

# SEN4CAP - Lessons learned from 2019 demonstration over 7 countries

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## CAP monitoring approach – Technology meets Policy 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

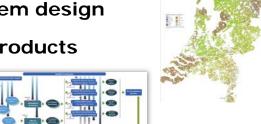
**Products Specifications** 

**Benchmarked Methods** 

Algo & System design

**Prototype products** 

**Validation** 



**Use cases demonstration** 

National scale

**Continuous monitoring** 

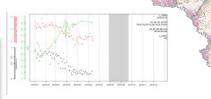
Validation & Fitness-to-use assessment

Capacity building and training

System qualification







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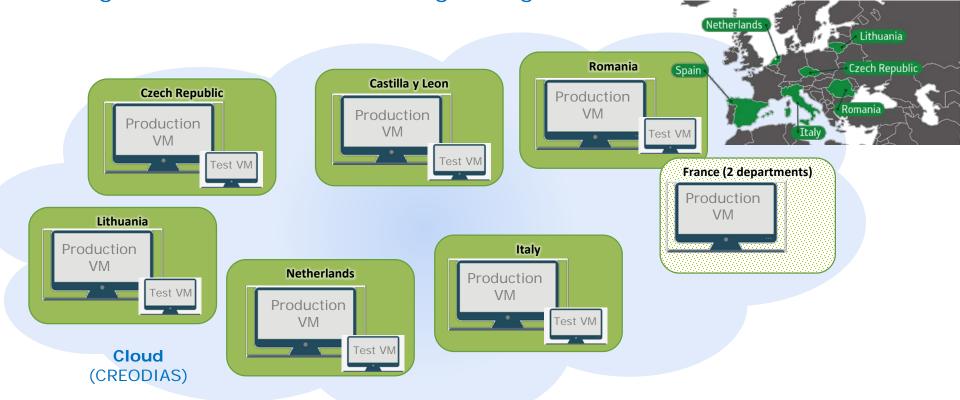








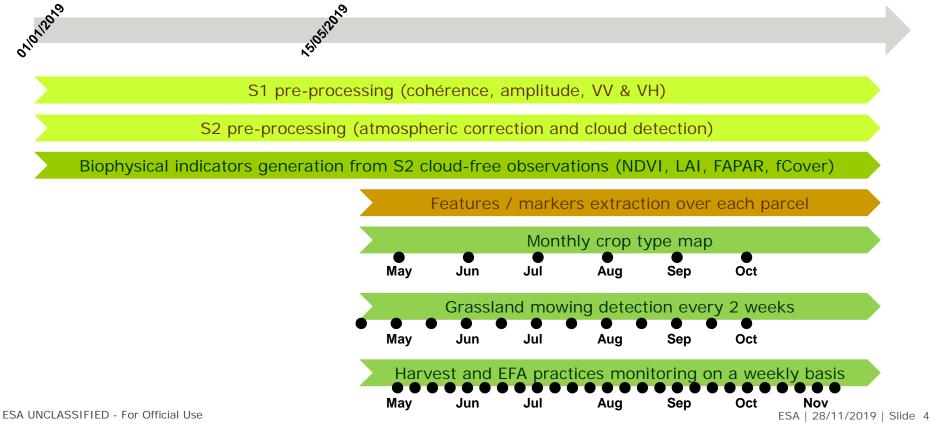
2018/2019 Sen4CAP demonstration for 6+1 Paying Agencies running on distinct DIAS VMs along the agricultural season



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### 2019 continuous monitoring





# Large dataset from S1 & S2 for a national coverage Sen4CAP system to process in near-real time full time series locally or on the cloud

#### Markers stored for each LPIS/GSAA parcel

22 markers every 10 days+ 3 markers at each cloud-free observation

16 markers every week + 4 markers at each acquisition + temporal features





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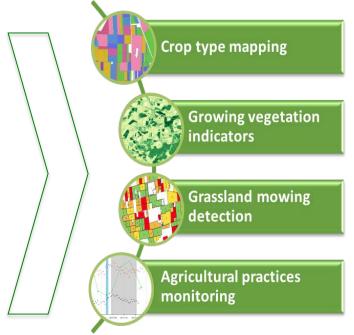
### Sentinel-derived markers and products assessed through use cases

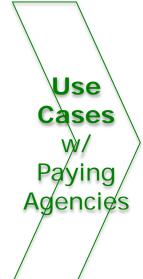




Markers for each LPIS/GSAA parcel







#### **Use cases**

**Crop diversification** 

Perm. grassland monitoring

**EFA-Land lying fallow** 

**EFA-Catch crops** 

**EFA-Nitrogen-fixing** crops

Land abandonment

Interactive visualization

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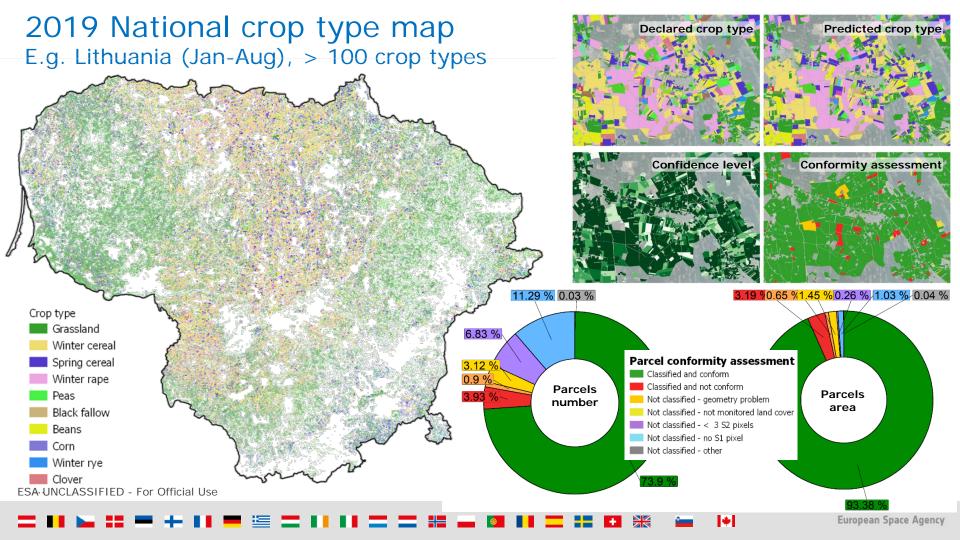












# Preliminary performances of crop type identification in different EU agricultural landscapes for 2019



- More than 15 millions of parcels assessed for 635,000 km<sup>2</sup>
- Improved overall accuracy for all countries with respect to 2018 (all countries>74 %, 5 countries > 80%)
- Little impact of parcel size and shape on the assessed areas is confirmed

Country	Total area	Total p	arcels	Non-assess	sed parcels	Overall accuracy		
Country	(km²)	Number	Area (km²)	Number	Area	2019	Compared to 2018	
Netherlands (full country)	37,380	806,247	18,838	18.82%	5.45%	97.39%	+ 2.44%	
Czech Republic (full country)	78,873	597,748	34,520	9.22%	0.64%	91.14%	+ 8.39%	
Lithuania (full country)	64,897	1,185,424	29,299	22.17%	3.43%	88.08%	+ 9.34%	
Spain (Castilla y León)	94,226	102,897	3,179	19.42%	2.17%	84.80%	+ 2.97%	
Italy (5 regions)	84,770	5,718,943	27,556	71.14%	18.81%	78.90%	+ 6.53%	
Romania (full country)	238,369	6,091,197	98,600	35.03%	7.93%	74.60%	+ 3.44%	
France (2 departments)	35,862	611,074	21,903	12.29%	1.07%	81.84%	/	

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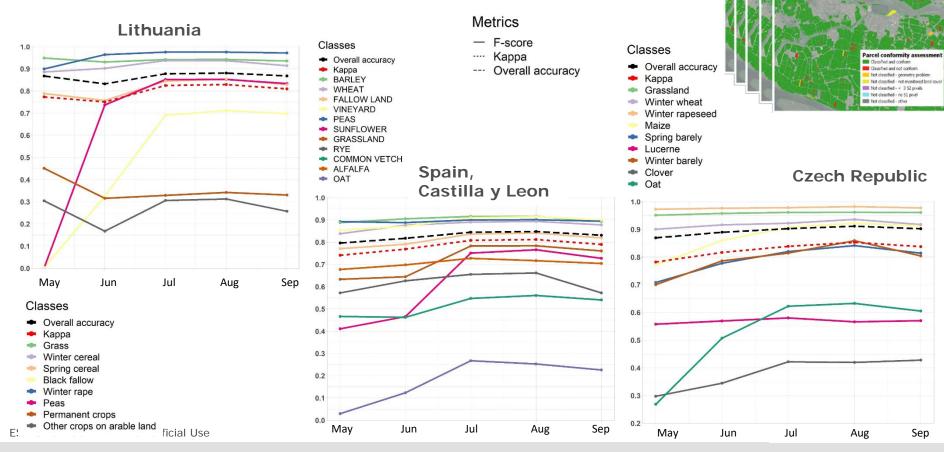








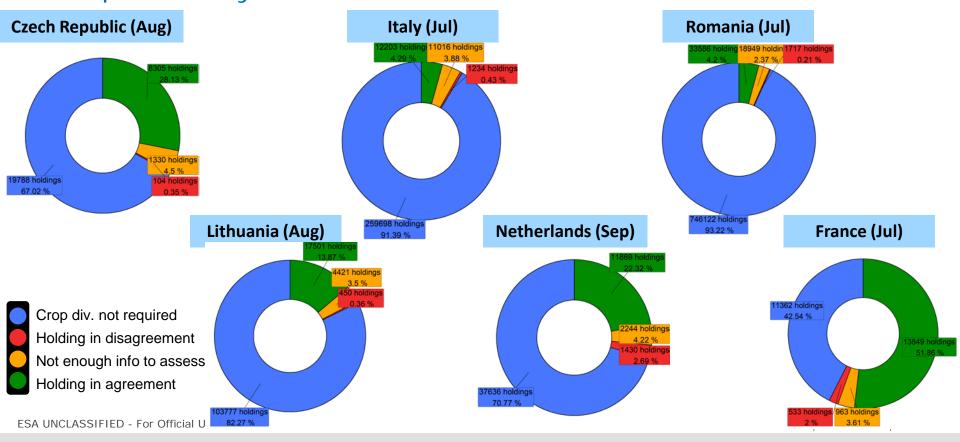
## High accuracy achieved from May/June





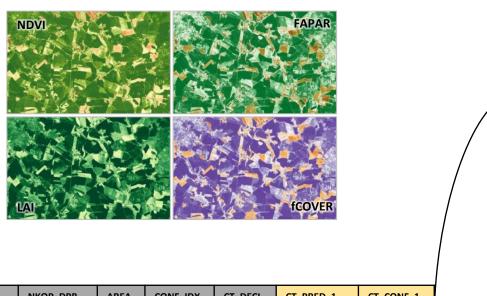
## CT maps to support the crop diversification assessment – 2019 preliminary results



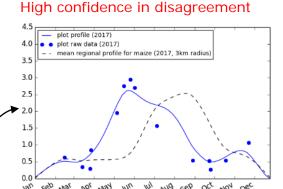


Biophysical indicators to further investigate the crop type labels

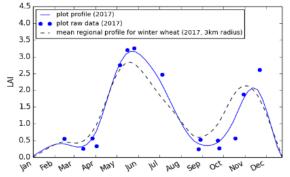




ID	NKOP_DPB	AREA	CONF_IDX	CT_DECL	CT_PRED_1	CT_CONF_1
5482	681104301/1	23275	0	Maize	Winter rapeseed	0,56
6581	665114804/1	18086	1	Winter Wheat	Grassland	0,25



#### High confidence in agreement



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Mowing detection over all grassland parcels based on S1 and S2 time series



Product info for each parcel



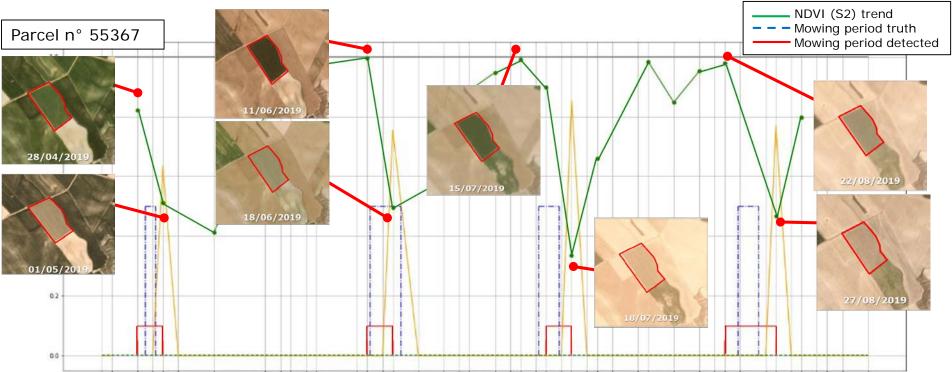
- ✓ Grassland Crop type
- ✓ Number of mowing events (maximum 4)
- ✓ For each mowing event (up to 4):
  - Temporal interval in which the mowing event occurred (t\_start and t\_end)
  - Confidence level in terms of probability of right mowing (conf)
  - Satellite mission data used for detection of mowing (S1, S2 or both)
  - Compliancy level

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ber of mowing	parcel_id	crop_code	mow_n	m1_dstart	m1_dend	m1_conf	m1_mis	m2_dstart	m2_dend	m2_conf	m2_mis	m3_dstart	m3_dend	m3_conf	m3_mis	m4_dstart	m4_dend	m4_conf	m4_mis	compl	1
	31.0000002869728.001	265	3	2018-05-08 00:0	2018-05-21 00:0	0.554000	S2	2018-07-12	2018-07-20	0.55300	S2	2018-08-24	2018-09-18	0.518	S2	0	0	0.0000	0	1	
	31.0000002869729.001	265	3	2018-05-08 00:0	2018-05-21 00:0	0.522000	S2	2018-07-07	2018-07-12	0.50200	S2	2018-08-24	2018-09-13	0.517	S2	0	0	0.0000	0	1	
	31.0000002869730.001	265	3	2018-05-08 00:0	2018-05-21 00:0	0.519000	S2	2018-07-07	2018-07-12	0.50700	S2	2018-08-24	2018-09-13	0.517	S2	0	0	0.0000	0	1	
Е	31.0000002811919.002	265	3	2018-05-08 00:0	2018-05-11 00:0	0.777000	S2	2018-05-21	2018-06-20	0.71200	S2	2018-08-06	2018-08-26	0.712	S2	0	0	0.0000	0	11,	2019   Sli
	31.0000002869731.001	265	1	2018-09-08 18:0	2018-09-14 18:0	0.486000	S1	0	0	0.00000	0	0	0	0.000	0	0	0	0.0000	0	1	
	31.0000002811948.002	265	1	2018-08-09 18:0	2018-08-15 18:0	0.448000	S1	0	0	0.00000	0	0	0	0.000	0	0	0	0.0000	0	1	opean Space

### Mowing detection example on Castilla y Leon





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## Assessment of grassland mowing w.r.t. national regulations – 2019 preliminary results



Country	Total	parcels	Non-assess	ed parcels	Detected	Non-				
	Number	Area (km²)	Number	Area	mowing*	detected mowing*	* Within the regulation peri			
Netherlands (full country)	501,663	10,209	0,16%	0,17%	92%	7,9%				
Czech Republic (full country)	336,935	10,373	0,01%	0,005%	78,9%	21,1%				
Lithuania (full country)	532,208	8643	0,02%	0,003%	75,2%	24,7%				
Spain (Castilla y León)	11,841	289	1,38%	0,07%	48,3%	50,3%				
Italy (5 regions)	1,830,870	25,339	0,01%	0,0001%	44,7%	55,3%				
Romania (full country)	548,368	4134	4,15%	0,04%	68,7%	27,1%				
France (2 departments)		In progress								

- Little impact of parcel size on the assessed areas
- Grazing as an important practice in specific countries (ITA & CyL: <50% of parcels with mowing)

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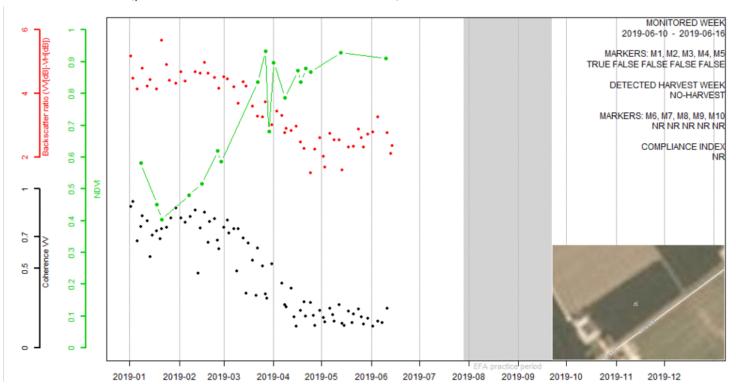




## EFA agricultural practices Harvest and catch crop monitoring



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



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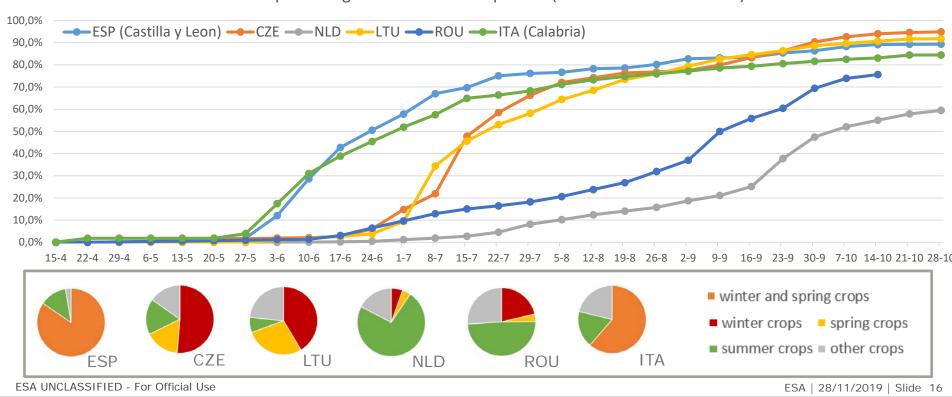




#### Evolution of harvest detection in 2019

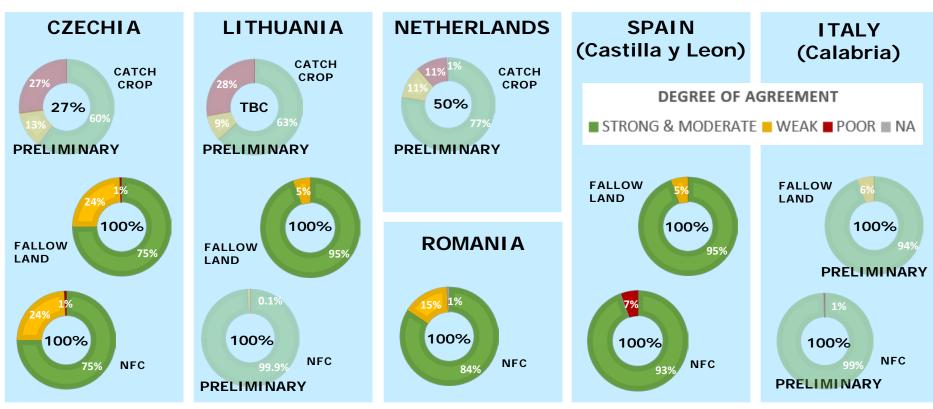


Evolution of the percentage of the harvested parcels (confirmed harvest week) in 2019



# Preliminary statistics about agricultural practices agreement - 2019





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#### Lessons learned from 2019 demonstration



- Near-real time processing at national scale for 7 Paying Agencies on CreoDIAS  $(>15.10^6 \text{ parcels assessed for } 635,000 \text{ km}^2)$
- Improved accuracy for all markers and products w.r.t. 2018 Validation to be completed, at product- and marker-level
- Open-source Sen4CAP system v1.0 qualified and delivered

Sen4CAP 1.0 released on 25<sup>th</sup> Nov. 2019 (http://esa-sen4cap.org/)

#### Installation package

The installation package of the Sen4CAP system has been split into 4 parts to ease its download:

- A zip archive containing all the necessary binaries and setup scripts (not considering MAJA, see below) [866MB]:
- o install script contains the installation scripts that are used to create the distribution and to install the system and the tool needed for the integration of the Sen4CAP processors in SNAP
- o rpm\_binaries the RPM files for all other system components (SLURM, orchestrator, downloader, processors)
- A zip archive containing the GIPP files [~1.2GB]: files needed by MAJA 3.2.2
- A zip archive containing the SRTM dataset [~16 GB]: files needed by MAJA 3.2.2
- A zip archive containing the SWBD dataset [~900 MB]: files needed by MAIA 3.2.2

- Direct download
- For the mandated Paying Agencies, there is also the possibility to get access to a test virtual machine where the system is already installed and to test the system over a small area























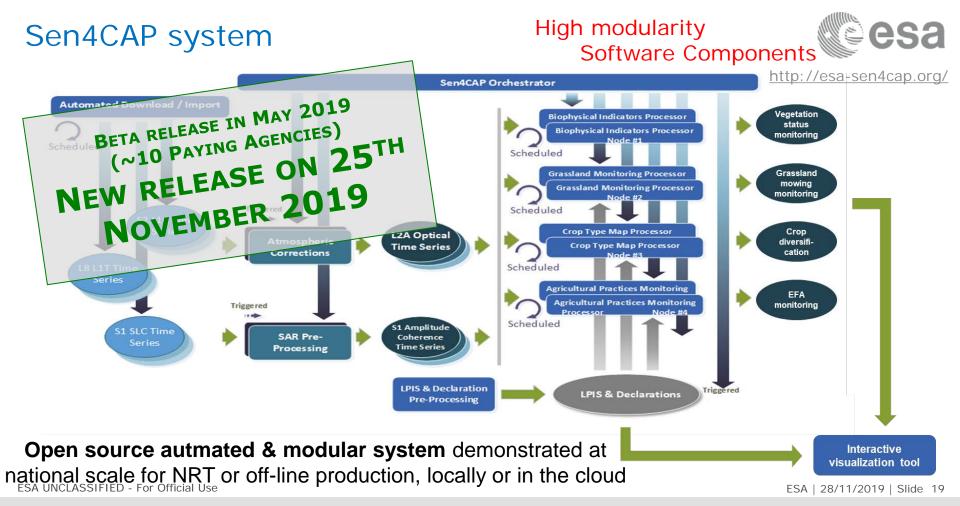


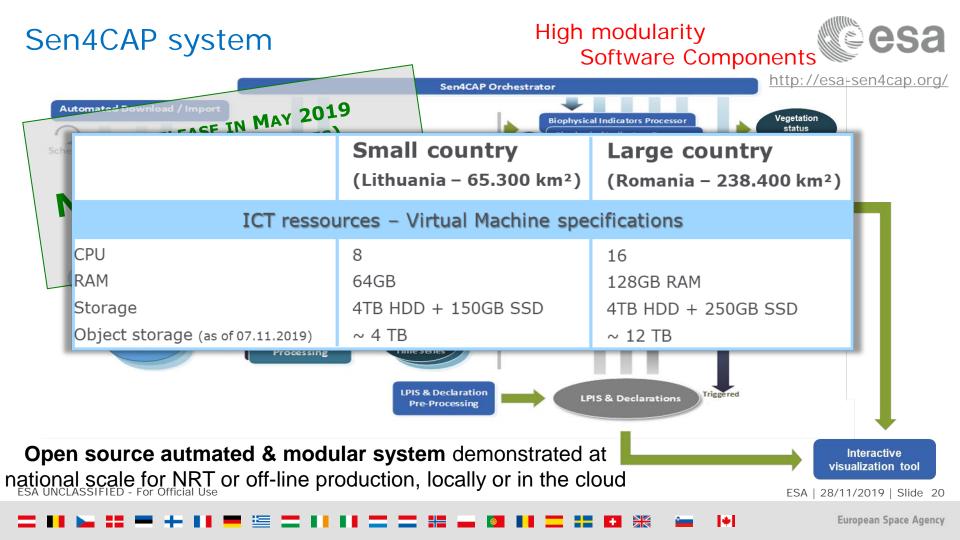












#### What do we have for you?



- Our lessons learned Sen4CAP contributing to show what is feasible and how
- Sen4CAP as an automated and modular EO processing system for national production
  - Near-real time or off-line production; running on the cloud or locally
  - Markers & products generated over each LPIS/GSAA parcel along the year
  - Parameterizable algorithms selected as the best ones over 6 countries but fully parameterized to address the specificities of each country
  - Flexibility to make it evolve (add your own markers, make your own use cases)
  - Already ~10 Paying Agencies asking for the Beta version
- Capacity building: training, forum on the website, regular webinars

SEN4CAP HANDS-ON TRAINING FOR ALL PAYING AGENCIES AND PARTNERS ON 20-21 JANUARY 2019 (TENTATIVE DATE), IN BELGIUM

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- One-year extension for new R&D and facilitate the use & hand-over of the system

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#### Sen4CAP Extension 2020

- Expression of interest from all 7 engaged Paying Agencies
- DG-AGRI requested ESA formally to extent the Sen4CAP
- Priorities for 2020:
  - Demonstration and **validation of reliable use cases**defined and conducted together with involved Paying Agencies
- got. Copperation informer the European Committee and the European Span Agency (F. N.) on the states operation Countryley dualsy.

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- **Development of additional algorithms** to further prepare the uptake of Copernicus observations in the upcoming Area Monitoring System.
- Transfer of the open source Sen4CAP system capable of running on the DIASes to interested Paying Agencies.
- Continuous collaboration with DG-AGRI, JRC and DG-GROW as part of the Sen4CAP steering group

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