Welcome to the 12th webinar

sen4cap
common agricultural policy

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, Diane Heymans & Maxime Troiani from *UCLouvain*

Cosmin Udroiu & Laurentiu Nicola from *CS GROUP - ROMANIA*

Members of the consortium available to answer your questions

UCL Université catholique de Louvain

SINERGISE

gisat

e-geos AN ASI / TELESPAZIO COMPANY

CS ROMÂNIA

Webinar outline

- Sen4CAP overview
- System evolution
  - Next version 3.2
- New use cases for 2022
  - Parcels heterogeneity
  - Bare soil detection
  - Change of land category
- Next events

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- **Sen4CAP overview**
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sen4cap
common agricultural policy

Funded by European Space Agency

esa

EO Experts

UCLouvain
gisat
SINERGISE
e-geos
AN ASI / TELESPAZIO COMPANY
CS ROMÂNIA

Sen4CAP system

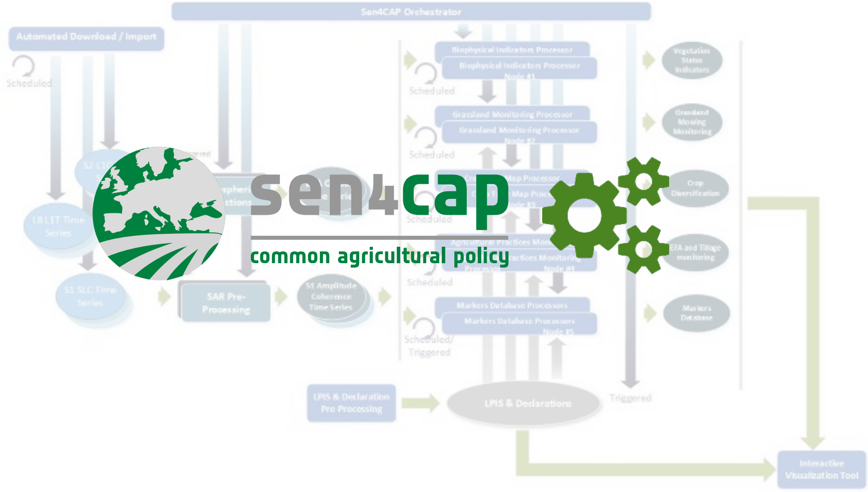
User group:
6+1 Paying Agencies

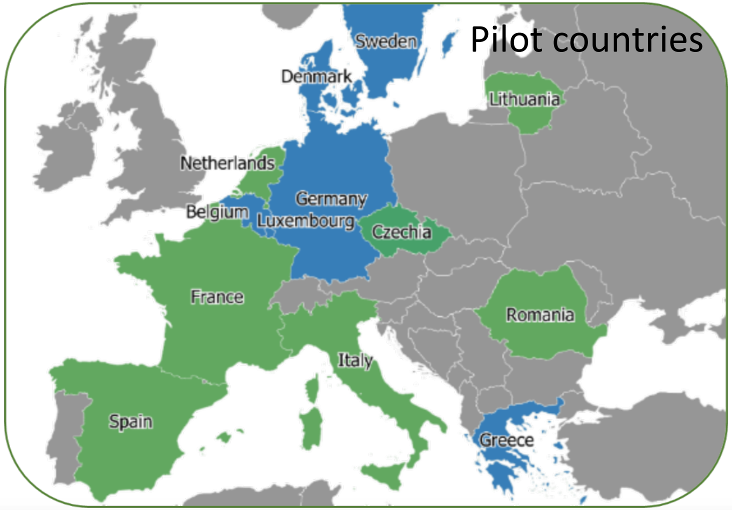
Guidance by DG-Agri, JRC, DG-Grow.

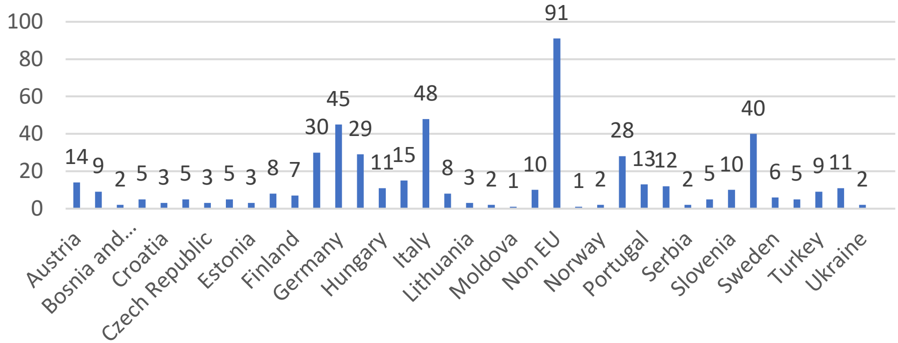
Commissioner P. Hogan: "...ESA has launched a tender Sen4CAP which will provide us useful knowledge and further possibilities on how we use Sentinel data in the context of the CAP ..."

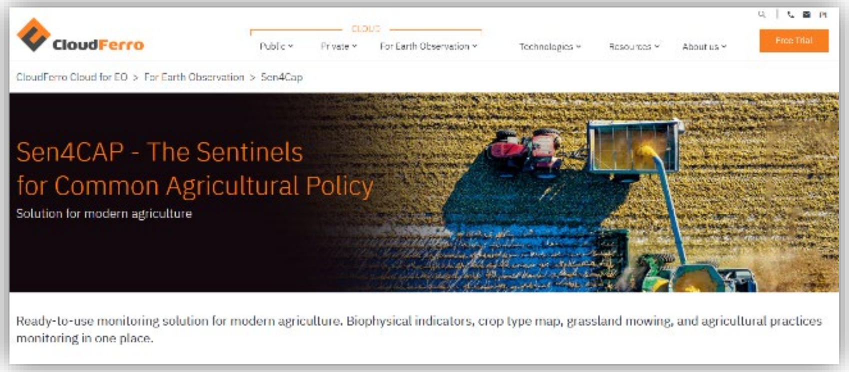
From an ESA project …

…to an open source system uptaken by the CAP community

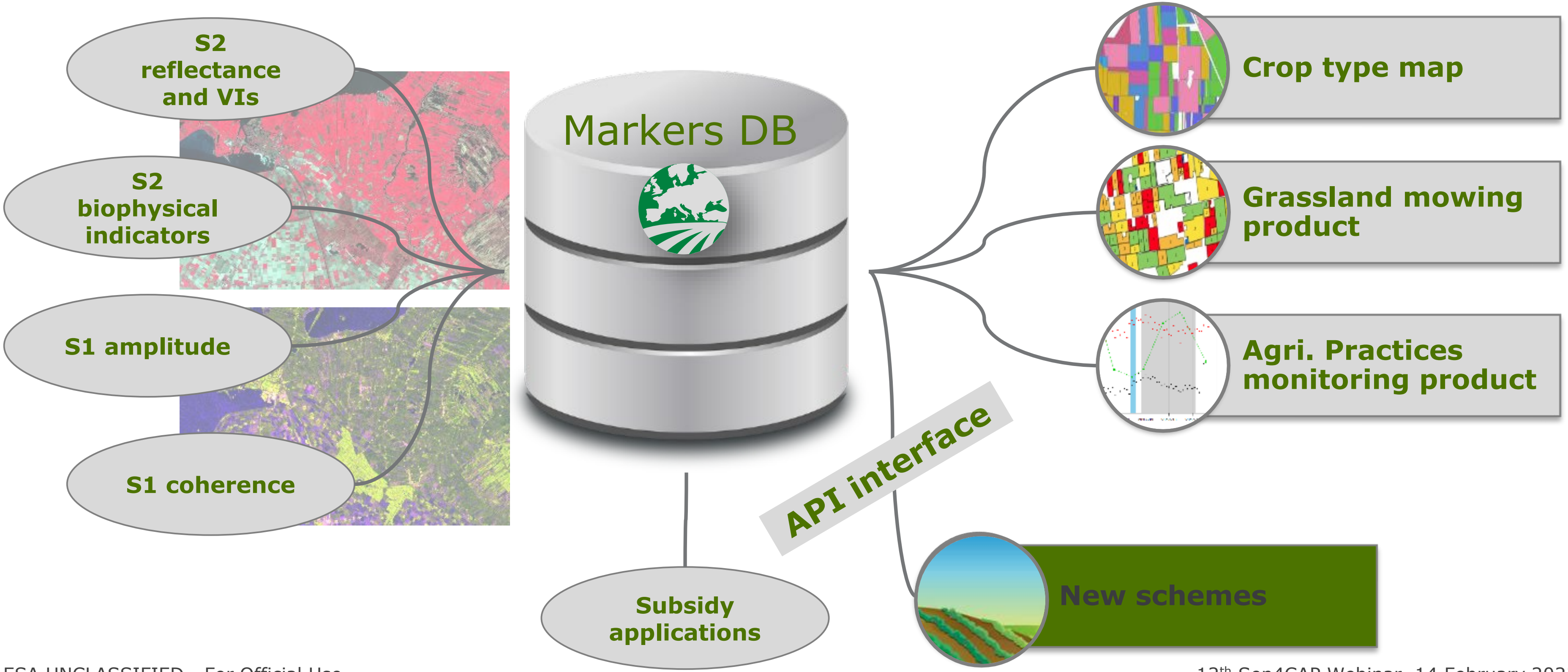




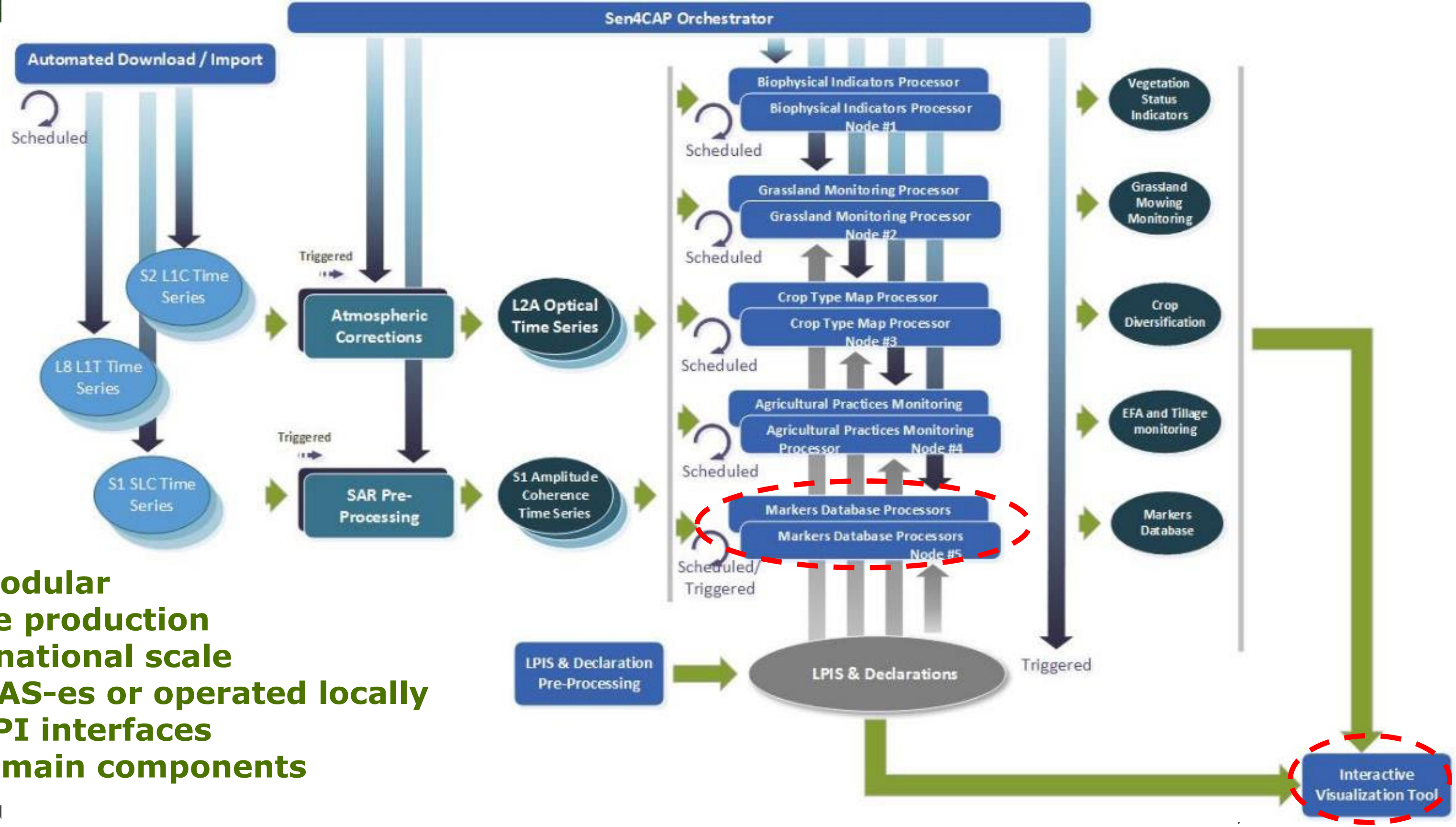




Markers and products assessed through selected use cases but available for many other applications

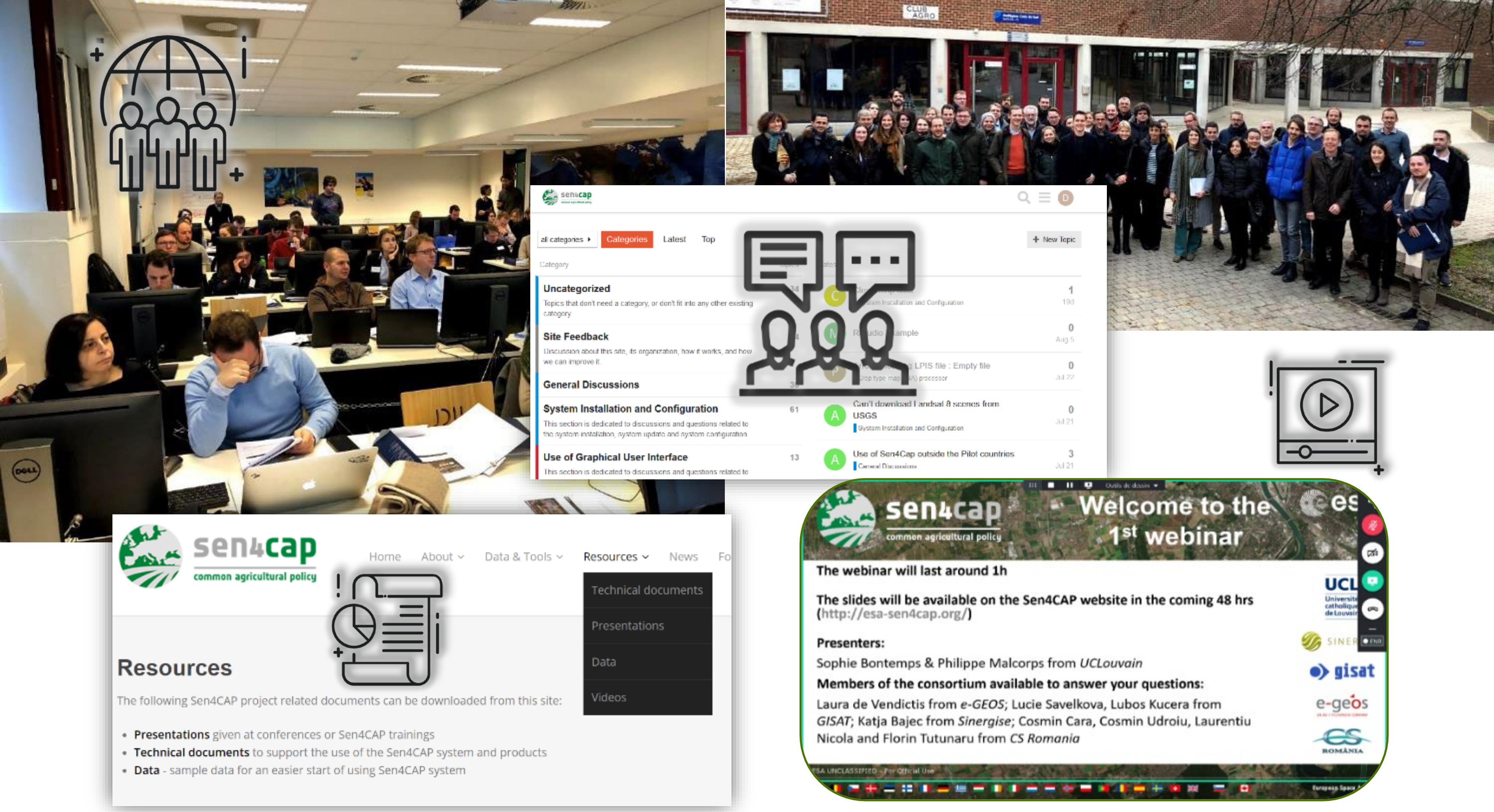


Sen4CAP – An open-source system



Version 3.1 delivered on 20 Jul 2022

- Sentinel-1 & -2
- Automated and modular
- For NRT or off-line production
- Demonstrated at national scale
- Portable on all DIAS-es or operated locally
- User-friendly & API interfaces
- Dockerization for main components



sen4cap
all categories
Categories
Latest
Top
New Topic
Category
Uncategorized
Topics that don't need a category, or don't fit into any other existing category
Site Feedback
Discussion about this site, its organization, how it works, and how we can improve it.
General Discussions
System Installation and Configuration
This section is dedicated to discussions and questions related to the system installation, system update and system configuration
Use of Graphical User Interface
This section is dedicated to discussions and questions related to
Can't download Landsat 8 scenes from USGS
System Installation and Configuration
Use of Sen4Cap outside the Pilot countries
General Discussions
sen4cap
common agricultural policy
Home
About
Data & Tools
Resources
News
Technical documents
Presentations
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
sen4cap
common agricultural policy
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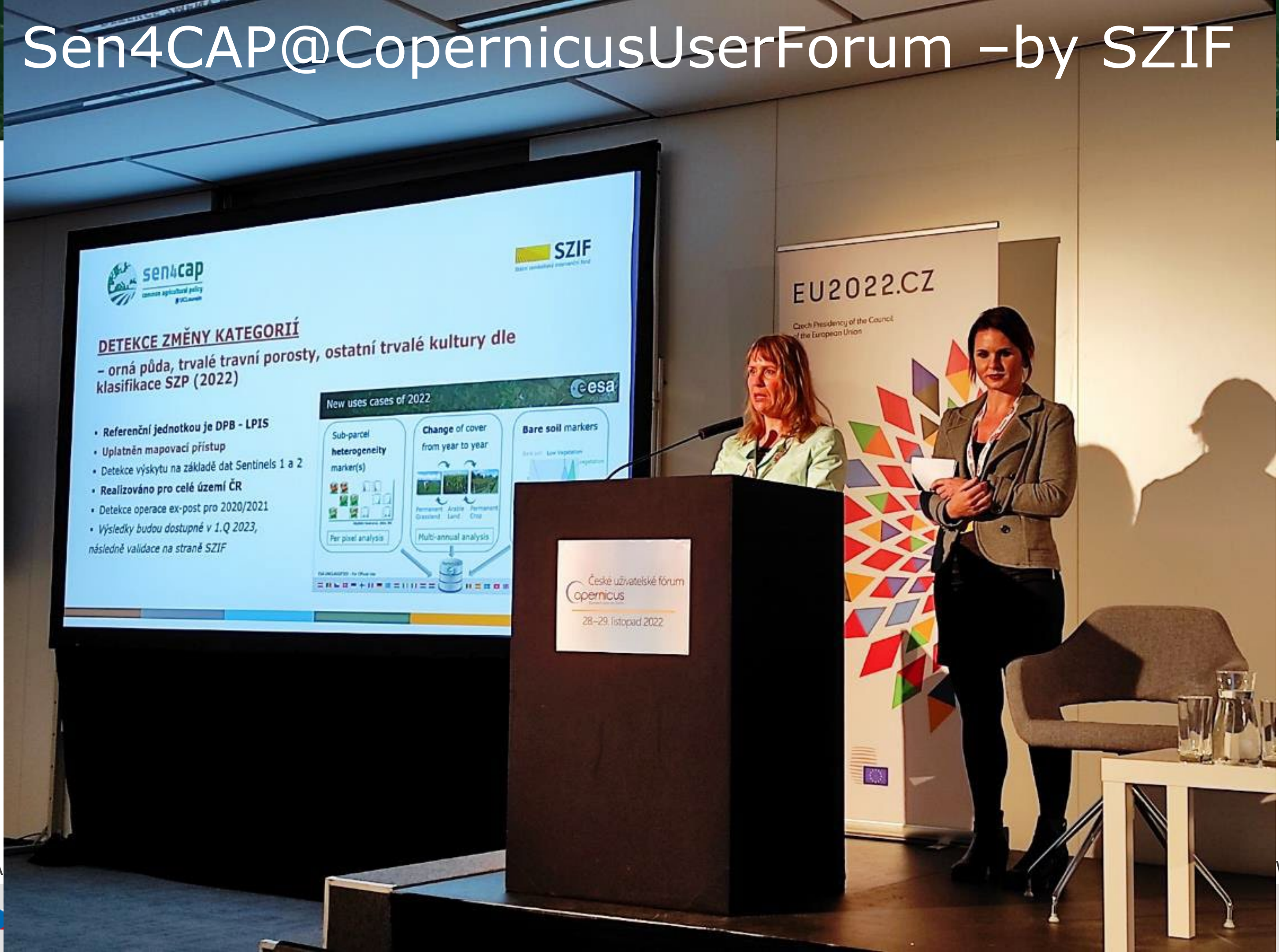
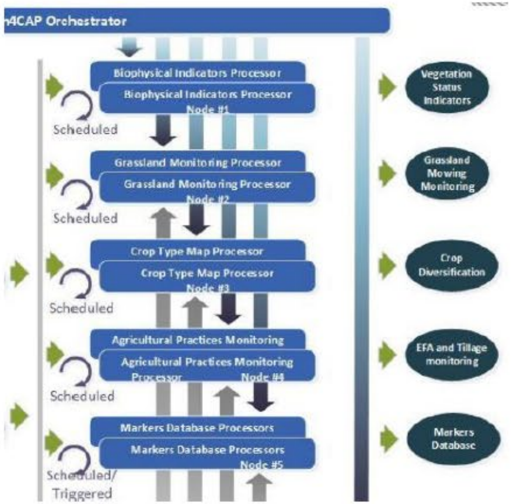
gisat
e-geos
ROMANIA

Sen4CAP@CopernicusUserForum –by SZIF



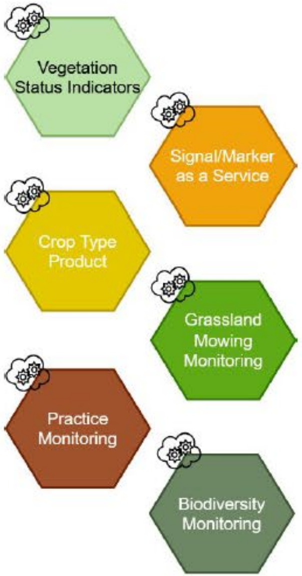
Checks by Monitoring (CbM) and Area Monitoring System - as a Service

sen4cap
common agricultural policy



Processing on premise

EO WIDGET



Data as a Service

Customer

CbM - aaS

DK

An open-source collaborative ICT system for EO agriculture scientists

Agriculture Virtual Laboratory (AVL)

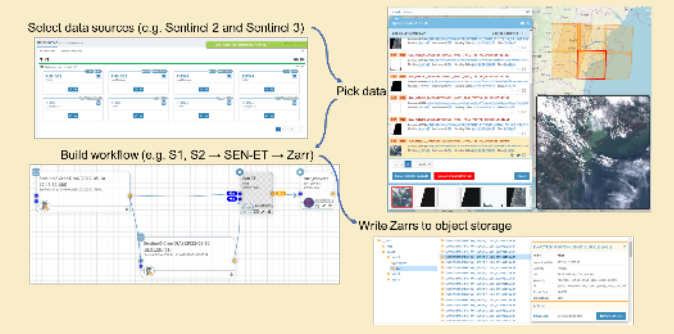
Approach

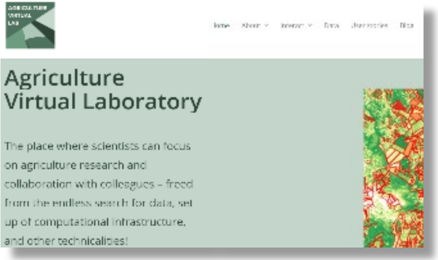
- Base solution on proven and well-established technologies
- Focus on seamless integration rather than on re-inventing wheels

1. Common components
2. Thematic processing subsystem
3. Exploitation subsystem

Technology

TAO, SNAP, xcube, geoDB, cate, Sentinel Hub, Python stack, OTB, R, GDAP, Sen2-Agri, Sen4CAP, Sen4Stat, SenET, etc.





https://agriculturevlab.eu/

Tailored Data cube generation and visualization // GeoDB	**Xcube Generator, Cube Viewer, GeoDB**
Interactive programming environment	**Jupyter Notebooks**
Web toolbox	**Cate**

Poster on Wednesday + Demo in the Agora

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- Sen4CAP overview
- **System evolution**
  - **Next version 3.2**
- New use cases for 2022
  - Parcels heterogeneity
  - Bare soil detection
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Sen4CAP versions

Nov. 2019 | 2020 | Jan. 2021 | Nov. 2021 | Jul. 2022 | 1st week of March 2023

Version 1.0 release candidate

Open-source

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

Version 1.1, 1.2, 1.3

Version 2.0

Markers database

Tillage processor

Dockerization

…

Version 3.0

Web interface

Products visualization

Additions in MDB

Secured services

Dockerization

…

Version 3.1

Big evolutions:
- **Support for MAJA 4.5.4**

Version 3.2

Big evolutions:
- **Updates for the Creodias datasources**
- **Updates for USGS datasources**
- **New markers in MDB1**
- **…**

Version 3.2 new features

- Updates for the Creodias datasource in order to accommodate new changes in the Finder API and S1 products re-organization
- USGS datasource updates for retrieving products after 20 October (API changes)
- Automatic detection for S1B presence and automatic configuration of S1 master and interval (working on 12-day time step)
- Added possibility to compute median, P25 and P75 in MDB1
- Enhanced site creation dialog
- Resolving some issues with the processors executions on past seasons
- Added support for handing the BOA add offset that is specified in the Sen2Cor S2 L2A created metadata
- Other minor corrections -> change log file

Next versions

- 3rd – 4th week of March 2023: version 3.3 with heterogeneity processor

- May 2023: version 3.4 with bare soil and change of categories processor

- In between: possibility to get the bare soil detection “home-made” codes (see later)

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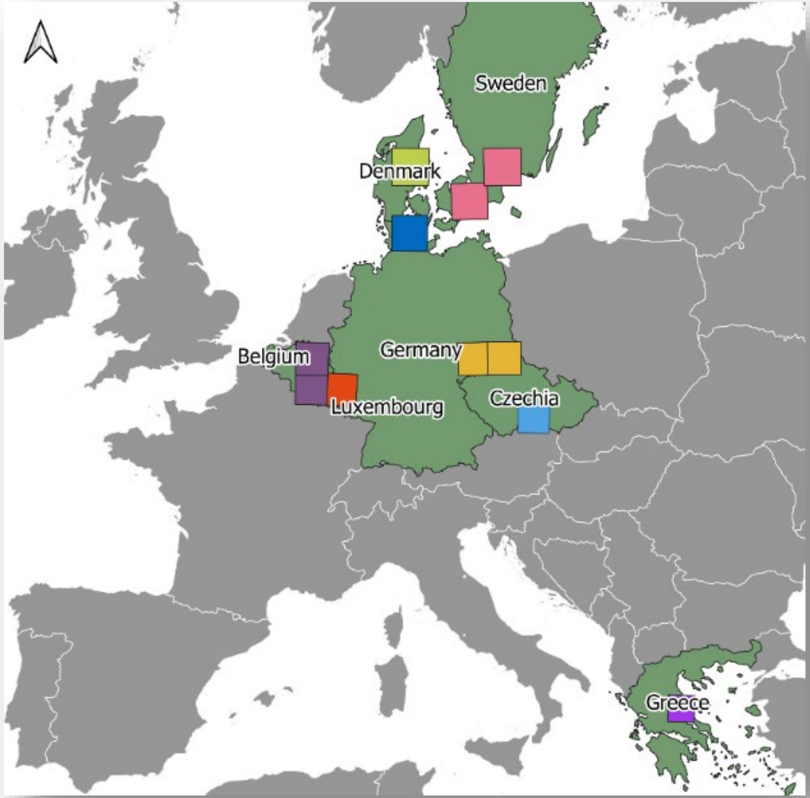
R&D with 7 pilot countries (8 Paying Agencies), sharing calibration and validation data

- 1 or 2 S2 tiles
- 1 or 2 years (2020-**2021**)
- All Sentinel-1 and Sentinel-2 preprocessed

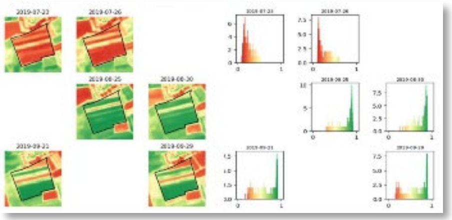
Sites list

Site name	Short name	Seasons			
		Season name	Season start	Season mid	Season end
Czechia	czechia	2020	2020-01-01	2020-07-03	2020-12-31
		2021	2021-01-01	2021-07-03	2021-12-31
Danish	danish	2021	2021-01-01	2021-07-03	2021-12-31
Greece	greece	2021	2021-01-01	2021-07-03	2021-12-31
Luxembourg	luxembourg	2020	2020-01-01	2020-07-03	2020-12-31
		2021	2021-01-01	2021-07-03	2021-12-31
Saxony	saxony	2021	2021-01-01	2021-07-03	2021-12-31
SaxonyV2	saxonyv2	2020	2020-01-01	2020-07-03	2020-12-31
		2021	2021-01-01	2021-07-03	2021-12-31
Schleswig	schleswig	2021	2021-01-01	2021-07-03	2021-12-31
Sweden	sweden	2021	2021-01-01	2021-07-03	2021-12-31
SwedenV2	swedenv2	2021	2021-01-01	2021-06-03	2021-12-31
Wallonie	wallonie	2020	2020-01-01	2020-07-03	2020-12-31
		2021	2021-01-01	2021-07-03	2021-12-31



New uses cases of 2022

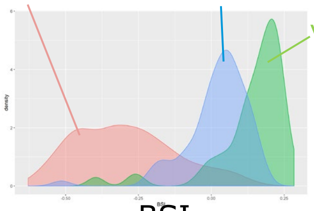
Sub-parcel **heterogeneity** marker(s)



MILENOV Pavel *et al.*, 2021, JRC

Per pixel analysis

Bare soil markers

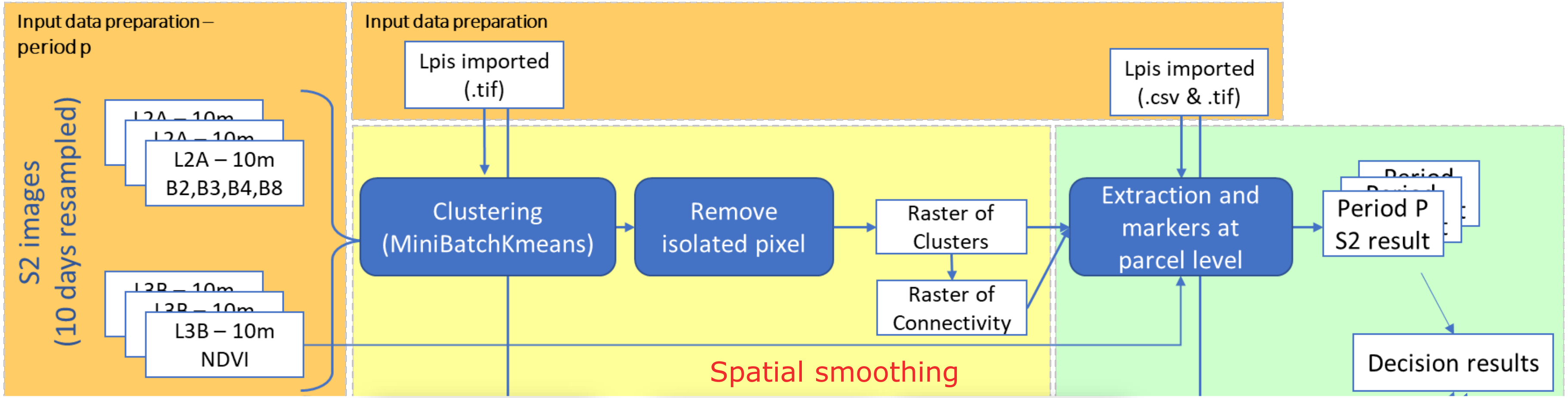


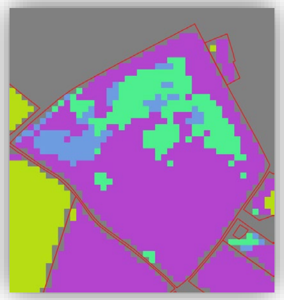
New Optical & SAR variables – all year round

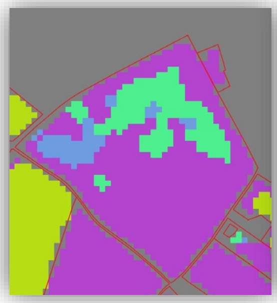
Change of cover from year to year

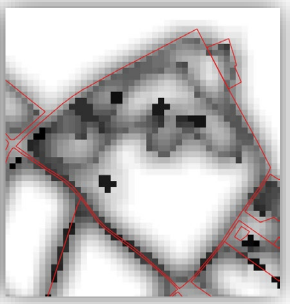
Multi-annual analysis

Heterogeneity Workflow



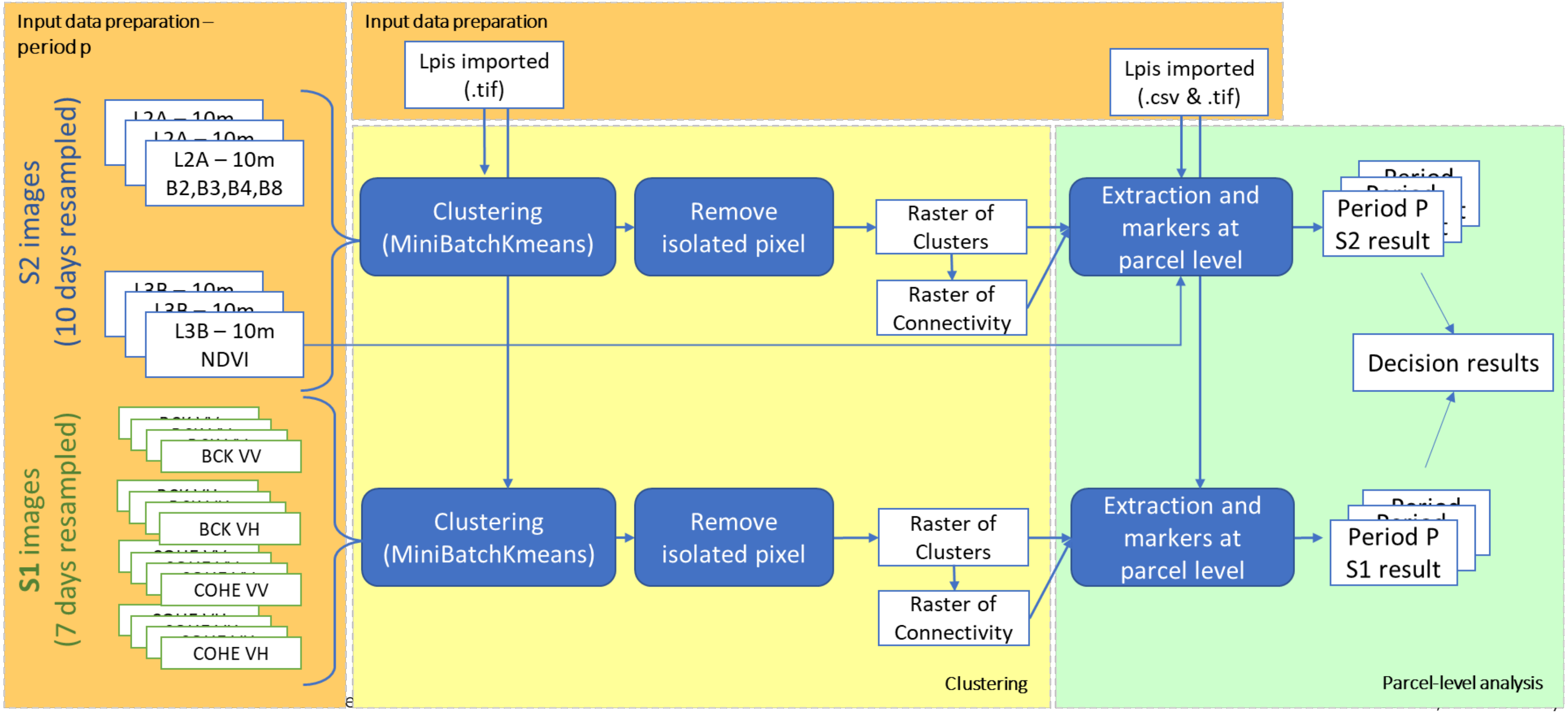






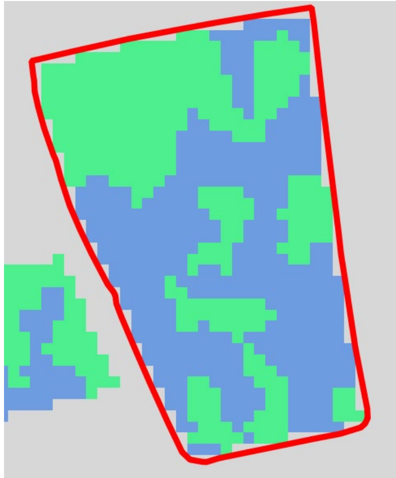
- Number & size of clusters ?
- Difference of NDVI between clusters ?
- Are the clusters compact ?

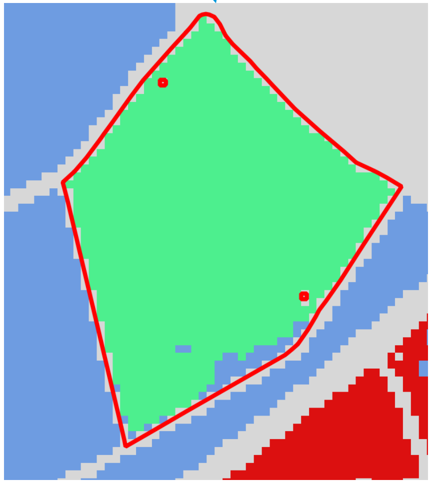
Heterogeneity Workflow



Heterogeneity – Markers S2 & S1

Marker	Description	Possible Value
M1	More than one big cluster (>*PerHetero* % of the parcel) with S2	1 / 0 / NA

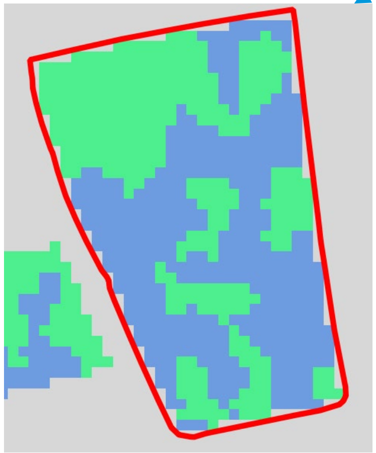


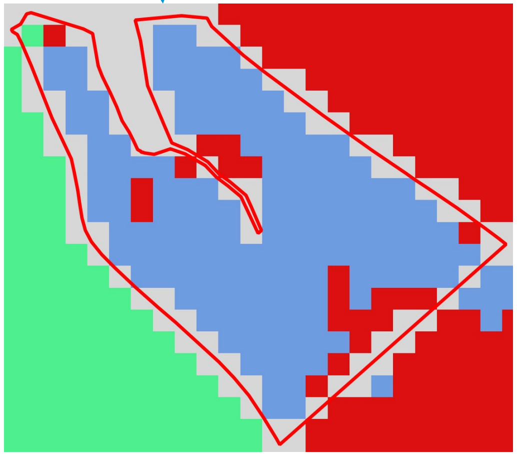


>90% is cover by one cluster

Heterogeneity – Markers S2 & S1

Marker	Description	Possible Value
M1	More than one big cluster (>*PerHetero* % of the parcel) with S2	1 / 0 / NA
M2	At least 2 clusters with more than *NPixClS2* & M1 =1	1 / 0 / NA

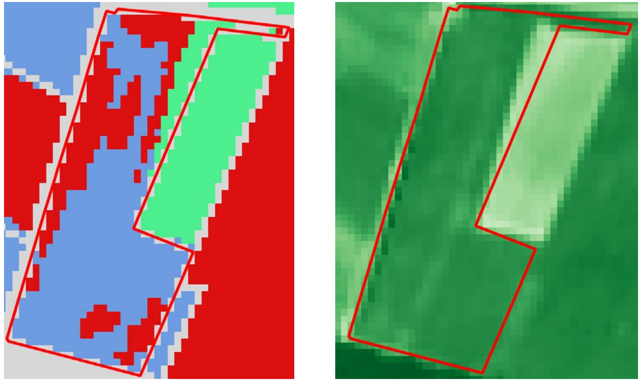




More than 20 pixels in the second cluster

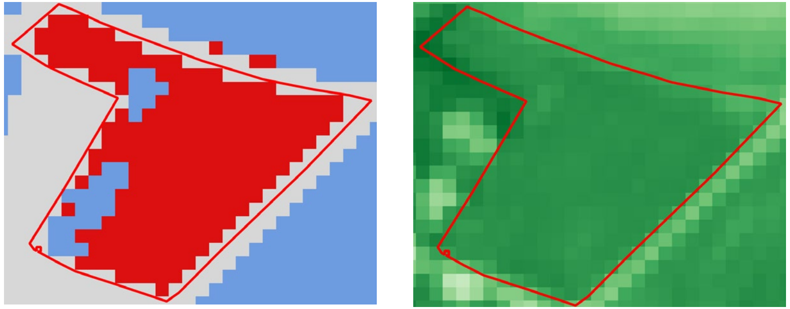
Heterogeneity – Markers S2 & S1

Marker	Description	Possible Value
M1	More than one big cluster (>*PerHetero* % of the parcel) with S2	1 / 0 / NA
M2	At least 2 clusters with more than *NPixClS2* & M1 =1	1 / 0 / NA
M3	DistNDVI > *ThrdNDVIdist*	1 / 0 / NA



distNDVI = 0,26

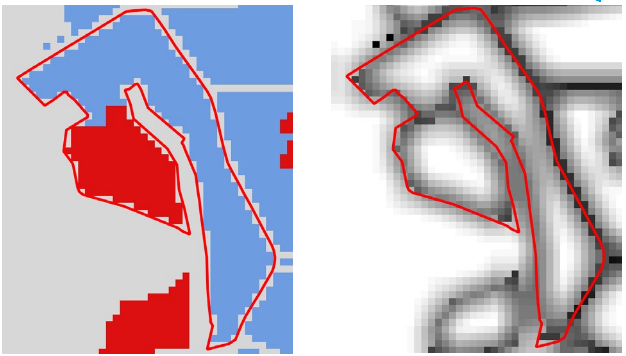
Bigger than 0,15



distNDVI = 0,03

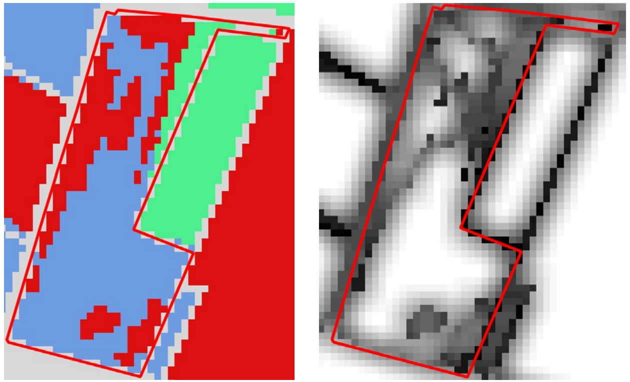
Heterogeneity – Markers S2 & S1

Marker	Description	Possible Value
M1	More than one big cluster (>*PerHetero* % of the parcel) with S2	1 / 0 / NA
M2	At least 2 clusters with more than *NPixClS2* & M1 =1	1 / 0 / NA
M3	DistNDVI > *ThrdNDVIdist*	1 / 0 / NA
M4	Compact S2 > *ThrdCompactS2*	1 / 0 / NA



CompactA = 3,2

Bigger than 3,0



CompactA = 2,6

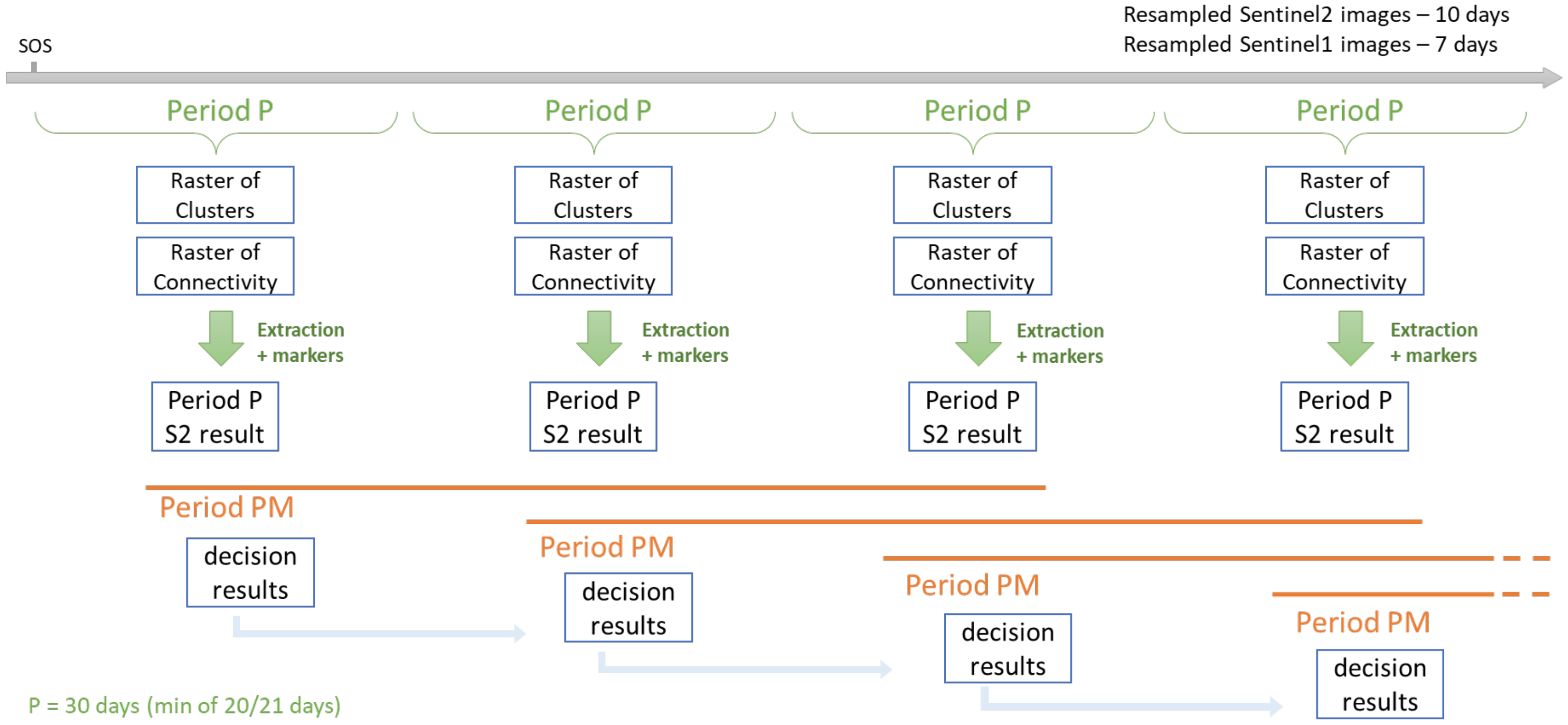
Heterogeneity – Markers S2 & S1

Marker	Description	Possible Value	
M1	**More than one big cluster (>*PerHetero* % of the parcel) with S2**	**1 / 0 / NA**	S2 Markers
M2	**At least 2 clusters with more than *NPixClS2* & M1 =1**	**1 / 0 / NA**	
M3	**DistNDVI > *ThrdNDVIdist***	**1 / 0 / NA**	
M4	**Compact S2 > *ThrdCompactS2***	**1 / 0 / NA**	
M5	More than one big cluster (>*PerHetero* % of the parcel) with S1	1 / 0 / NA	S1 Markers
M6	At least 2 clusters with more than *NPixClS1*	1 / 0 / NA	
M7	Compact S1 > ThrdCompactS1	1 / 0 / NA	

Parameters :

- PerHetero = Percentage of the biggest cluster in the parcel (default = 90%)
- NPixClS2 = Number of S2 pixel needed to determine if a cluster can be big enough (default = 20)
- NPixClS1 = Number of S1 pixel needed to determine if a cluster can be big enough
- ThrdNDVIdist = difference of NDVI needed for heterogeneity
- ThrdCompactS2 = Threshold of compactness (varies according to the radiusC - see connectivity raster)
  (Saxony – radius = 3, thrdcompacts2 = 3 VS Greece – radius = 2, thrdcompacts2 = 1.7)

Heterogeneity – decision period



P = 30 days (min of 20/21 days)
PM = 3*P

Heterogeneity – C_INDEX decision

STRONG: All (3) periods with all markers = 1

MODERATE: At least 1 period with all markers = 1

WEAK: One marker missing each period

POOR: Half of the markers = 1

	M1	M2	M3	M4
P1				
P2				
P3				

→ P_Hete_L = 1 & C_INDEX = MODERATE

	M1	M2	M3	M4
P2				
P3				
P4				

→ P_Hete_L = 2 & C_INDEX = STRONG

	M1	M2	M3	M4
P3	1	1	1	1
P4	1	1	1	1
P5	1	0	0	0

→ P_Hete_L = 2 & C_INDEX = STRONG

S1 as support for S2 detection
& when not available

P_Hete_L = Last confirmed period with best detection

Heterogeneity – C_INDEX decision

STRONG: All periods with all markers = 1

MODERATE: At least 1 period with all markers = 1

WEAK: One marker missing each period

POOR: Half of the markers = 1

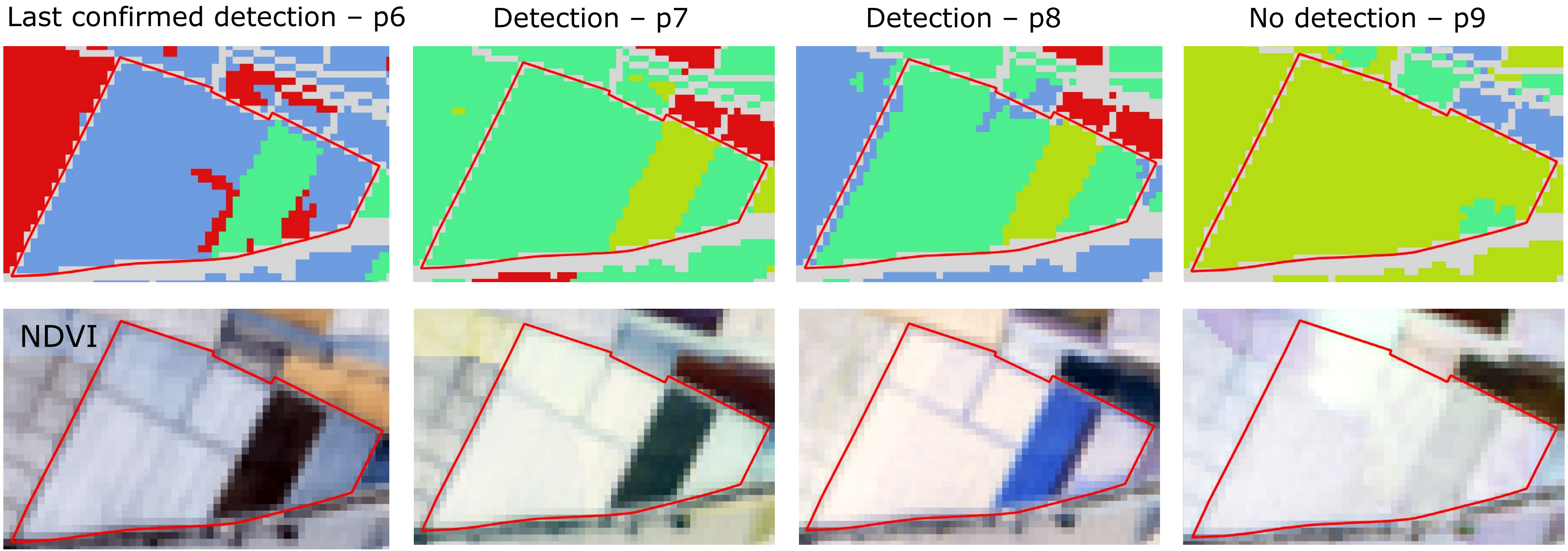
Saxony Results: **27,5%** with a detection

→ POOR: 71%
→ WEAK: 27%
→ MEDIUM: 1%
→ STRONG: 1%

Greece Results: **8,5%** with a detection

→ POOR: 68,5%
→ WEAK: 29,5%
→ MEDIUM: 1%
→ STRONG: 1%

Heterogeneity – Example in Saxony

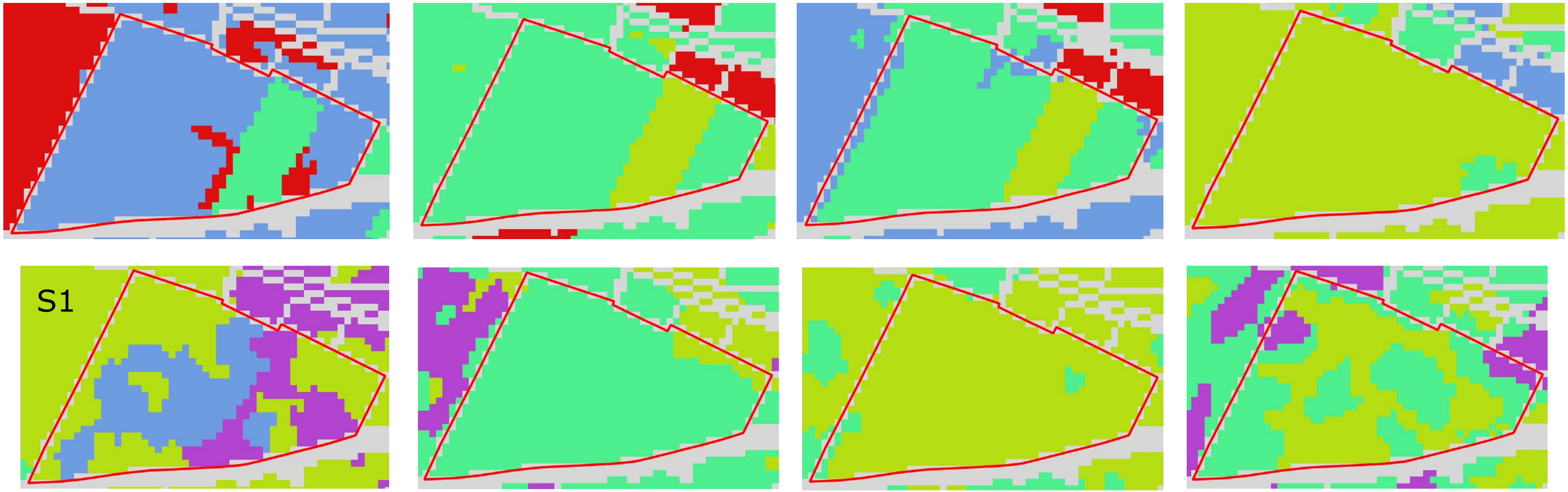


Id = 14236

STRONG detection with S2

Heterogeneity – Example in Saxony

Last confirmed detection – p6 | Detection – p7 | Detection – p8 | No detection – p9

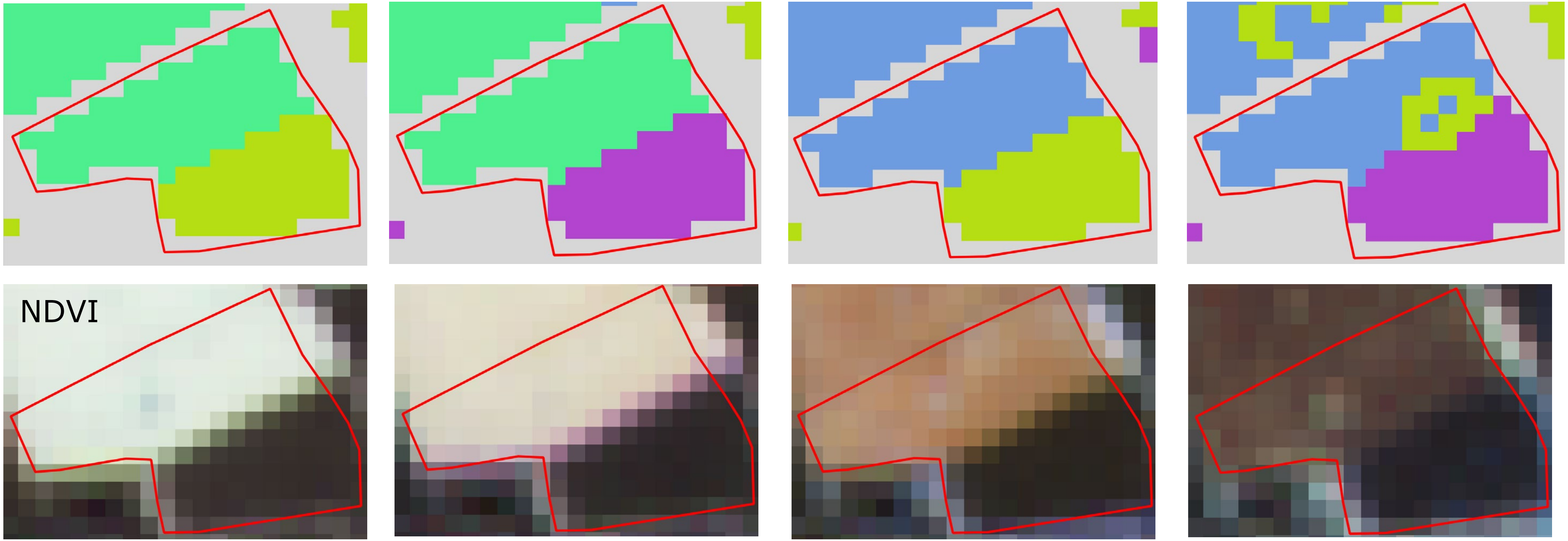


Id = 14236

STRONG detection with S2

Heterogeneity – Example in Greece

Last confirmed detection – p6 | Detection – p7 | Detection – p8 | No Compacity – p9

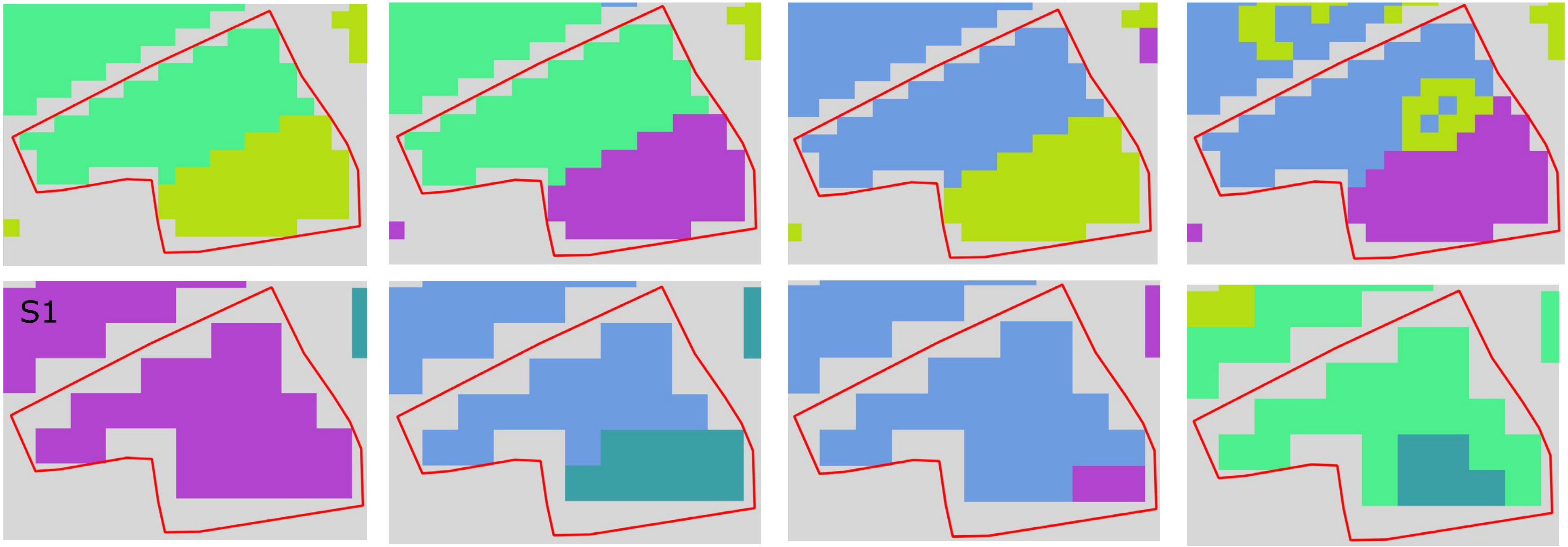


Id = 626

STRONG detection with S2

Heterogeneity – Example in Greece

Last confirmed detection – p6 | Detection – p7 | Detection – p8 | No Compacity – p9



Id = 626

STRONG detection

Bare Soil : Classification

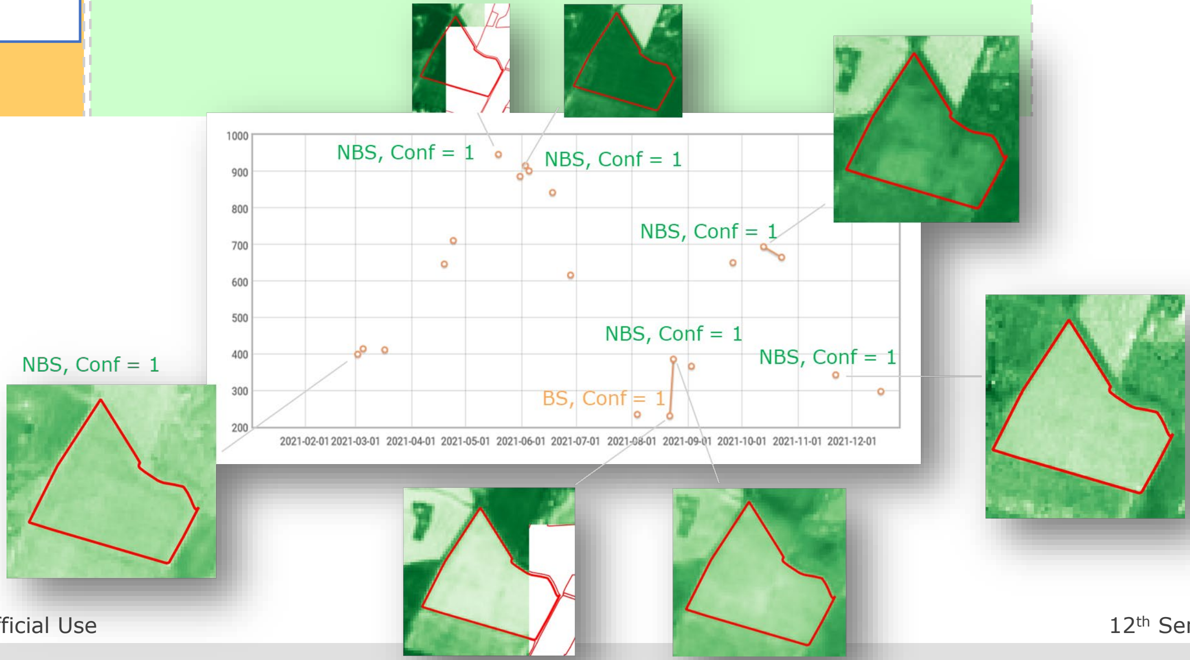
Input data preparation

S2 time series
L2A bands, L3B and variables
(MBD1)

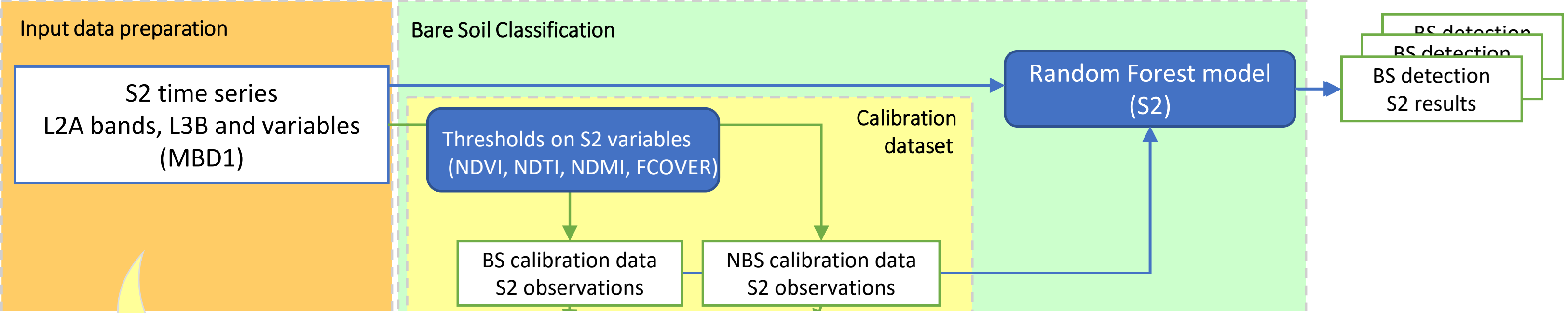
Bare Soil Classification

Random Forest model
(S2)

BS detection
S2 results



Bare Soil : Calibration dataset with S2

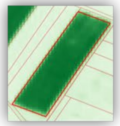


For each parcels and at each date during ***the period of training***

→ *Looks if NDVI, NDTI, BSI, NDMI < BS_threshold* BS

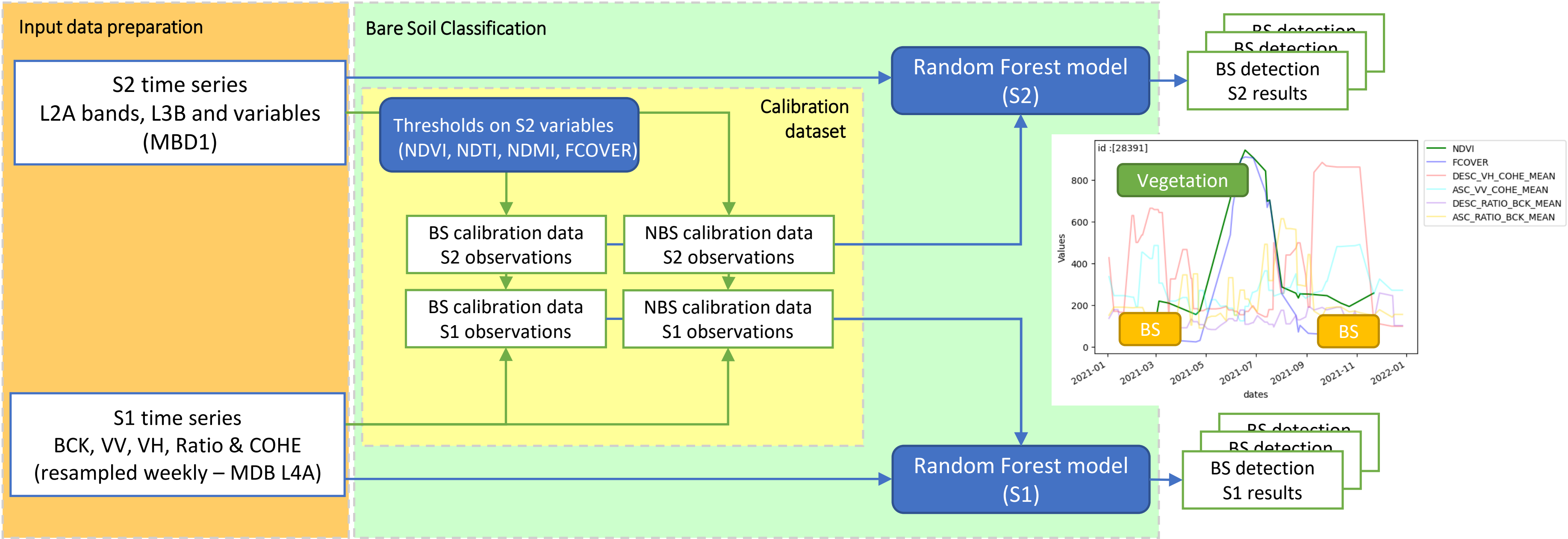
✓ *The date and parcel goes to the calibration dataset as bare soil*

→ *Looks if NDVI, NDTI, BSI, NDMI > NBS_threshold* Vegetation

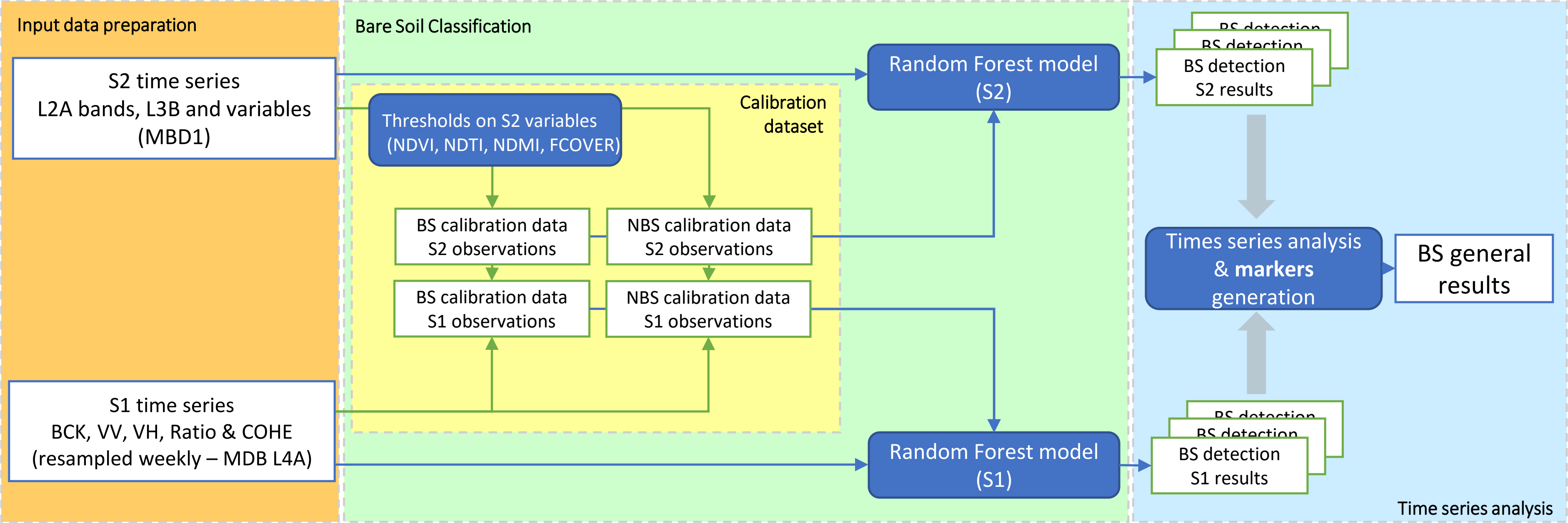


✓ *The date and parcel goes to the calibration dataset as vegetation*

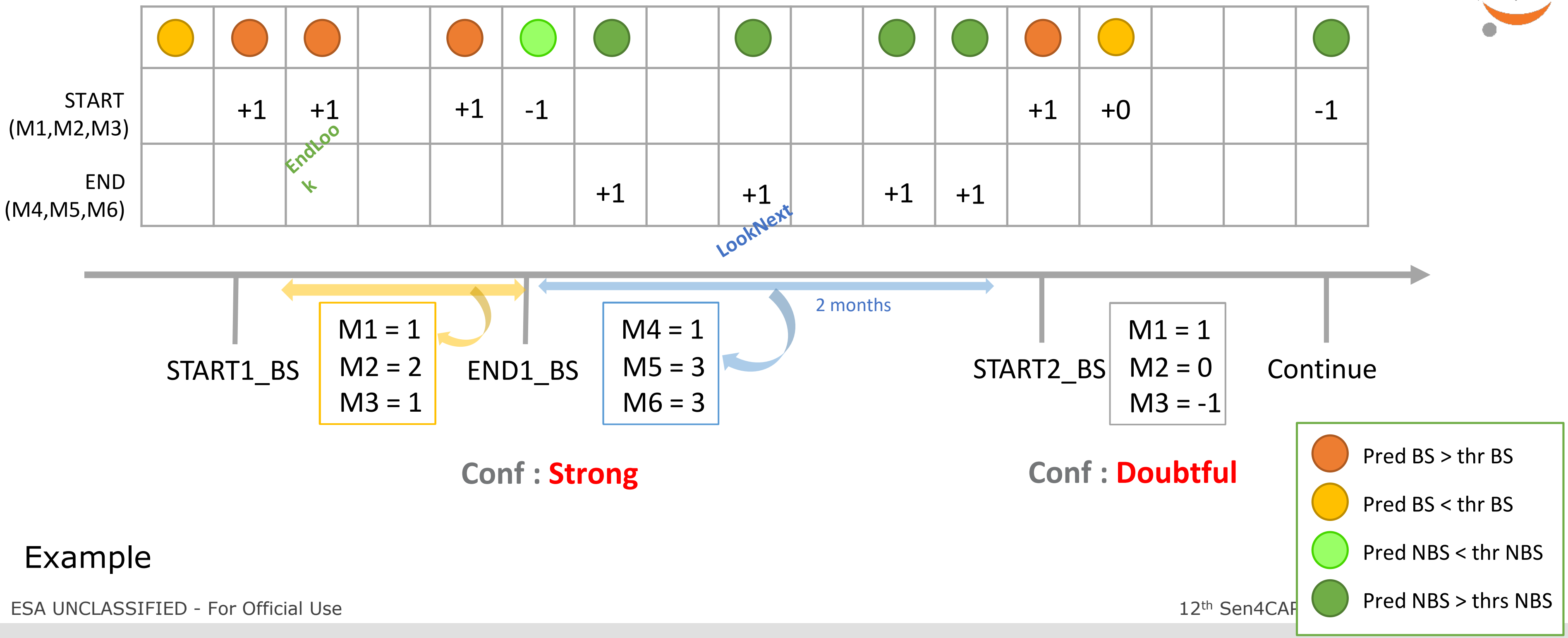
Bare Soil Classification S1 & S2



Bare Soil : Complete workflow



Time Series Analysis & Markers



Example

Time Series Analysis & Markers

	Description	Values possible
M1	First observation of BS with conf > *thr_bs* → **Allow to set the *START_BS_S2***	0 / 1
M2	Observation of BS in conf > *thr_bs* → **+1** → 1st confirmation → **LookEnd** = True (look for the end of the BS period) → Allow to see **number of strong BS in the BS period**	0 / 1+ / NA
M3	Observation of BS in conf > thr_bs → +1 & Observation of NBS → -1 → Number of strong observation – number of noise in the BS period	-1 / 0 / 1+ /NA
M4	Observation of NBS with conf > *thr_nbs* → **Allow to set the END_*BS_S2***	0 / 1
M5	Observation of NBS in conf > *thr_nbs* → +1 → Allow to see **number of strong NBS in the Plong period (2 months) after the BS period**	0 / 1+ / NA
M6	Observation of NBS in conf > thr_bs → +1 & Observation of BS → -1 → Number of strong observation – number of noise	-1 / 0 / 1+ / NA

Parameters:
- *Thr_bs* : Threshod of BS that indicate the minimum confidence level in the **BS prediction** to be consider as a **strong detection**.
- *Thr_nbs* : Threshod of NBS that indicate the minimum confidence level in the **NBS prediction** to be consider as a **strong detection**.
- *Psmall* : 1. As the maximum number of days after after the START_BS where if the END_BS is not found, the ENDS_BS is equal to the START_BS.
  2. to see if there a strong detection of BS after the set of the ENDS_BS. When it happens two times, the END_BS is restarted.
- *Plong* : Long period that is used as the duration to look for vegetation (NBS) after the END_BS. It has an impact on the M5 and M6.

Confidence level in the detection

Strong : M2 >= 3, M3 > = 2 and M6 >= 0

Good : M2 > 0, M3 >= 0 and M5 > 0

Medium : M2 > 0 and M3 >= 0

Poor : M2 >= 0 and M3 < 0

Doubtful : only M1 = 1 (only one strong BS)

Results & use of S1 as confirmation of S2

Czechia :
52,5% of the parcels with a detected bare soil (M1_S2)

Confidence	S2	S2 & S1
Doubtful	19.07%	17.30%
With S1 conf		1.78%
Poor	6.34%	4.75%
With S1 conf		1.59%
Medium	18.49%	13.91%
With S1 conf		4.58%
Good	25.92%	16.64%
With S1 conf		9.28%
Strong	30.17%	11.51%
With S1 conf		18.66%

→ 36% with a S1 confirmation

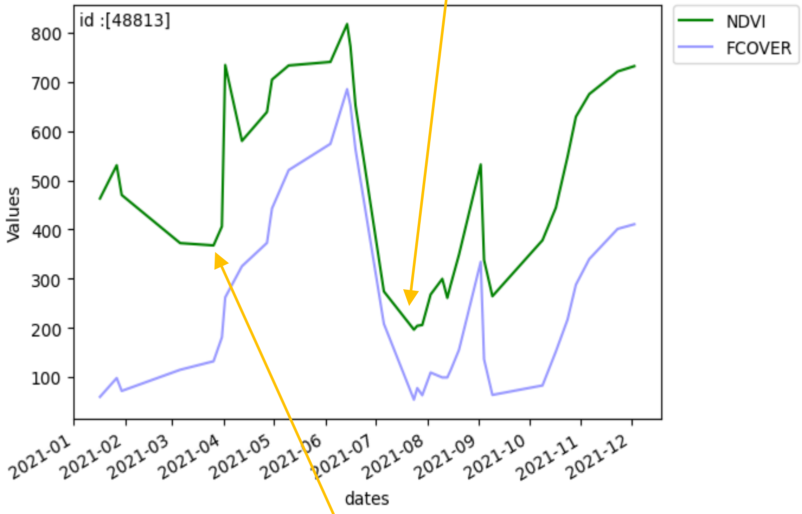
Sweden :
32,7% of the parcels with a detected bare soil (M1_S2)

Confidence	S2	S2 & S1
Doubtful	32.66%	29.41%
With S1 conf		3.25%
Poor	6.52%	5.77%
With S1 conf		0.75%
Medium	13.07%	11.76%
With S1 conf		1.32%
Good	12.50%	10.63%
With S1 conf		1.88%
Strong	35.24%	17.62%
With S1 conf		17.62%

→ 25% with a S1 confirmation

Bare Soil – Example in Czechia

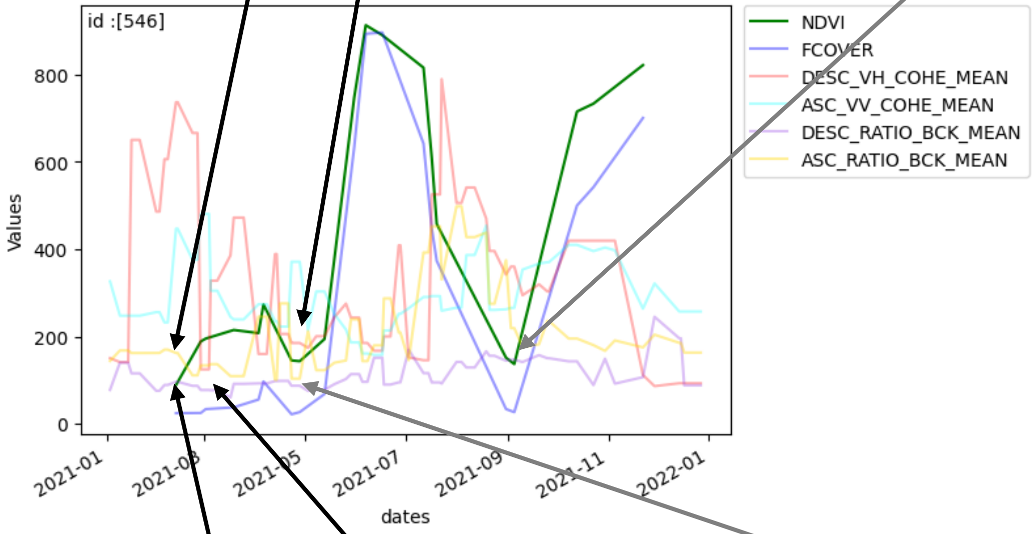
NewID	M1_S2	M2_S2	M3_S2	M4_S2	M5_S2	M6_S2	START_BS_S2	END_BS_S2	Conf_S2	Look_nextS2
48813	1	2	1	1	13	11	24-07-21	29-07-21	Strong	TRUE



M1_S1	M2_S1	M3_S1	M4_S1	M5_S1	M6_S1	START_BS_S1	END_BS_S1	Conf_S1	Look_nextS1
1	0	-9				01-03-21	01-03-21	Doubtful	TRUE

Bare Soil – Example in Sweden

NewID	M1_S2	M2_S2	M3_S2	M4_S2	M5_S2	M6_S2	START1_BS_S2	END1_BS_S2	Conf1_S2	Nbr1S2	Look_nextS2	START2_BS_S2	END2_BS_S2	Conf2_S2	Nbr2S2
546	1	1	0	1	2	2	12-02-21	13-05-21	Strong+_S1	9	VRAI	31-08-21	05-09-21	Good	2



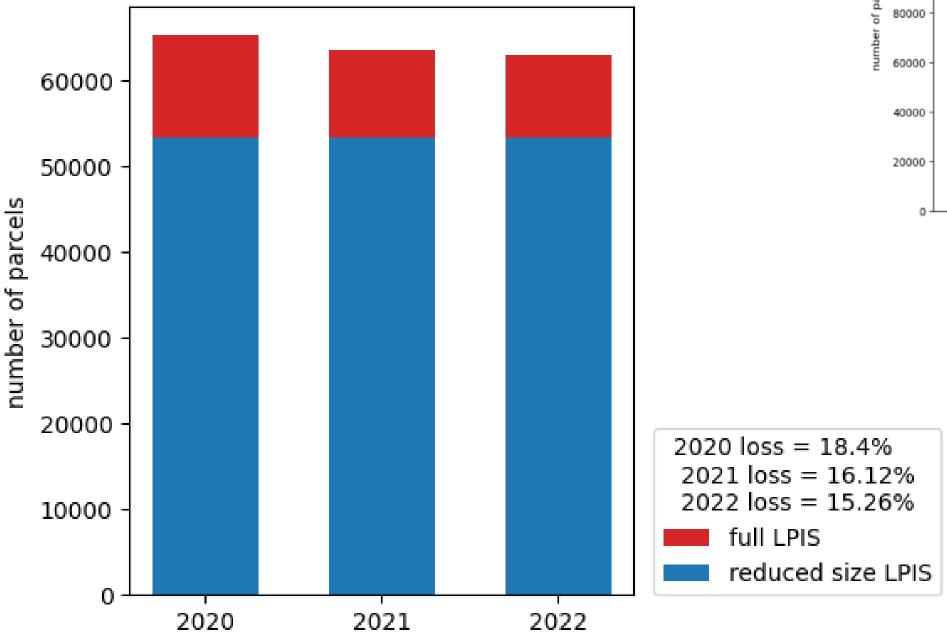
M1_S1	M2_S1	M3_S1	M4_S1	M5_S1	M6_S1	START1_BS_S1	Conf1_STARTS1	END1_BS_S1	Nbr_S1	Look_nex	START2_BS_S1	Conf2_STARTS1	END2_BS_S1	Nbr_S1
1	0	-3				08-02-21	01-03-21	Strong	4	VRAI	26-04-21	26-04-21	Doubtful	4

Change of Agricultural Category

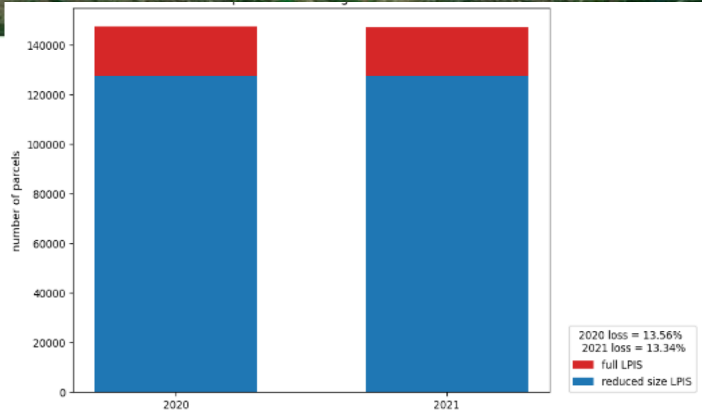
LPIS/GSAA standardization

Selecting stable parcels between years

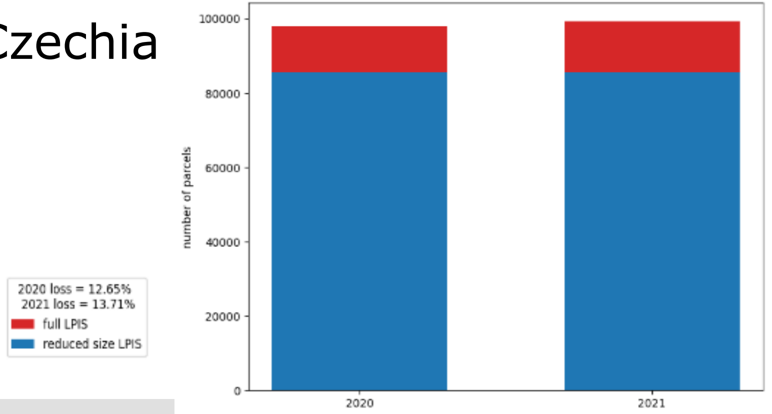
Luxembourg



Saxony



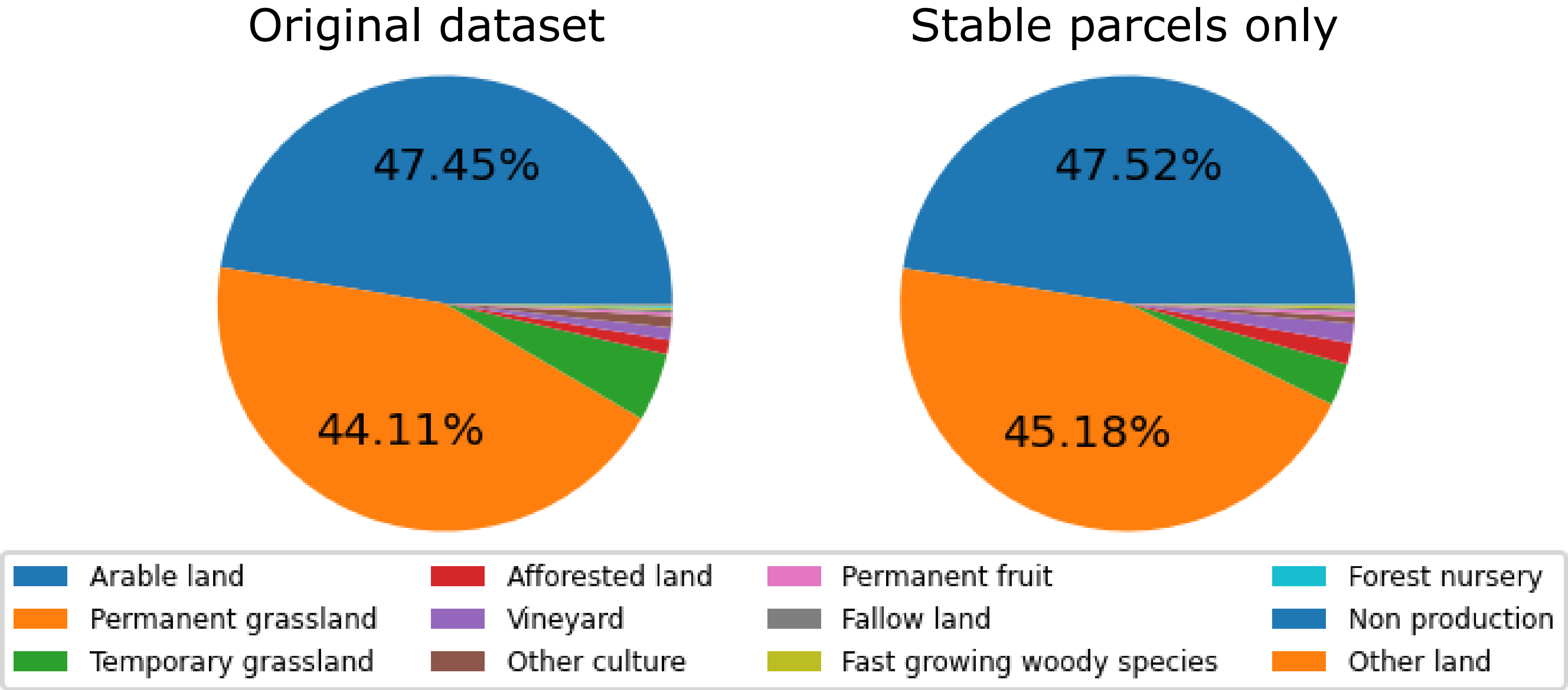
Czechia



LPIS/GSAA standardization

Stable parcels between years are representative

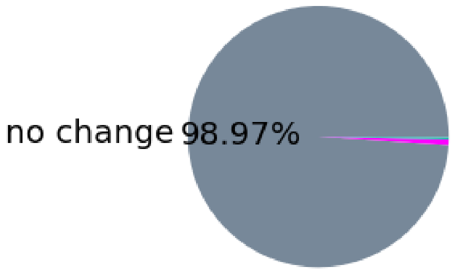
Czechia



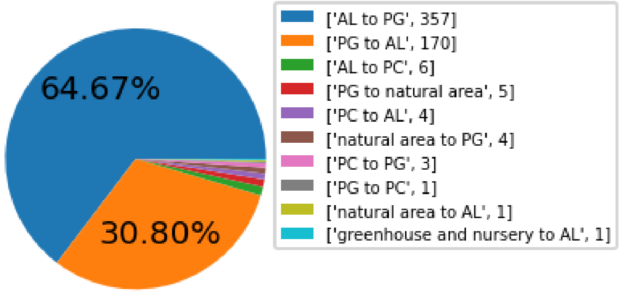
Change of Agricultural Category

Luxembourg

2020-2021

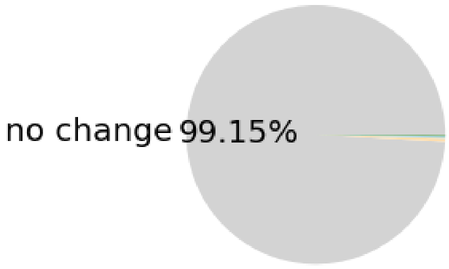


main changes

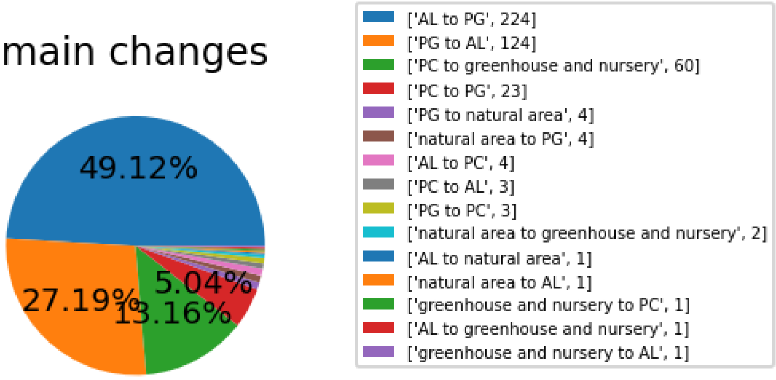


Working sample: 552 parcels

2021-2022



main changes

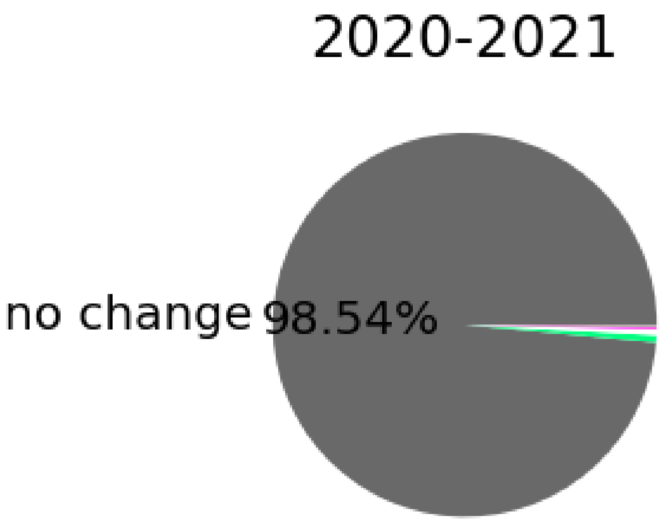


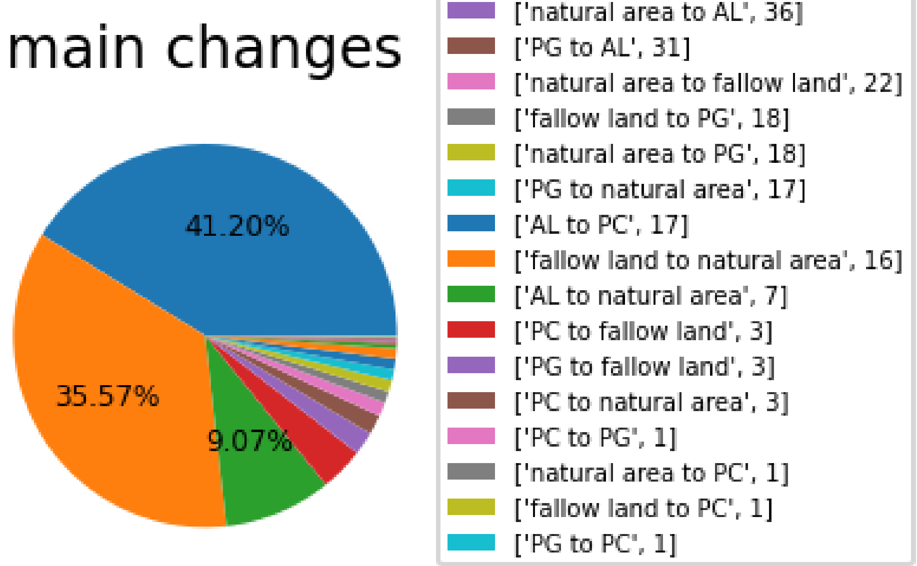
Working sample : 456 parcels

Change of Agricultural Category

Saxony

Working sample : 1864 parcels

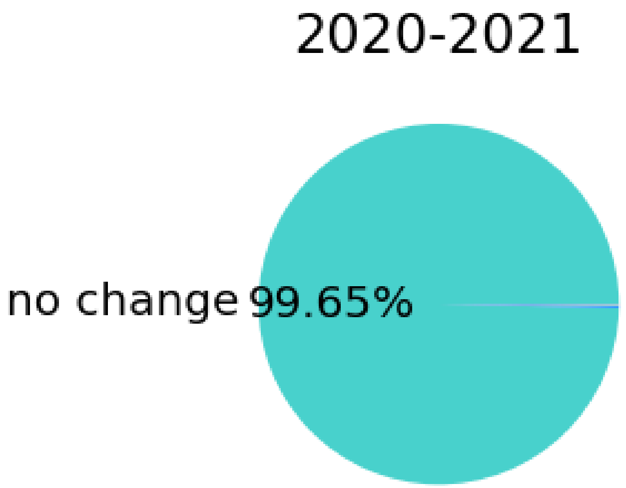


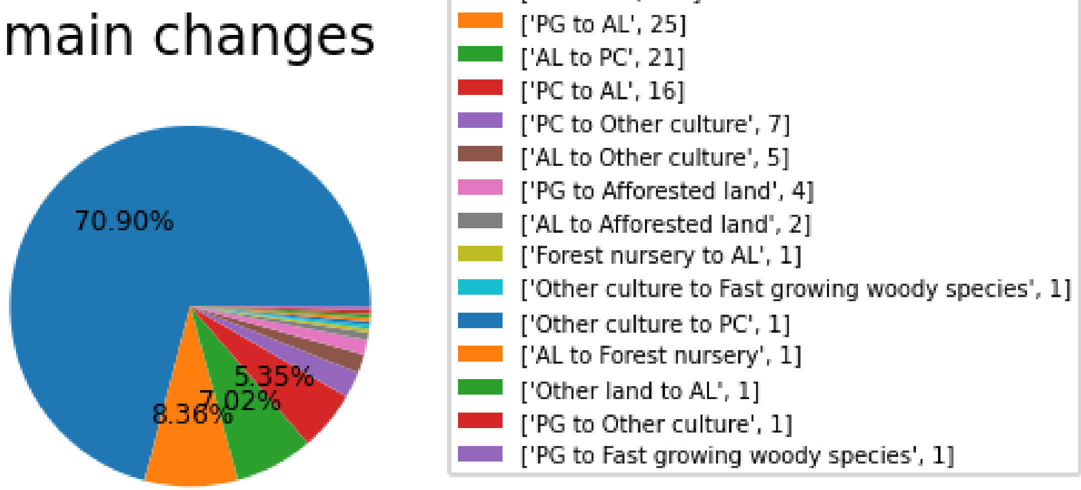


Change of Agricultural Category

Czechia

Working sample : 299 parcels



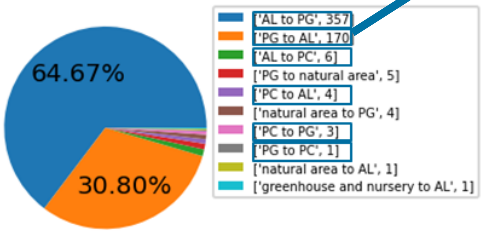


Category: Permanent Grassland to Arable Land

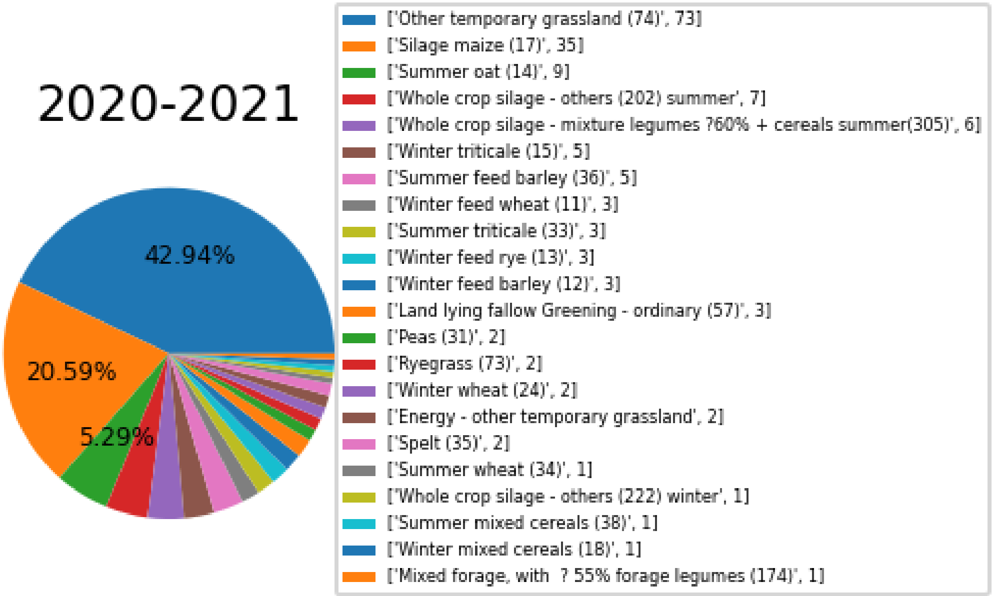
Luxembourg

Change of agricultural category : PG to AL

main changes



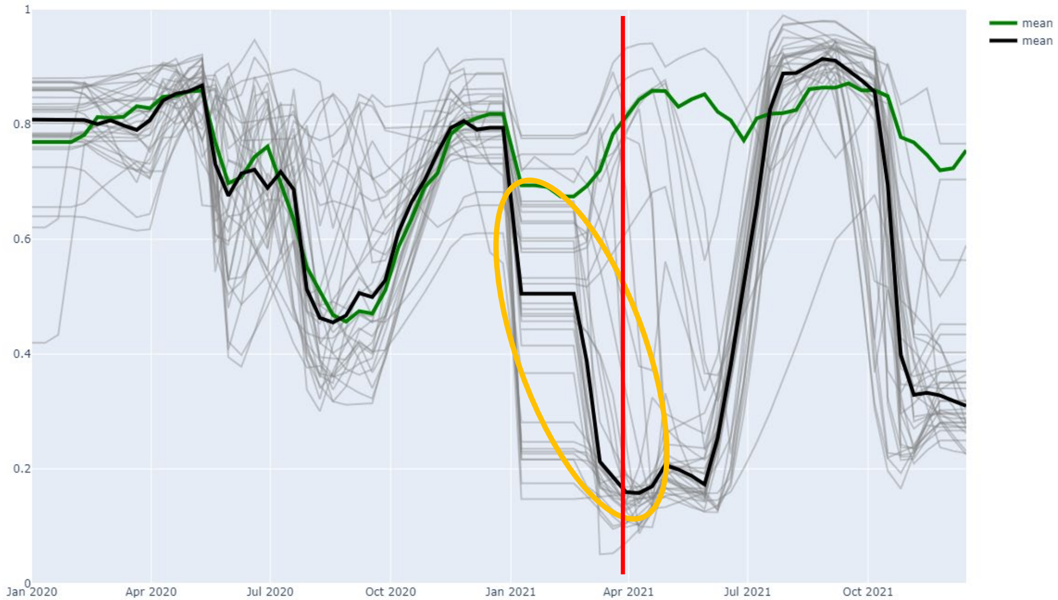
2020-2021



Category: Permanent Grassland to Arable Land
Summer crops

Luxembourg

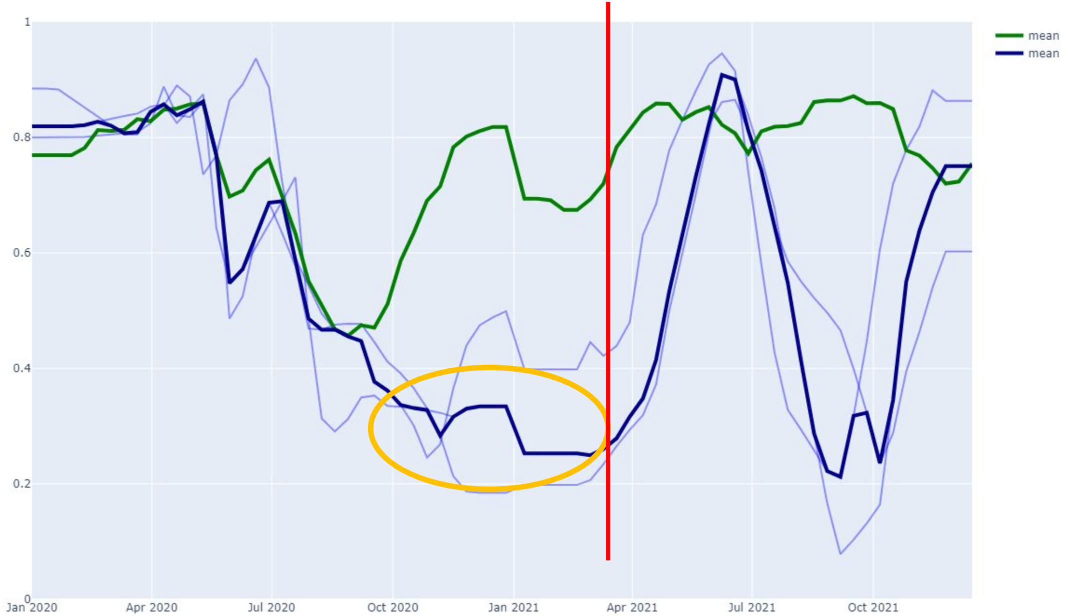
Pemanent grasslands becoming silage maize



Category: Permanent Grassland to Arable Land
Winter crops

Luxembourg

Pemanent grasslands becoming winter feed wheat

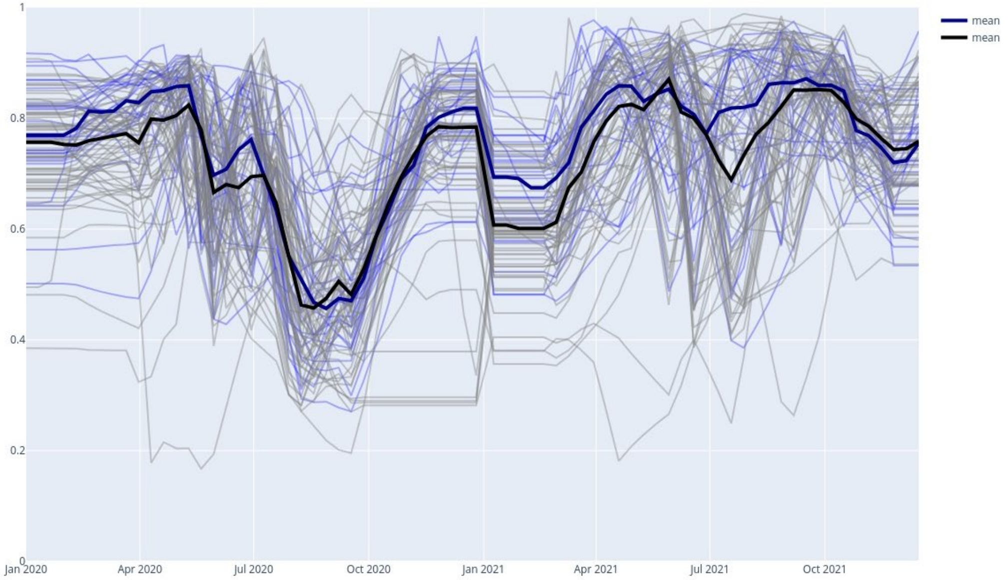


Category: Permanent Grassland to Arable Land

Temporary grassland

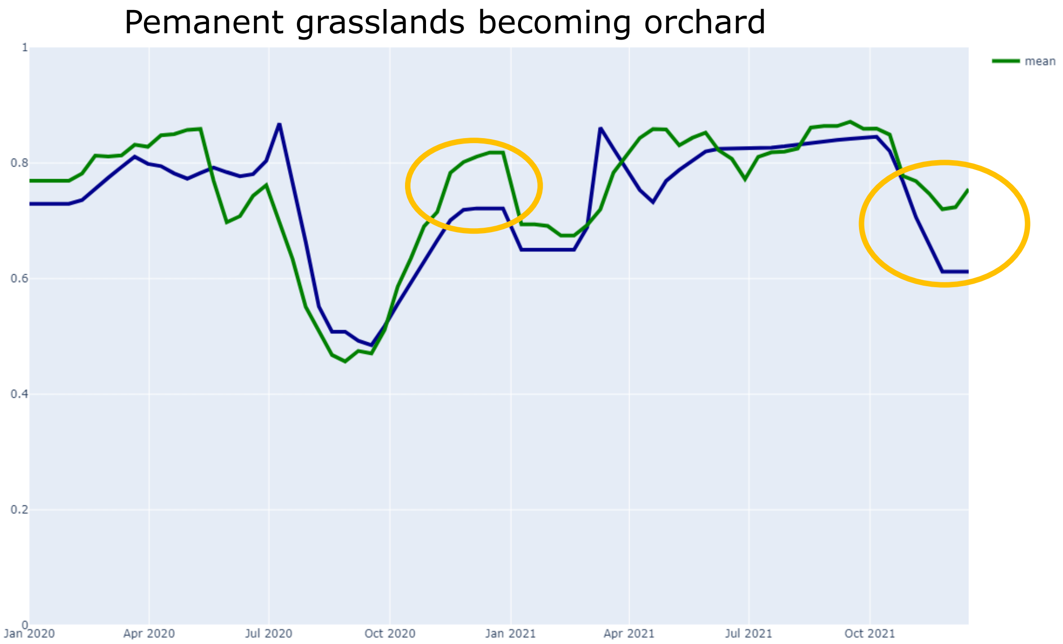
Luxembourg

Pemanent grasslands becoming temporary grasslands



Category: Permanent Grassland to Permanent Crop

Luxembourg



Webinar outline

- Sen4CAP overview
- System evolution
  - Next version 3.2
- New use cases for 2022
  - Parcels heterogeneity
  - Bare soil detection
  - Change of land category
- **Next events**

Next events

- **Forum** for your questions about the system 3.1 and 3.2 (and other)
- Next version **Sen4CAP 3.2**: 1st week of March 2023
- Next version **Sen4CAP 3.3 (heterogeneity processor)**: 3rd-4th week of March 2023
- Release of V2 products to pilot countries: 3rd week of March 2023
- Next webinar **April 2023**

- **Your questions ???**


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