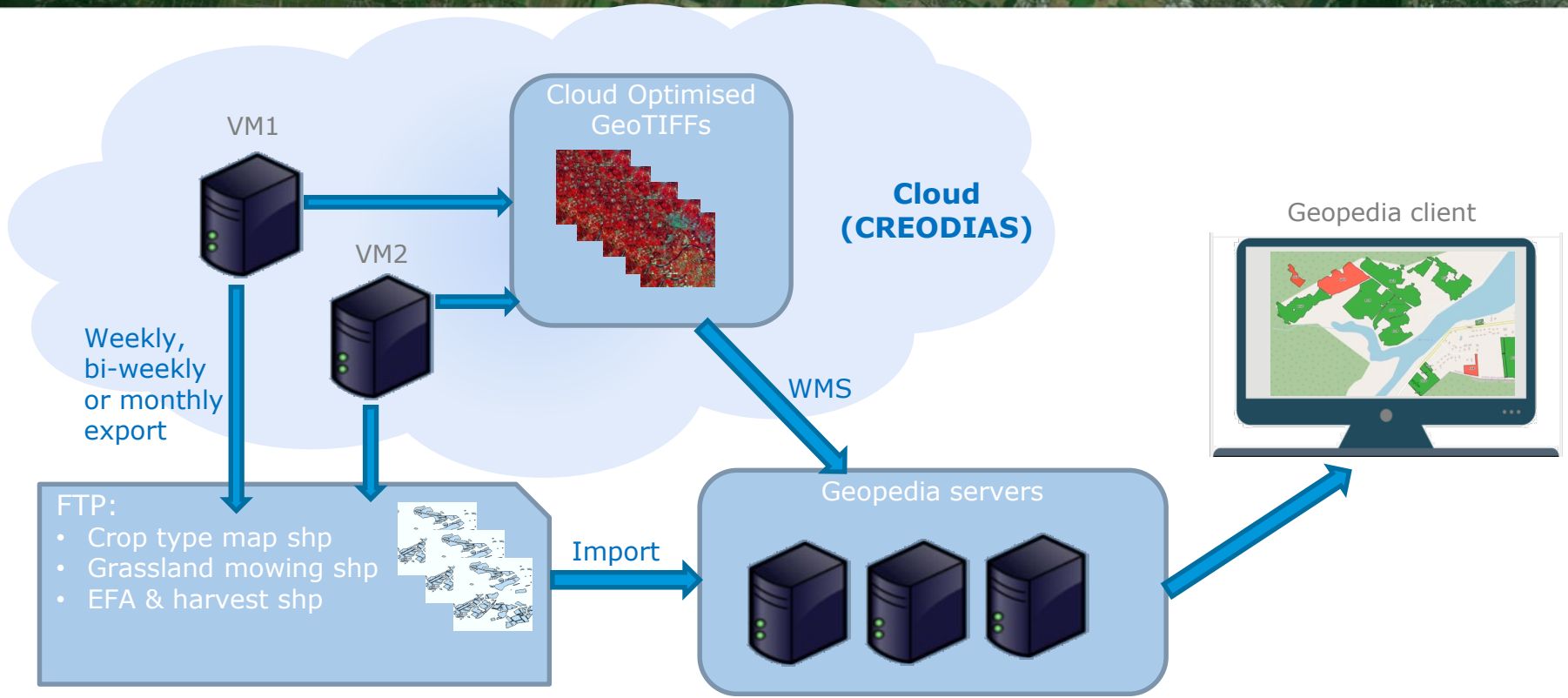
Catch crop in the period from 29.7.2019 to 29.9.2019

Area: 2.5 ha

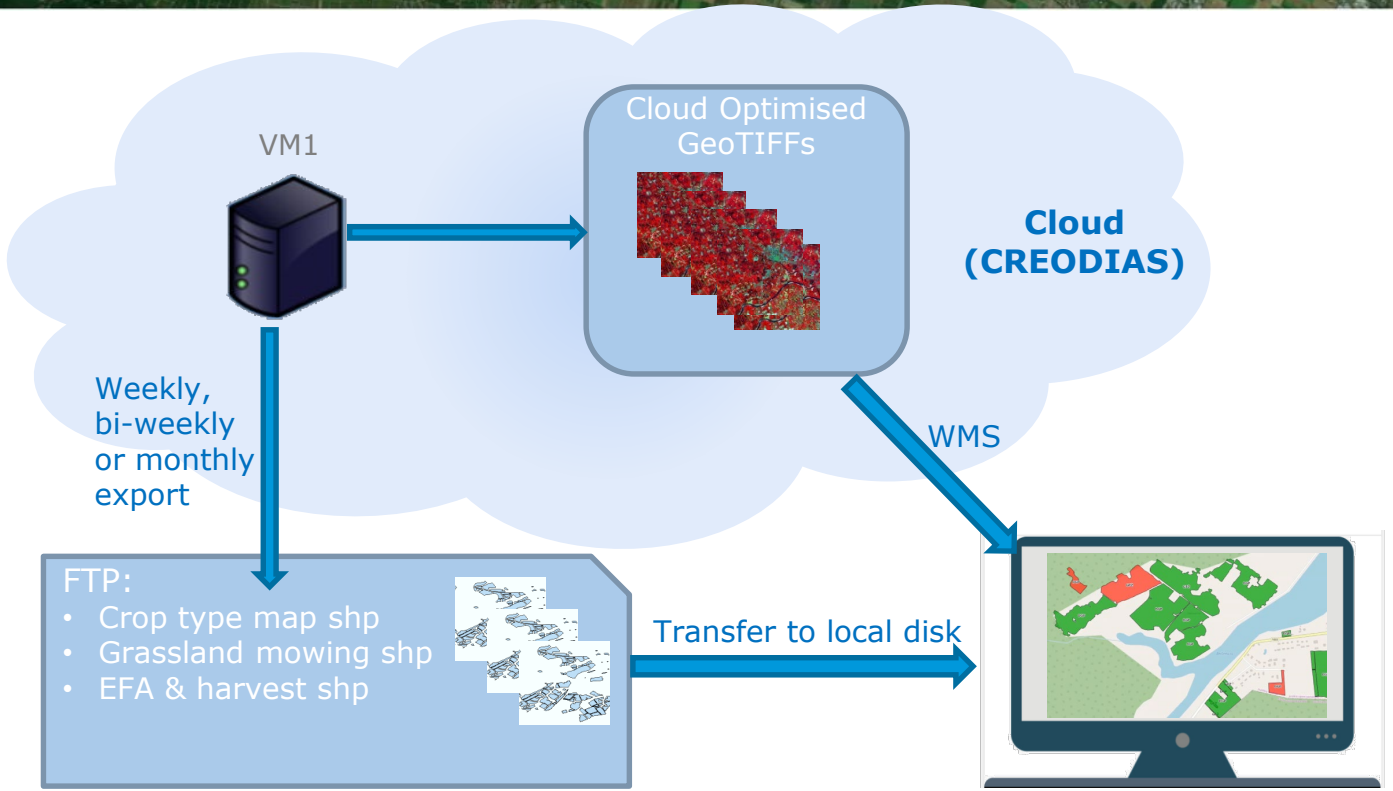
Sen4CAP system – Visualization tool



Visualization tool to access all markers and products at parcel-level (Web application)



Exploring the products in Qgis



Overview of the session

1) **What is Sen4CAP?**
   - Sen4CAP system and visualization tool
   - **Subsidy application and auxiliary information preparation**

2) System operation: first steps with the system (presentation and hands-on training using the system web interface)
   - Launch a site in the automatic mode
   - Prepare and upload parcels information
   - Launch additional jobs
   - Access system database

3) System installation: ICT requirements and procedure

4) Questions and answers

Subsidy applications layer and auxiliary information preparation

1) System operation: continuous monitoring
2) List of files to upload
3) Area of interest (AOI)
4) Subsidy applications layer (parcels)
5) L4A crop type (LUT)
6) L4B grassland mowing detection (configuration file)
7) L4C agricultural practices monitoring (configuration file and practice table)

⇒ We are still working to better document some of these files

⇒ Examples of all these files are given on the website: http://esa-sen4cap.org/content/data

Subsidy applications layer and auxiliary information preparation

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System operation: continuous monitoring

- System designed to run in continuous mode -> **continuous monitoring**
- **At the beginning of the season**:
  - No parcel with declaration: crop type, practice, etc.
  - BUT, it is **important to launch the preprocessing of the EO data** (S1, S2 and L8), which represents the highest part of the processing time
- **When the first version of the subsidy applications layer (parcels) is available**:
  - Upload in the system
  - **+ upload of needed auxiliary information** for the use of the advanced processors (L4A crop type, L4B grassland mowing detection and L4C agricultural practices monitoring)

System operation: continuous monitoring

Start of the monitoring period

At the beginning of the season: System initialization

Sen4CAP system : main parameters settings	
Area of Interest (AOI)	Shapefile to be uploaded
Monitoring period	Start, mid- and end dates to be defined
S1+S2 / S1+S2+L8	L8 to be selected

When launched, the system will begin to:

- **Download/access** the low-level products (S1, S2 and L8 Level-1 data)
- **Preprocess** these data:

⇒ S2 and L8: atmospheric correction and cloud detection

⇒ S1: backscattering and weekly coherence computation (VV & VH)

- **Generate biophysical indicators** from S2 and L8 cloud-free observations (if activated)

AUTOMATIC

System operation: continuous monitoring

During of the monitoring period → **End of the monitoring period**

Before the generation of advanced products (L4x processors):

Subsidy applications layer and auxiliary information upload

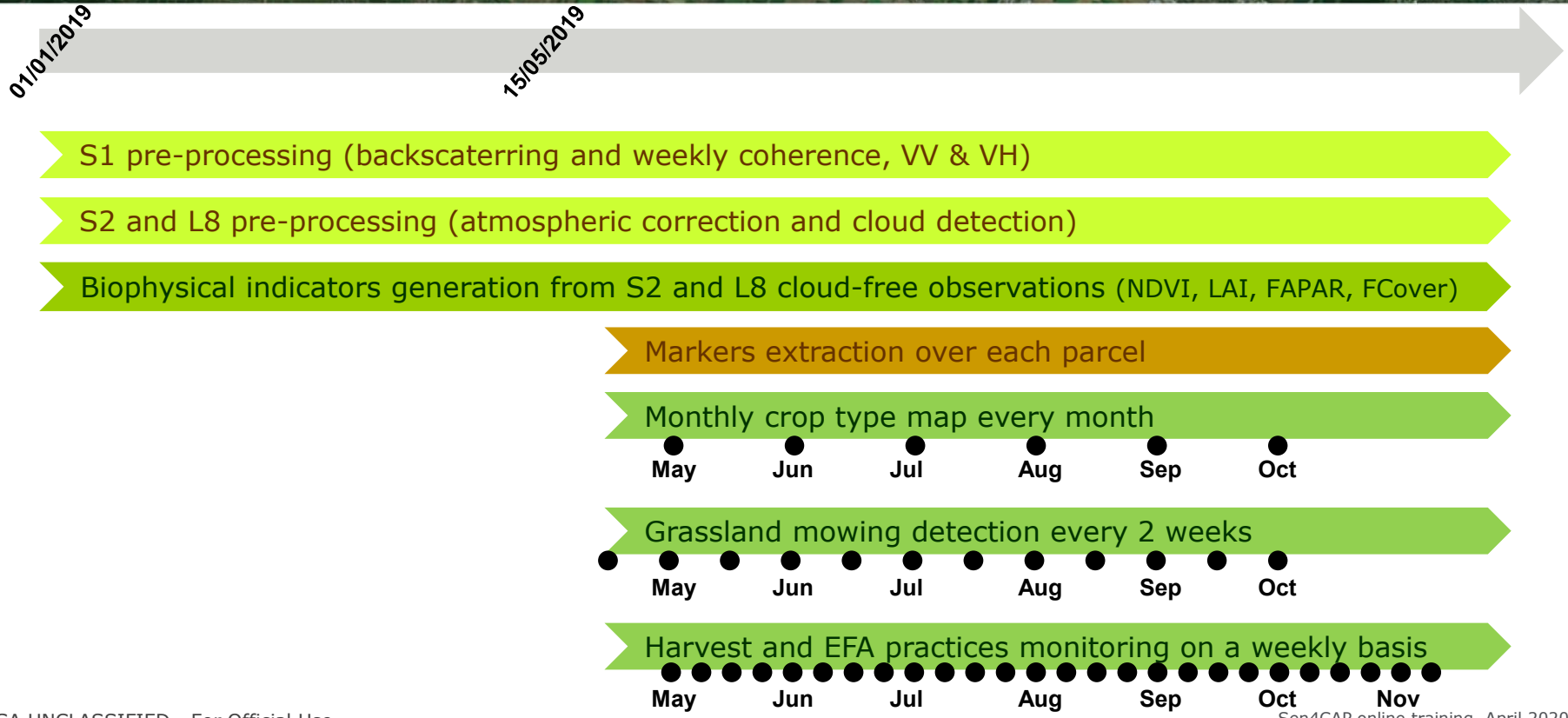
Sen4CAP system : auxiliary information	
Parcels (shp)	Subsidy applications layer
Tables and config files (cfg and csv)	L4A crop type LUT L4B config file L4C config file + agri practices tables

Then, the system is able to **run advanced processors**:

- L4A crop type
- L4B grassland mowing detection
- L4C agricultural practices monitoring

AUTOMATIC using by-default scheduling

System operation: continuous monitoring



System operation: continuous monitoring

- 2 operating modes:

Automated mode through the web interface

a) Based on the Orchestrator with by-default parameterization, automatic data download/access and processing until the end of the season, on-time delivery => **operational scenarios**

b) Processor execution on user request, with by-default parameterization, with the *Scheduled job* approach

Manual mode: to run processors independently, with custom parameters

a) Through the web interface, with the *Custom job* approach

b) In command lines through a Linux console

Subsidy applications layer and auxiliary information preparation

1) System operation: continuous monitoring
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3) Area of interest (AOI)
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List of files to upload

- At the beginning of the monitoring period:
  - Area of Interest (AOI) → 1 shapefile
- Before the generation of advanced products (L4x processors):
  - Subsidy applications layer (parcels) → 1 shapefile
  - L4A crop type: crop code Look-Up-Table (LUT) → 1 csv table
  - L4B grassland mowing detection: configuration file → 1 cfg file
  - L4C agricultural practices monitoring:
    - Configuration file → 1 cfg file
    - 1 table by monitored practice → Potentially 4 csv tables

Subsidy applications layer and auxiliary information preparation

1) System operation: continuous monitoring
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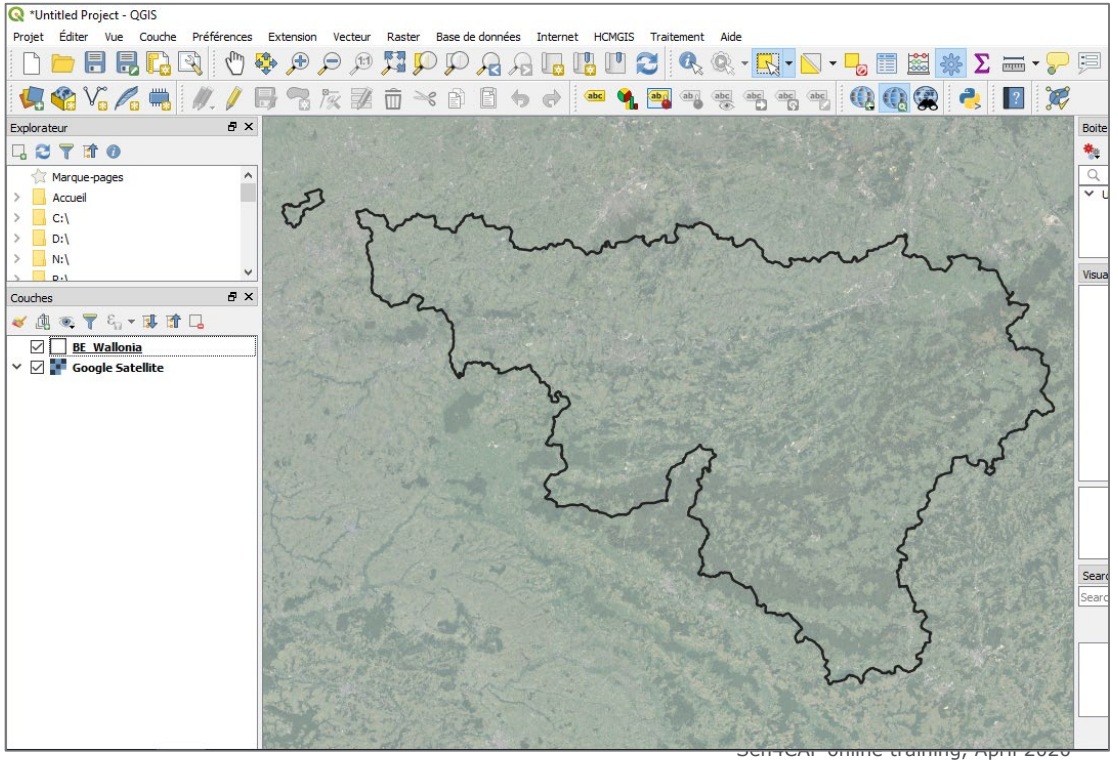
Area of interest (AOI)

- FORMAT: **zip file**, containing a shapefile

⇒ Mandatory files: .dbf, .prj, .shp, .shx

- PROJECTION: **WGS84/UTMzoneXXX**
- Will only be used to define the area where the system will look at S1, S2 and L8 data

Example: Wallonia (BE)



Subsidy applications layer and auxiliary information preparation

1) System operation: continuous monitoring
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Subsidy applications layer (parcels)

- FORMAT: **zip file**, containing a shapefile

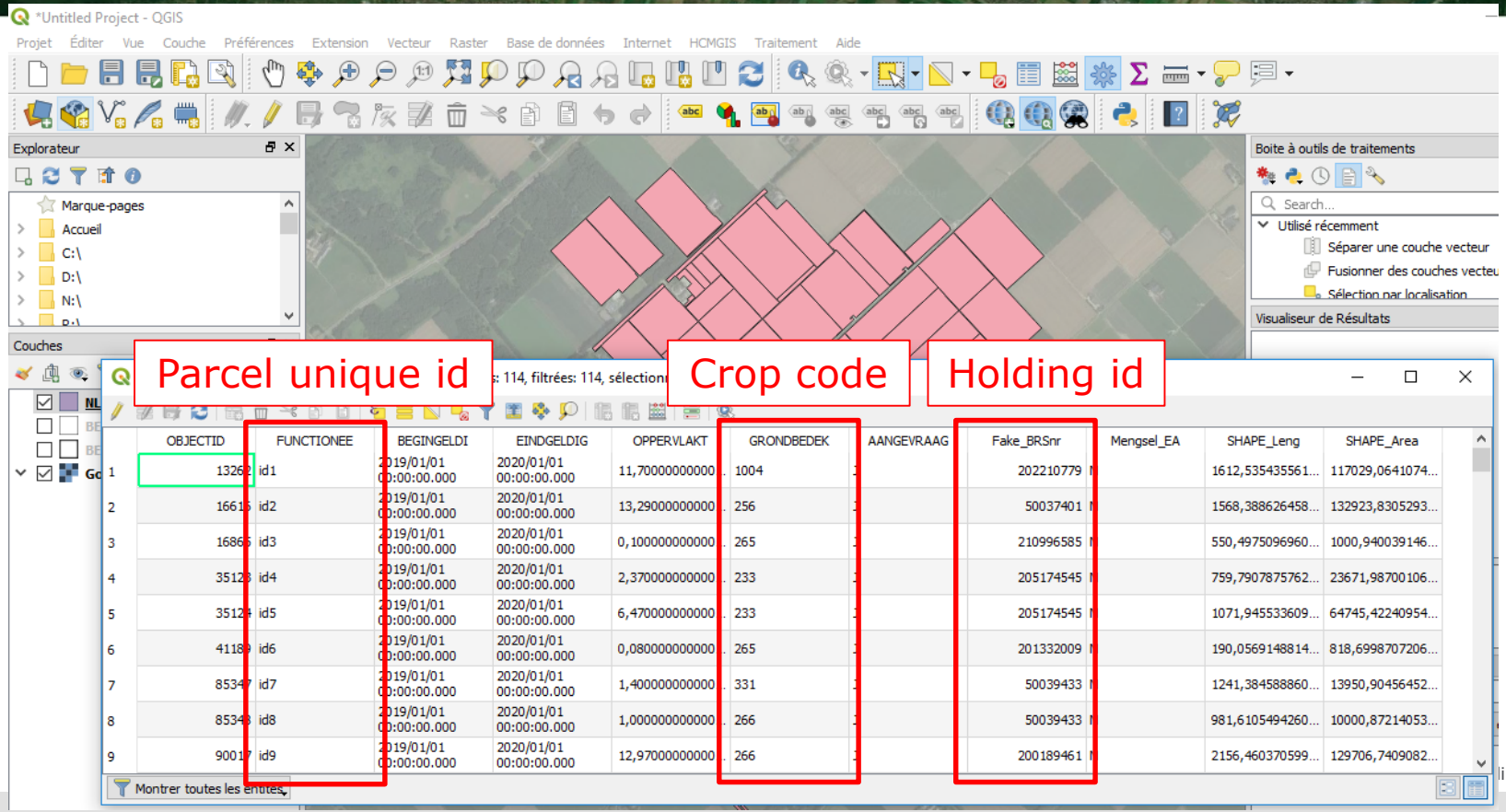
⇒ Mandatory files: .dbf, .prj, .shp, .shx

- PROJECTION: **any projection**

⇒ This projection will be used as the projection of the advanced products

- Must contain 3 INFORMATION (in the attribute fields table):
  - **Unique id of the parcel** (txt or num): can be contained in one attribute field or via the concatenation of several attribute fields
  - **Holding id of the parcel** (txt or num):
    - ⇒ Only used for the crop diversification use case
    - ⇒ If not interested, create one field with a unique value
  - **Crop code of the parcel** (txt or num): code used to defined the crop type

Subsidy applications layer (parcels)



	OBJECTID	FUNCTIONEE	BEGINGELDI	EINDGELDIG	OPPERVLAKT	GRONDBEDEK	AANGEVRAAG	Fake_BRSnr	Mengsel_EA	SHAPE_Leng	SHAPE_Area
1	13262	id1	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	11,700000000000	1004		202210779		1612,535435561...	117029,0641074...
2	16615	id2	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	13,290000000000	256		50037401		1568,388626458...	132923,8305293...
3	16865	id3	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	0,100000000000	265		210996585		550,4975096960...	1000,940039146...
4	35123	id4	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	2,370000000000	233		205174545		759,7907875762...	23671,98700106...
5	35124	id5	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	6,470000000000	233		205174545		1071,945533609...	64745,42240954...
6	41189	id6	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	0,080000000000	265		201332009		190,0569148814...	818,6998707206...
7	85347	id7	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	1,400000000000	331		50039433		1241,384588860...	13950,90456452...
8	85348	id8	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	1,000000000000	266		50039433		981,6105494260...	10000,87214053...
9	90017	id9	2019/01/01 00:00:00.000	2020/01/01 00:00:00.000	12,970000000000	266		200189461		2156,460370599...	129706,7409082...

Example from the Netherlands

Subsidy applications layer and auxiliary information preparation

1) System operation: continuous monitoring
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6) L4B grassland mowing detection (configuration file)
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L4A crop type LUT

- FORMAT: **csv file**
- CONTENT: **for each crop type**
  - List of all the original crop code from the subsidy applications layer (parcels)
  - Definition of the high-level land cover category
    - 1 = Annual crop
    - 2 = Permanent crop
    - 3 = Grassland
    - 4 = Fallow land
    - 5 = Greenhouse and nursery
    - 0 = Other natural areas
  - Definition of the groups for the classification
  - Information for the crop diversification use case

L4A crop type LUT

Original crop code list

New sequential number

Crop type name

High-level land cover category

Crop code for classification (and name)

Crop code for crop diversification use case (and name)

Crop diversification use case related information

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Ori_crop	CTnum	CT	LC	CTnumL4A	CTL4A	CTnumDIV	CTDIV	EAA	AL	PGrass	TGrass	Fallow	Cwater
2	174	1	Flower seeds open ground	1	54	Flower_seeds	44	Flower_seeds	1	1	0	0	0	0
3	233	2	Wheat winter-	1	151	Winter wheat	109	Triticum_winter	1	1	0	0	0	0
4	234	3	Wheat summer-	1	142	Triticum_summer	110	Triticum_summer	1	1	0	0	0	0
5	235	4	Barley winter	1	68	Hordeum_winter	55	Hordeum_winter	1	1	0	0	0	0
6	236	5	Barley summer-	1	69	Hordeum_summer	56	Hordeum_summer	1	1	0	0	0	0
7	237	6	Rye (not cut corn)	1	126	Secale	98	Secale	1	1	0	0	0	0
8	238	7	Oats	1	11	Avena	11	Avena	1	1	0	0	0	0
9	241	8	chick peas (and gray peas)	1	37	Chick peas	91	Pisum	1	1	0	0	0	0
10	242	9	Beans brown-	1	12	Beans	89	Phaseolus	1	1	0	0	0	0

Subsidy applications layer and auxiliary information preparation

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6) **L4B grassland mowing detection (configuration file)**
7) L4C agricultural practices monitoring (configuration file and practice table)

L4B grassland mowing detection (configuration file)

- FORMAT: **cfg file** (can be adapted using any notepad)
- CONTENT:
  - Algorithm parameters

```
; Netherlands
prod_type_list = SNDVI
sc_fact = 1000
corrupted_th = 0.1
invalid_data = -10000
decreasing_abs_th = 0.12
decreasing_rate_th = -0.000001
increasing_rate_th = 0.9
high_abs_th = 0.75
low_abs_th = 0.5
```

These parameters can be adapted to better fit with the region specificities in terms of grassland growing conditions and agricultural practices

Ex. from the 7 pilot countries

L4B grassland mowing detection (configuration file)

- FORMAT: **cfg file** (can be adapted using any notepad)
- CONTENT:
  - Algorithm parameters
  - Rules corresponding to each grassland type

```
; Netherlands
crop_codes = 265, 331, 336, 266, 332, 33
crop_time_intervals = ('01/04/2019', '31
('01/04/2019', '31/10/2019'), ('01/04/20
('01/04/2019', '31/10/2019'), ('01/04/20
('01/04/2019', '31/10/2019')
crop_rule = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
```

It defines the monitoring periods during which a grassland mowing event must be observed, to be compliant

Subsidy applications layer and auxiliary information preparation

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7) **L4C agricultural practices monitoring (configuration file and practice table)**

L4C agricultural practices monitoring (configuration file)

- FORMAT: **cfg file** (can be adapted using any notepad)
- CONTENT:
  - ❑ Algorithm parameters corresponding to each marker

```
[DEFAULT_TIME_SERIES_ANALYSIS_PARAMS]
# IMPORTANT: Please do not remove any of these keys from this section

# OPTTHRVEGCYCLE - Used in Marker 1 as NDVI presence threshold for de
OPTTHRVEGCYCLE=350
# NDVIDW - Used in Marker 2 as the Lower limit of the NDVI loss thers
NDVIDW=300
# NDVIUP - Used in Marker 2 as the Upper limit of the NDVI loss thres
NDVIUP=350
# NDVISTEP - Used in Marker 2, 7 and 8 as the Value to which the comp
NDVISTEP=5
# OPTTHRMIN - Used in Marker 2 as the Minimum NDVI threshold
OPTTHRMIN=100

# COHTHRBASE - Used
COHTHRBASE=0.05
# COHTHRHIGH - Used
```

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
MARKERS FOR DECLARED PRATICES		
M6	Presence of vegetation	High values of NDVI
M7	Growth of vegetation	Break in NDVI (increase)
M8	No loss of vegetation	No break in NDVI (decrease)
M9	No loss of vegetation	No increase of the backscatter ratio
M10	Presence of vegetation (dynamic conditions)	No Break in VV Coherence (increase) and no high values of VV Coherence

These parameters can be adapted to better fit with the region specificities in terms of crop growing conditions and agricultural practices

Ex. from the 7 pilot countries

L4C agricultural practices monitoring (configuration file)

- FORMAT: **cfg file** (can be adapted using any notepad)
- CONTENT:
  - Algorithm parameters corresponding to each marker
  - Corrections for each monitored practice

```
[CC_TIME_SERIES_ANALYSIS_PARAMS]
CC_CATCHMAIN="CatchCrop_3"
CC_CATCHPERIODSTART="${YEAR}-07-15"
CC_NDVIUP=500
CC_AMPTHRMIN=0.2
CC_COHTHRBASE=0.1
CC_COHTHRABS=0.7
CC_EFAAMPTHR=0.03
CC_AMPTHRBREAKDEN=3
CC_AMPTHRVALDEN=3

[FL_TIME_SERIES_ANALYSIS_PARAMS]
# Section not used

[NFC_TIME_SERIES_ANALYSIS_PARAMS]
# Section not used

[NA_TIME_SERIES_ANALYSIS_PARAMS]
NA_NDVIUP=500
NA_AMPTHRMIN=0.2
NA_COHTHRBASE=0.1
```

NA = Harvest
CC = Catch Crop
FL = Fallow Land
NFC = Nitrogen Fixing Crop

L4C agricultural practices monitoring (practice table)

- FORMAT: **csv files** (1 for each monitored practice)
- CONTENT: for each monitored practice
  - List of parcels to be monitored and associated practice
  - Time ranges of monitored practices

	A	B	C	D	E	F	G	H	I
1	FIELD_ID	MAIN_CROP	VEG_START	H_START	H_END	PRACTICE	P_TYPE	P_START	P_END
2	id36	233	20-05-19	15-07-19	15-10-19	CatchCrop	CatchCrop_3	15-10-19	NA
3	id46	233	20-05-19	15-07-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
4	id56	2708	20-05-19	03-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
5	id66	1044	20-05-19	03-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
6	id76	2014	20-05-19	10-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
7	id86	3804	20-05-19	20-05-19	15-10-19	CatchCropIsN	CatchCropIsN	15-05-19	7/15/2019
8	id96	372	20-05-19	20-05-19	15-10-19	CatchCropIsN	CatchCropIsN	15-05-19	7/15/2019
9	id106	233	20-05-19	15-07-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
10	id116	854	20-05-19	03-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA

Ex. of catch crop table

L4C agricultural practices monitoring (practice table)

⇒ VEG_START to H_END = **vegetation period** (crop growing period)

⇒ H_START to H_END = **harvest period** (period when the harvest must be observed)

Of the main crop

⇒ P_START to P_END = **practice period** (period when the agricultural practice (catch crop) must be observed)

	A	B	C	D	E	F	G	H	I
1	FIELD_ID	MAIN_CROP	VEG_START	H_START	H_END	PRACTICE	P_TYPE	P_START	P_END
2	id36	233	20-05-19	15-07-19	15-10-19	CatchCrop	CatchCrop_3	15-10-19	NA
3	id46	233	20-05-19	15-07-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
4	id56	2708	20-05-19	03-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
5	id66	1044	20-05-19	03-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
6	id76	2014	20-05-19	10-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
7	id86	3804	20-05-19	20-05-19	15-10-19	CatchCropIsN	CatchCropIsN	15-05-19	7/15/2019
8	id96	372	20-05-19	20-05-19	15-10-19	CatchCropIsN	CatchCropIsN	15-05-19	7/15/2019
9	id106	233	20-05-19	15-07-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA
10	id116	854	20-05-19	03-06-19	15-10-19	CatchCrop	CatchCrop_1	15-10-19	NA

Ex. of catch crop table

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