Welcome to the webinar

The webinar will last around 1h

The slides will be available on the Sen4Stat website in the coming 48 hours (https://www.esa-sen4stat.org/)

Presenters:

Sophie Bontemps & Boris Nörgaard from *UCLouvain*

Joseph Pacon from PRDP, Philippines

Members of the consortium available to answer your questions

Webinar outline

- Sen4Stat overview

- Sen4Stat demonstration worldwide

- User's perspectives: the case of PRDP, Philippines

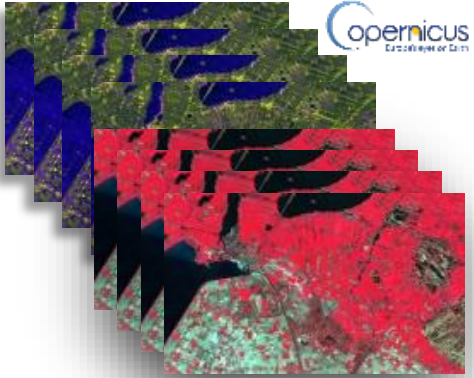- What's next

- Questions and answers

- **Sen4Stat overview**

- Sen4Stat demonstration worldwide

- User's perspectives: the case of PRDP, Philippines

- What's next

- Questions and answers

Sen4Stat: coupling EO data and statistical surveys for improved statistics

Sentinel-1 and -2
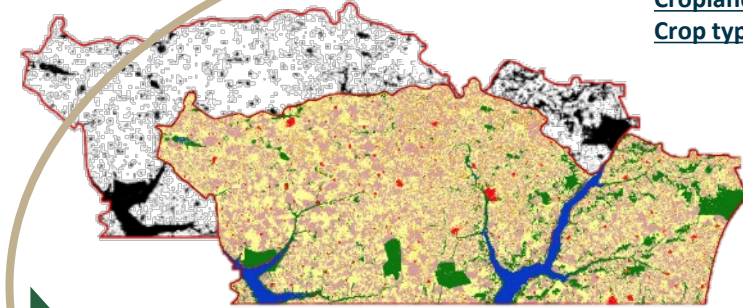
Copernicus

Agri. surveys

EO cloud
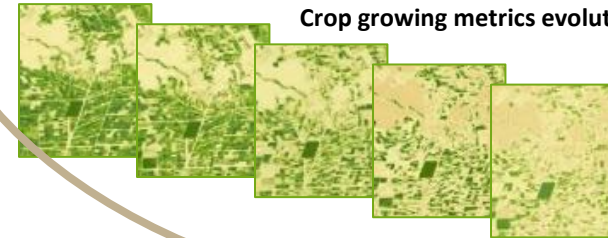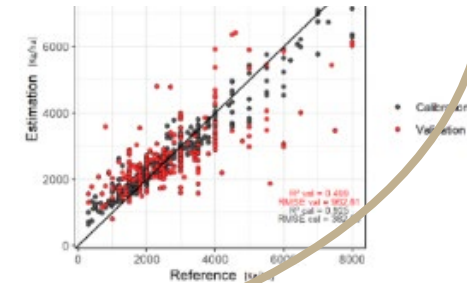
Sen4stat

EO products

SENEGAL – NIORO DU RIP
Cropland – non cropland map
Crop type map
  OA: 88,2 %
  F-Score Groundnut : 95,2%
  F-Score Mil : 83,8 %
  F-Score Maize : 54,8%

SPAIN – CASTILLA Y LEON
Soft wheat yield estimation

SENEGAL
Crop growing metrics evolution
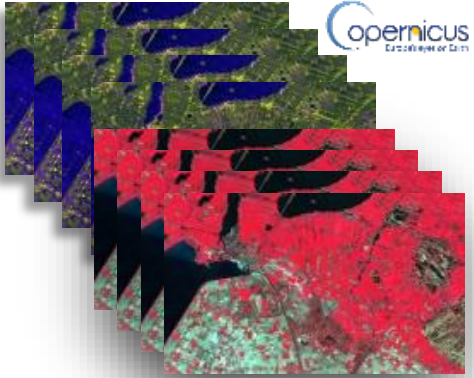
IMPROVED STATISTICS

UCLouvain

4

Sen4Stat: coupling EO data and statistical surveys for improved statistics
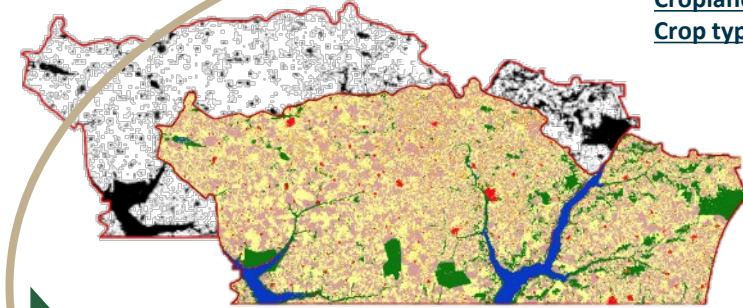

Sentinel-1 and -2

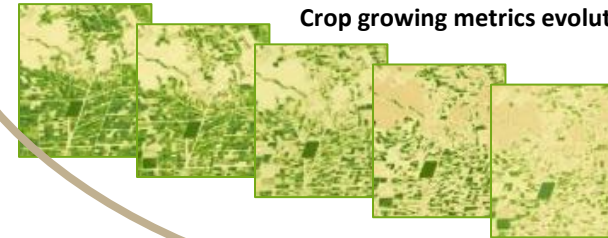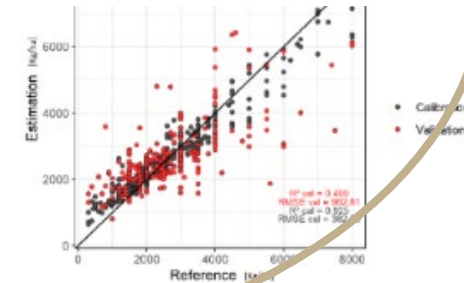**Agri. surveys**

EO cloud

Sen4stat

EO products

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SPAIN – CASTILLA Y LEON
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Crop growing metrics evolution

COST EFFICIENCY

STAT. GRANULARITY

STAT. TIMELINESS

SAMPLING DESIGN

SURVEY & DATA QA

DOWNSTREAM APPLICATIONS

UCLouvain

- Processing Sentinel-1, Sentinel-2 and Landsat-8&9 time series according to the state-of-the-art including advanced SAR products (coherence, gamma naught,…)

- Delivering automatically or on request **5 types of products** (*processors*) in near real time along the satellite data acquisition or off-line :

   1. **Optical 10m cloud free temporal synthesis and SAR temporal synthesis**

   2. **time series of spectral indices** (NDVI, coherence,…) and **biophysical variables** (LAI, fCover, fAPAR)

   3. **10m crop type maps** along the season based on in situ dataset and stratification

   4. **a large set of crop growth conditions metrics** (including even meteorological data)

   5. **crop yield estimation** at various aggregation levels (national, regional, …)
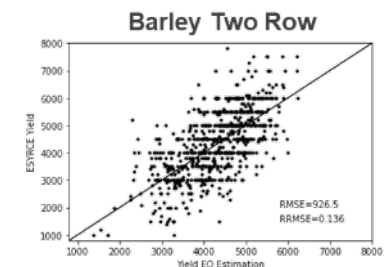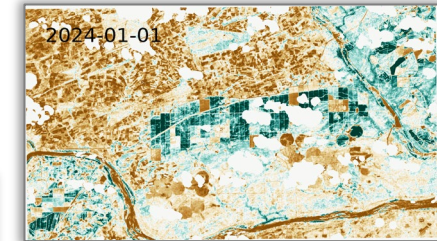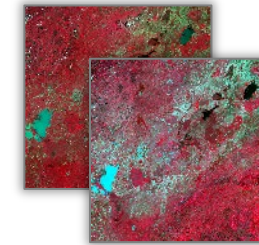
Barley Two Row

UCLouvain
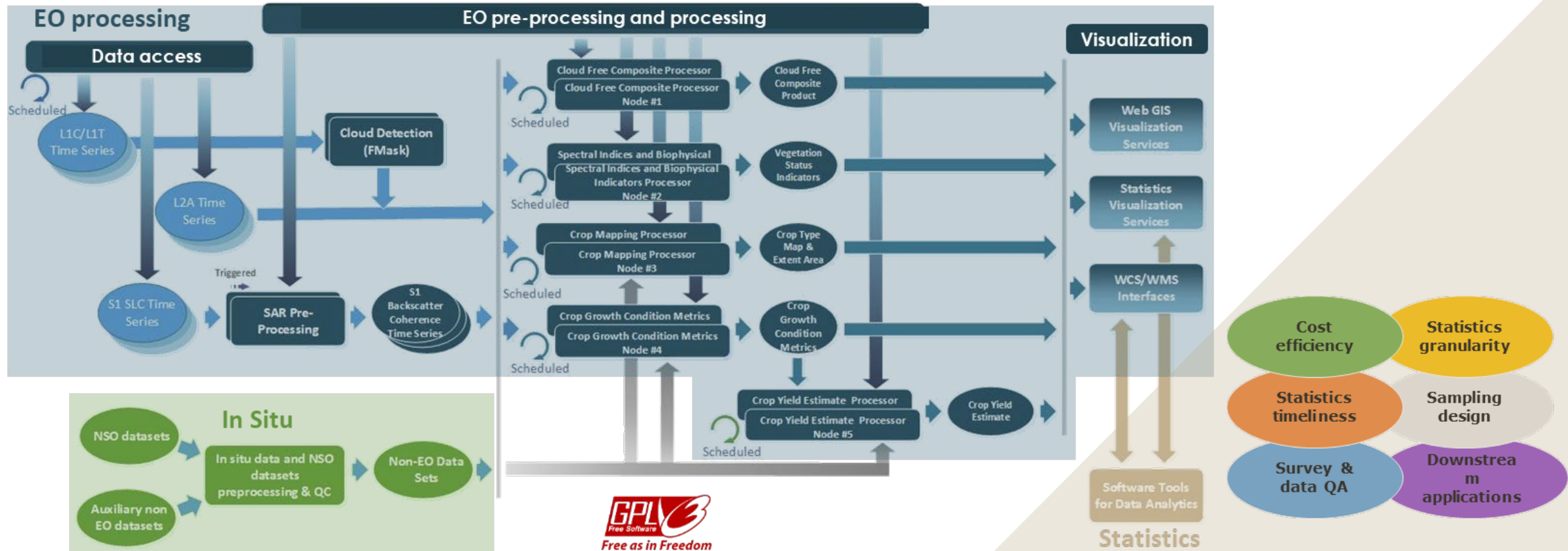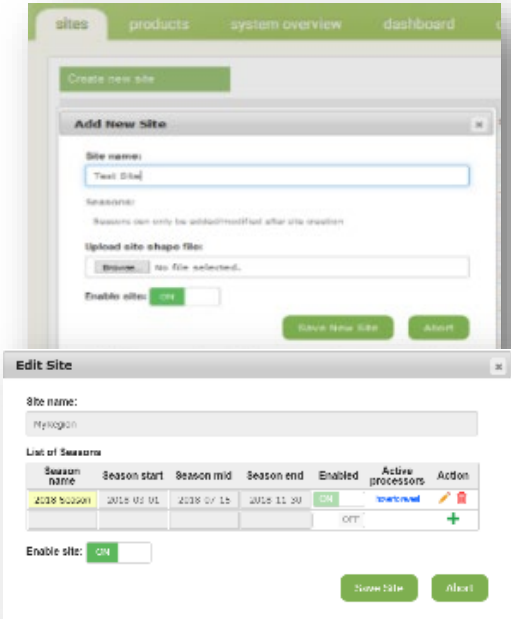
- Sentinel-1 & Sentinel-2
- For NRT & off-line production
- Running on the cloud or locally

- In situ data QA embedded
- Compatible with list and area frame surveys

System configuration

Start of the season

End of the season...

Cloud Computing

Sen4Stat : parameters settings

Area of Interest	Shapefile to be uploaded
Monitoring period	Start and end dates to be defined
S1 - S2 - L8&9	To be selected
Data sources	ESA&USGS – AWS – DIAS – local storage…
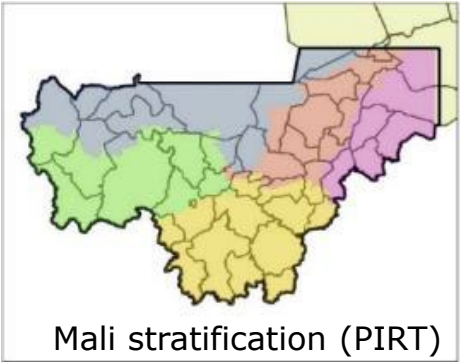
Mali stratification (PIRT)

Sen4Stat : field campaign

Sampling design	Stratification and sampling
Field visit	In situ data collection – early survey
	In situ data collection – mid-season survey
Data upload	Field data quality control and formating

UCLouvain

8

In Situ data

- In-situ data needed for
  - **calibration**: learning dataset to train the algorithm or model
  - **validation**: estimate the products accuracy (with a confidence interval) using a statistically-sound sampling to be objective and independent
  - **statistics estimation**: statistical survey designed to estimate crop acreage
- Integrated data formatting and quality control

Statistical survey data for acreage estimation
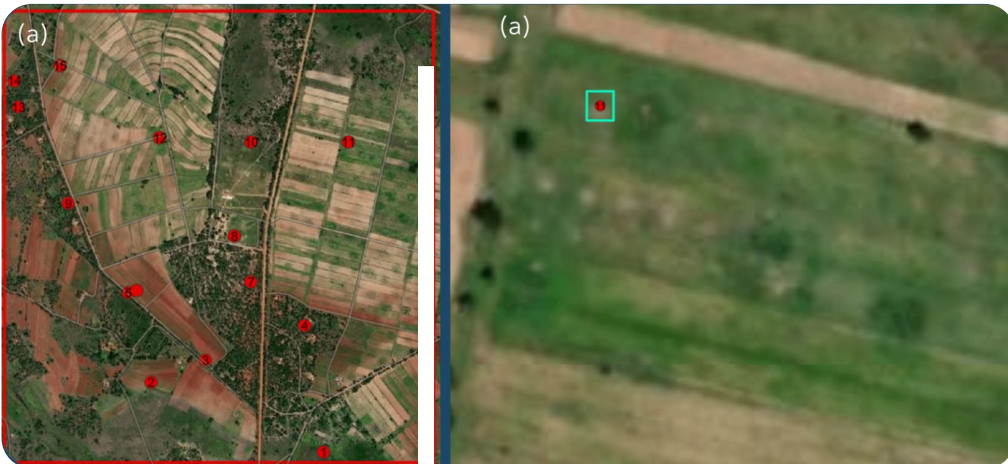
Windshield survey (points taken along the road) data for mapping purposes
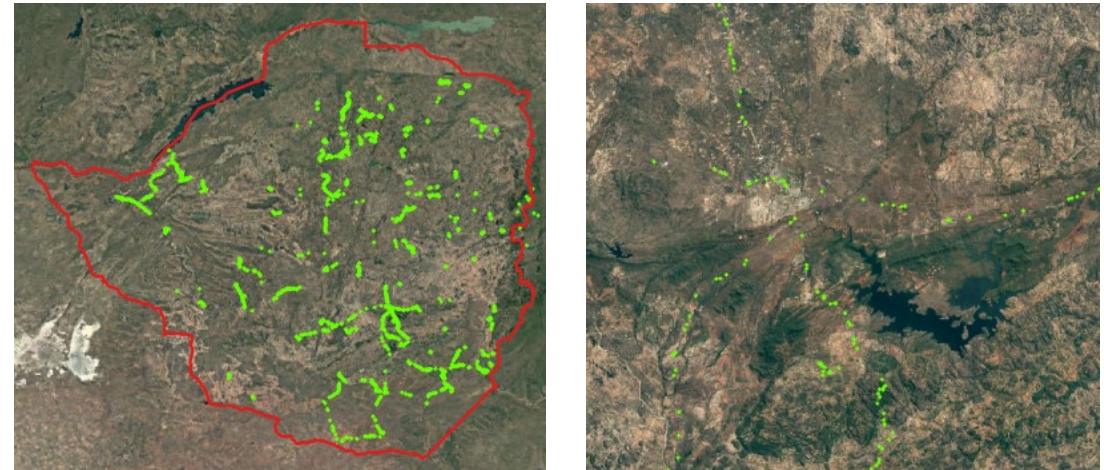
Western Cape Province monitored by Sentinel 2

Winter grain production region (South Africa)

June   July   August   September   October   November

Cape Town

Spectral indices and biophysical indicators

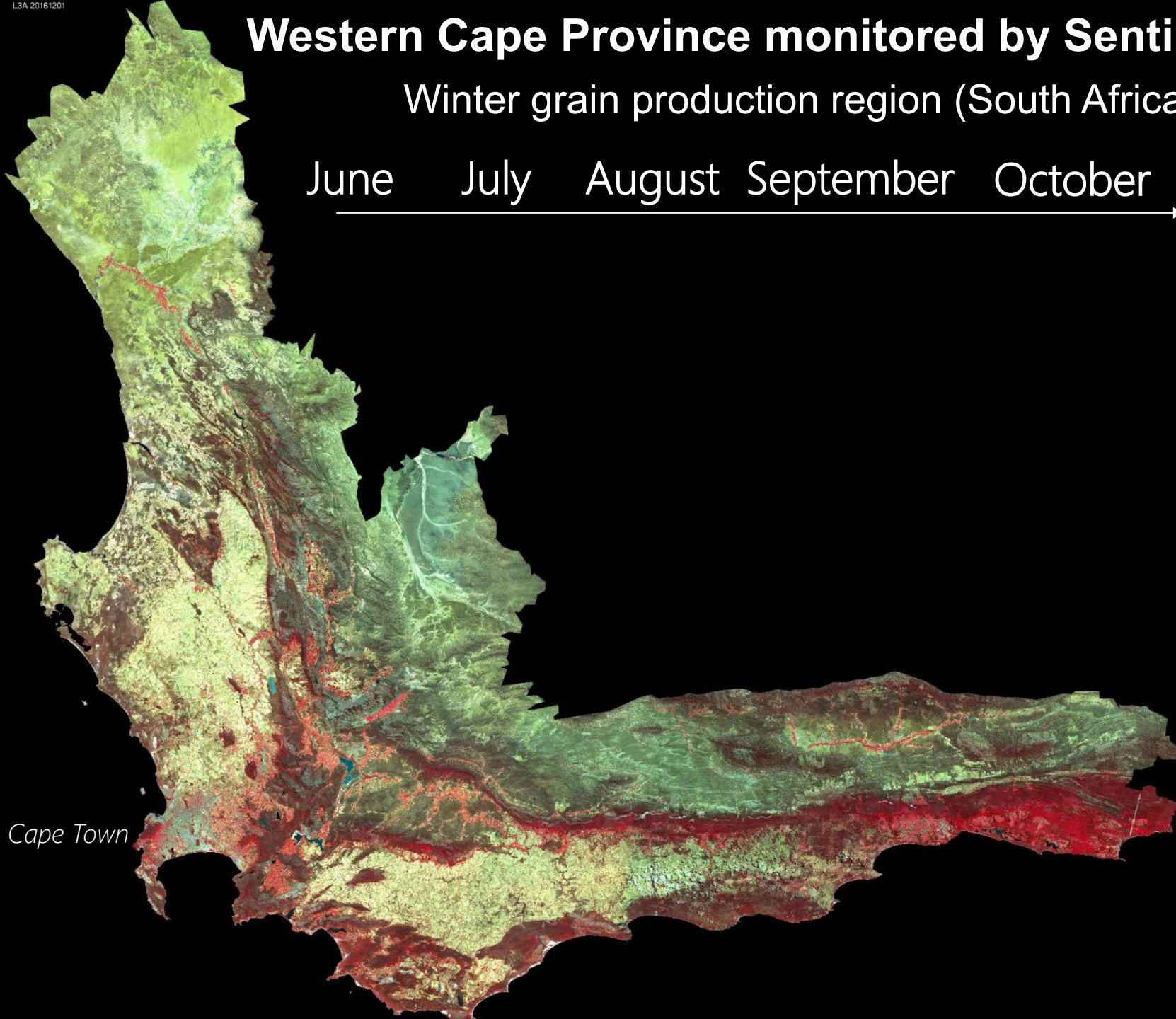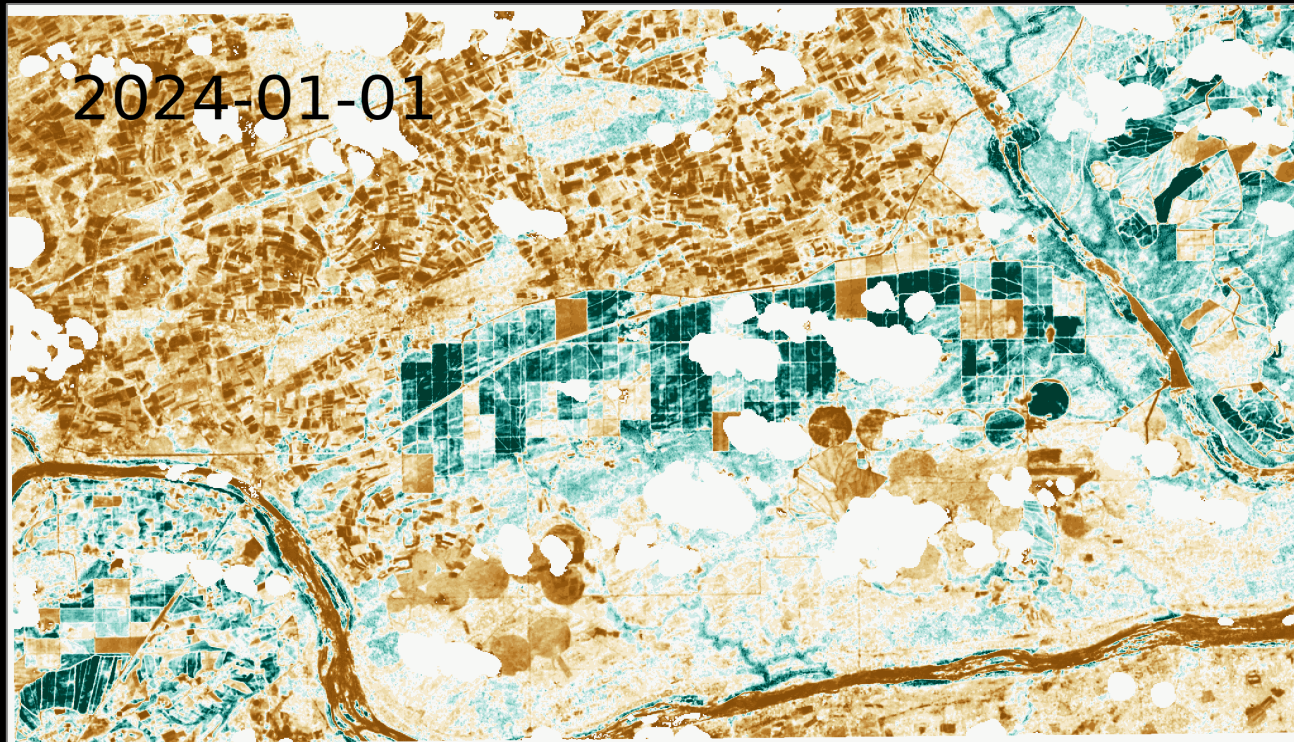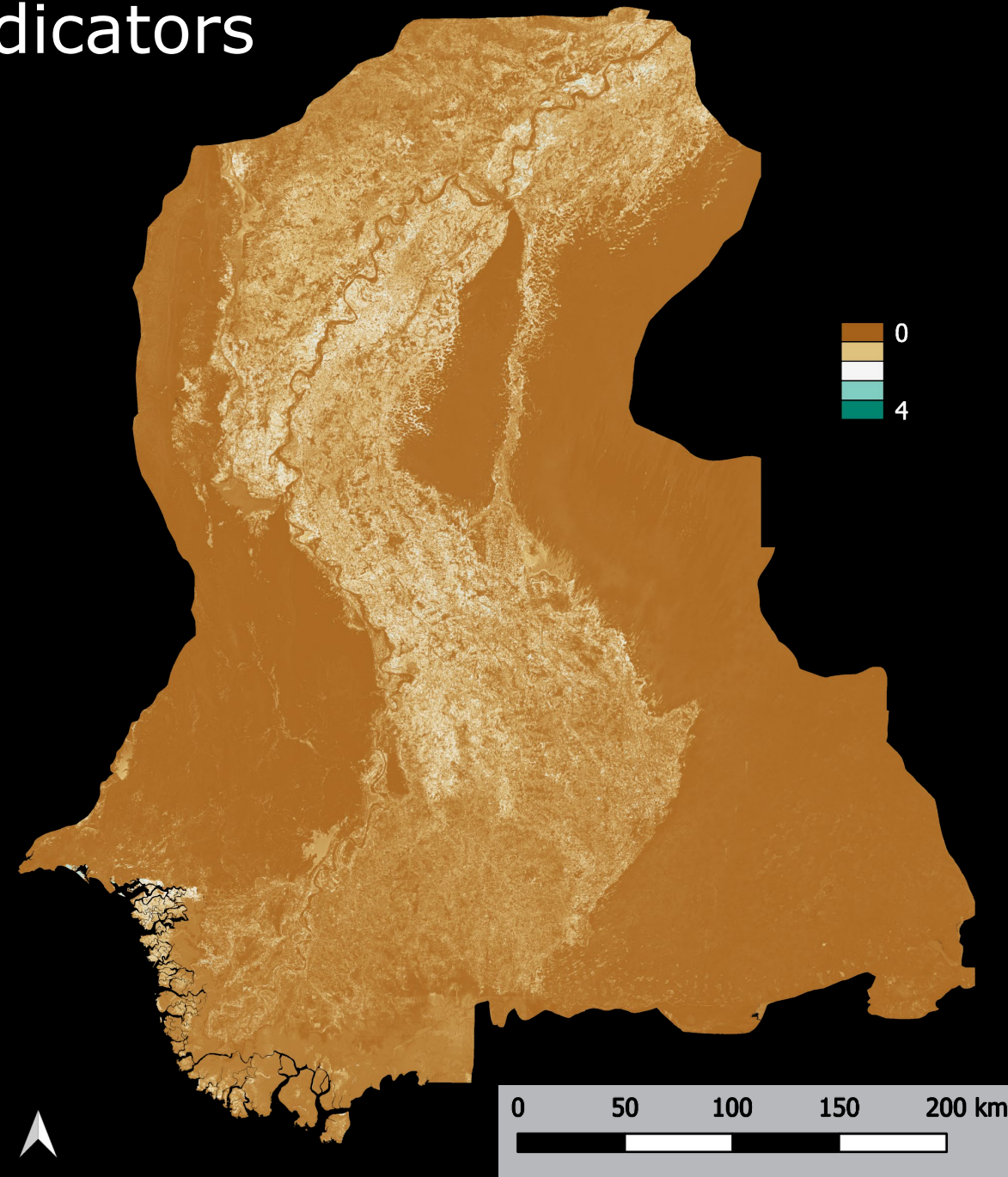*BV-Net approach*
(Weiss et al.)

2024-01-01

LAI time series in Chiredzi district, Zimbabwe

0

4

0   50   100   150   200 km

Monthly LAI Composites in Sindh, Pakistan From November 2024, until May 2025

National scale crop type map, Spain, 2020

2020 Pixel based national crop type map of Spain

- **Stratified classifification** based on agro-ecological criterias
- Spectral bands yearly time series
- NDVI, NDWI, Brightness time series

- Pixel-specific temporal metrics on spectral indices time series (min, max, sd, median)

Class			
Grassland	Leafy or stem vegetables	Barley two-row	Rapeseed
Shrubland	Fruit bearing vegetables	Barley six-row	Safflower
Tree cover	Spice crops	Rye	Sunflower
Olive groves	Hard wheat	Millets	Potatoes
Vineyard	Soft wheat	Quinoa	Sweet potatoes
Forest	Triticale	Carrots	Beans
Bare soil	Maize	Garlic	Broad beans
Builtup surfaces	Rice	Onions	
	Sorghum	Soya beans	

**Combining unbiased information with spatially exhaustive information**

Automated mode through the web graphical user interface (GUI)
a) based on the Orchestrator with by-default parameterization, automatic data download and processing until the end of the season, on-time delivery => **operational scenarios**
b) Processor execution on user request, with by-default parameterization

Manual mode: to run processor independently, wit
custom parameters
a) Through the GUI, with the *Custom job* approach
b) Through SNAP software Only processor of Level 3 and not the atmospheric correction (L2A).
c) In command line through a linux terminal
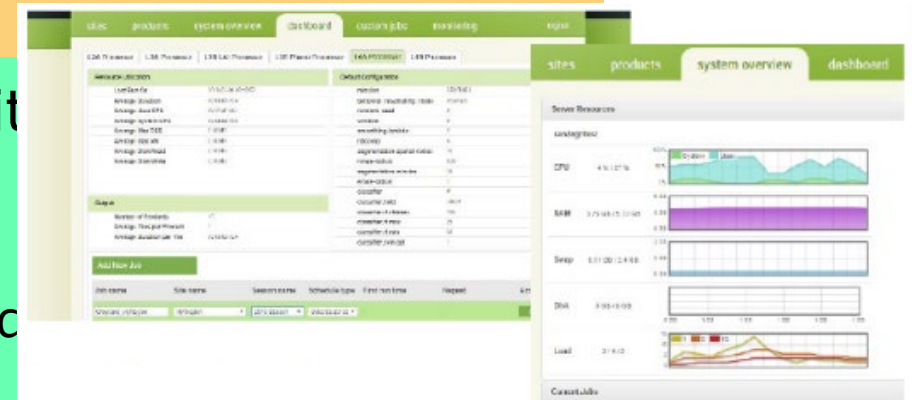
Sen4Stat is free and open source
Based on existing open source software

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 : **Alma or Rocky LINUX**

PostgreSQL and **PostGIS** implementation

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Cost efficiency

Improving design-based **acreage and yield** estimators by reducing the standard error while providing unbiased estimates => reducing the CoV without increasing the number of samples

ESYRCE : integrated list and area frame survey (49 ha ESU; systematic sampling; all crops within ESU)

	Data	Acreage (hectares)	Uncertainty			Sampling Error (CV%)	Relative efficiency
			95% Confidence Interval (hectares)				
			Limits	Amplitude			
Wheat (F-Score: 0,845)	Ground (ESYRCE)	1.652.141	Lw: 1.572.269	159.743		2,47	------
			Up: 1.732.012				
	Ground+RS	1.500.143	Lw: 1.472.431	55.423		0,94	8,312
			Up: 1.527.854				
Maize (F-Score: 0,965)	Ground (ESYRCE)	401.563	Lw: 338.013	127.098		8,07	------
			Up: 465.111				
	Ground+RS	365.367	Lw: 349.945	30.844		2,15	16,988
			Up: 380.789				
Sunflower (F-Score: 0,842)	Ground (ESYRCE)	579.599	Lw: 531.858	95.493		4,2	------
			Up: 627.341				
	Ground+RS	526.876	Lw: 513.882	25.988		1,26	13,51
			Up: 539.870				

|	ESYRCE			EO Yield Model		
	N	Mean	Sd	N	Mean	Sd
Àvila	107	4241.5	83.0	150	4232.4	34.9
Burgos	315	4826.8	64.9	446	4764.3	38.2
Leòn	37	3822.0	103.8	52	3817.5	57.0
Palencia	211	4602.1	32.3	302	4557.5	17.0
Salamanca	87	4155.8	63.1	122	4155.8	57.9
Segovia	206	4168.0	52.5	294	4134.1	35.4
Soria	192	3640.1	35.2	275	3542.6	26.8
Valladolid	320	4574.6	37.8	459	4531.1	26.5
Zamora	142	4586.8	65.0	204	4569.1	54.7
Castilla Y Leòn	1617	4426.5	16.5	2304	4391.9	14.0

Statistics granularity

Barley acreage estimates at the municipality level in Zamora

Not available without EO (estimation error becomes acceptable, < 20%)

Municipality		Acreage	
		Has.	Error (CV%)
49020	Belver de los Montes	212.96	29.1
49043	Castroverde	2914.22	8.0
49156	Pinilla de Toro	963.30	10.0
49168	Quintanilla del Monte	466.65	20.3
49219	Toro	615.91	14.0
49235	Vezdemarbán	1358.22	12.6
49250	Villalpando	560.05	39.1
49252	Villamayor de Campos	1056.23	11.1
49260	Villanueva del Campo	784.03	13.2
49263	Villar de Fallaves	844.16	11.0
49267	Villardondiego	516.40	11.5
49270	Villavendimio	656.07	10.4
Total Zamora		10948.2	8.16

Irrigation status
Rainfed
Irrigated
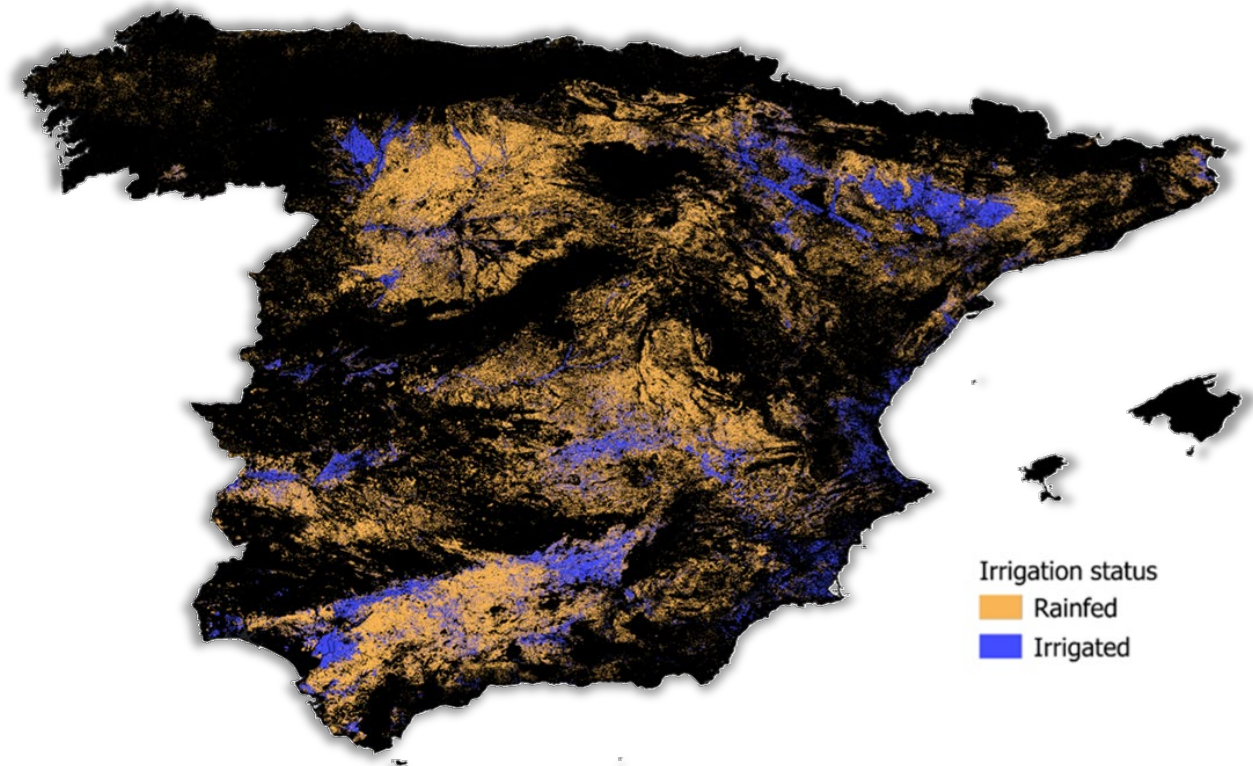
Sampling design

Mapping irrigation to support a better allocation of samples
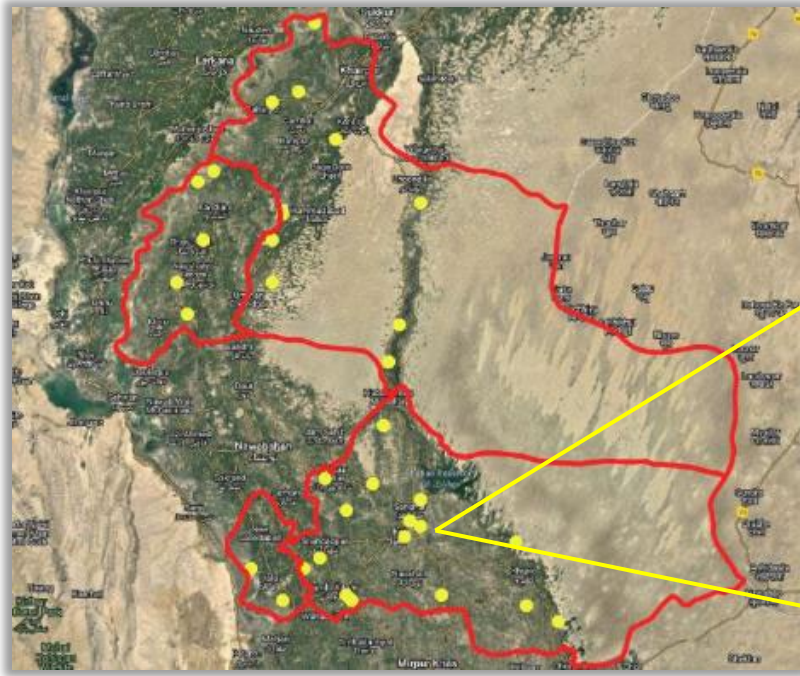
Example of area sampling frame specifically designed for the Rabi season 2024

Wheat map

THE WORLD BANK

	Precision	Recall	F-score
	0.879	0.822	0.849

	Statistical Survey	Windshield Survey
Irrigated Wheat	208	726
Other Crop	87	448
Non Crop	238	495
Total	533	1707

Survey & data QA
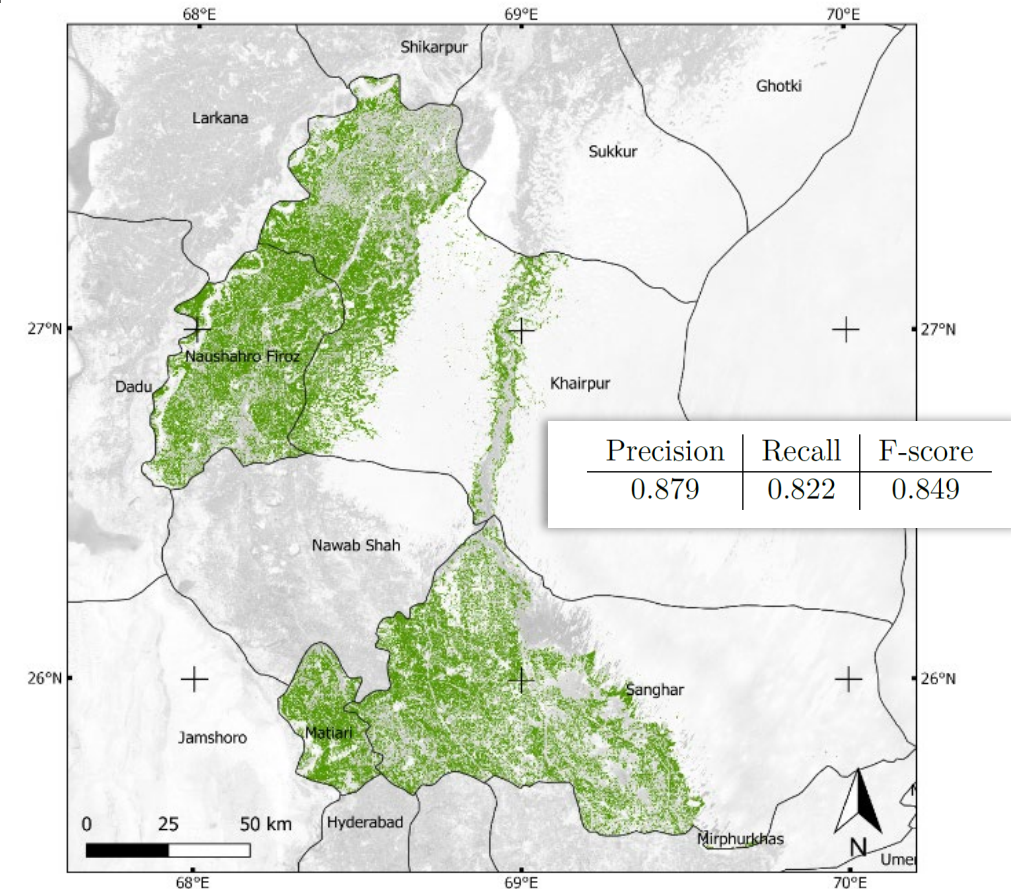
UCLouvain

Without EO

Sen4Stat

No confidence interval

No confidence interval

No confidence interval

Estimated Wheat Acreage (in Ha)

Crop reporting service (first estimation)

Crop reporting service (final estimation)

Inference from statistical survey

Wheat map

THE WORLD BANK

Precision	Recall	F-score
0.879	0.822	0.849
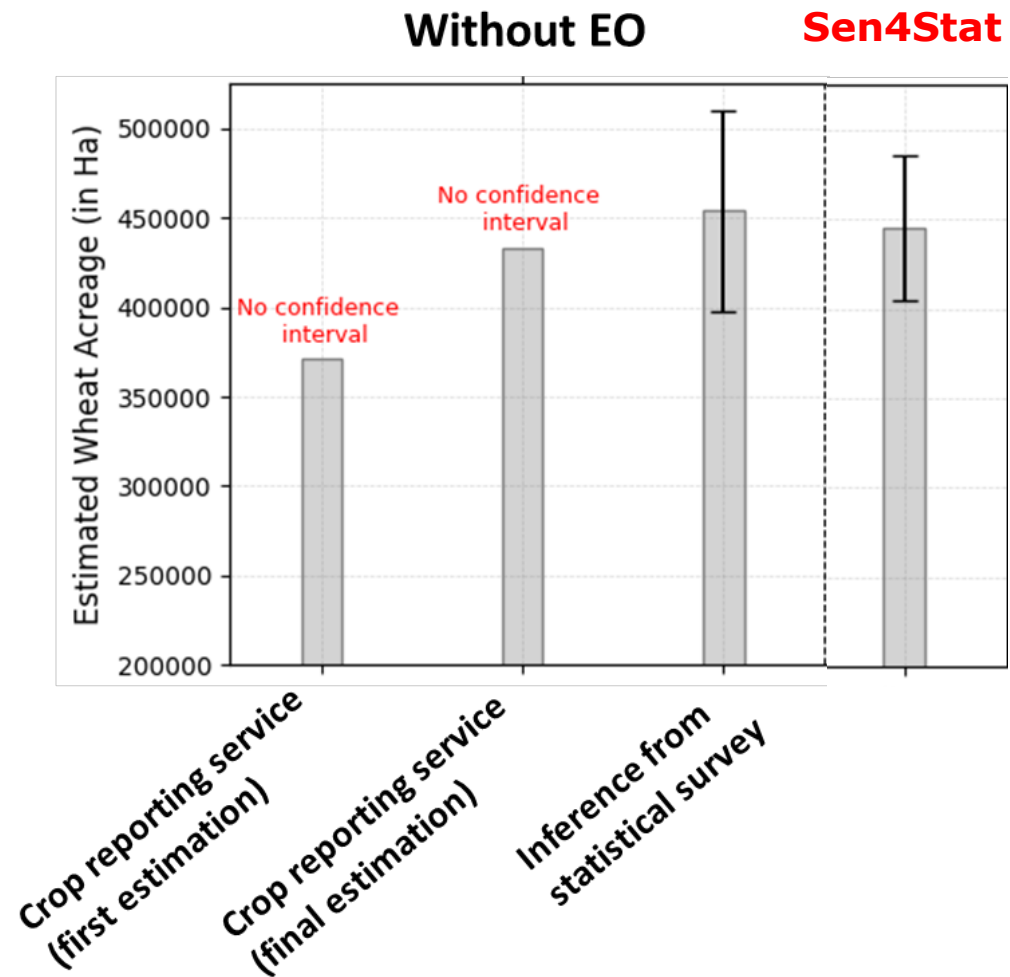
Survey & data QA

Cost efficiency
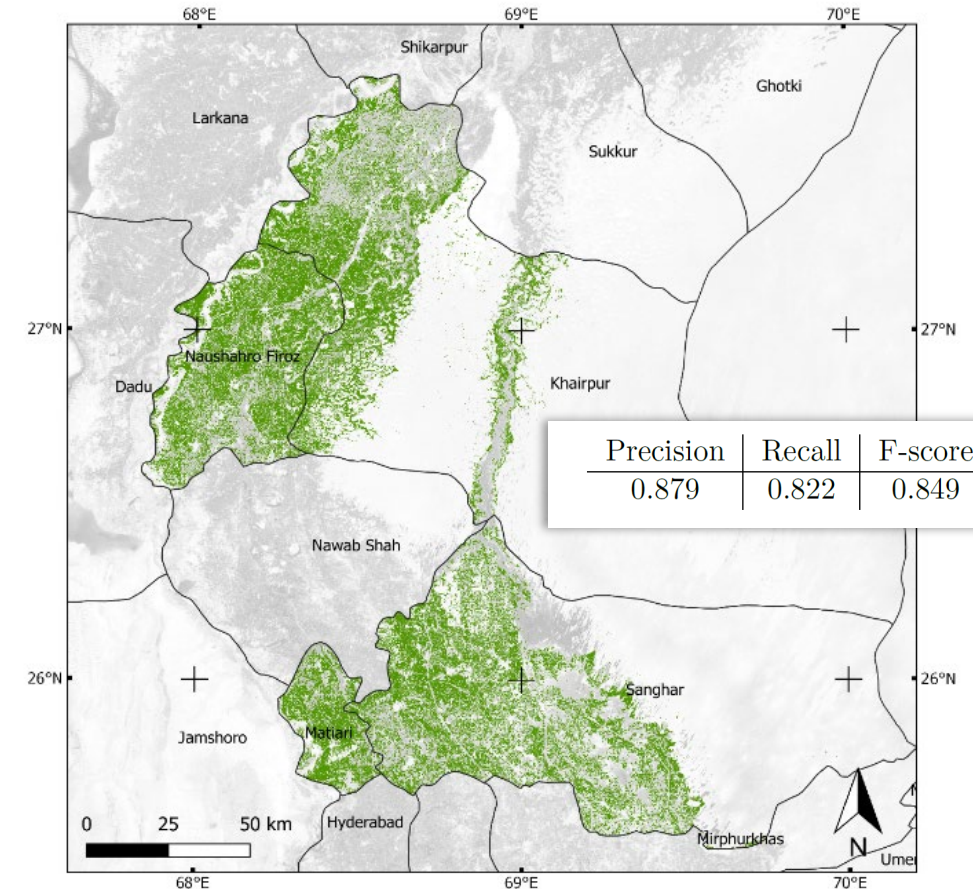
UCLouvain

Survey & data QA

- Systematic collection of parcels boundaries
- Comparing area measurements with tablet and with GPS
- Addressing the challenge of working with 2 devices (tablet and GPS)
- QA of data in near real time during the field campaign by us and by DAPSA
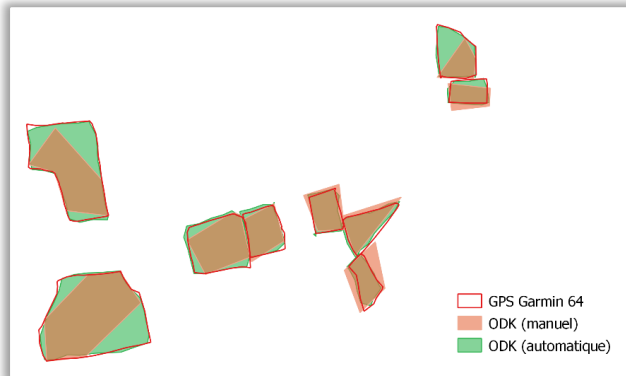
GPS Garmin 64
ODK (manuel)
ODK (automatique)

UCLouvain

Cost efficiency

Improving design-based **acreage** estimators by reducing the standard error while providing unbiased estimates => reducing the CoV without increasing the number of samples.

Prototype in the department of Nioro

Extension to 6 departments + yield protocol adjustment
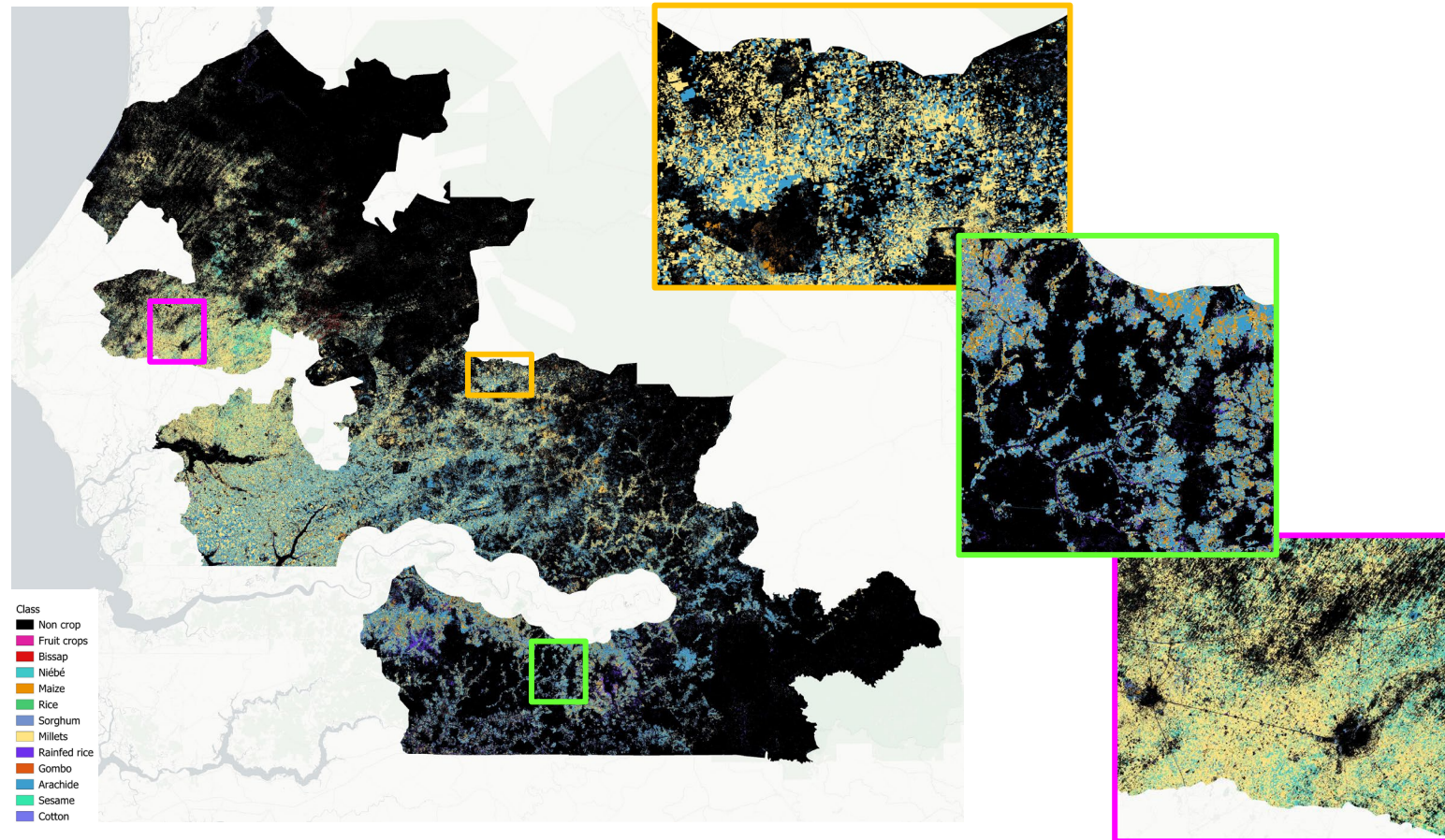
Class
- Non crop
- Fruit crops
- Bissap
- Niébé
- Maize
- Rice
- Sorghum
- Millets
- Rainfed rice
- Gombo
- Arachide
- Sesame
- Cotton

Statistical survey data for acreage estimation
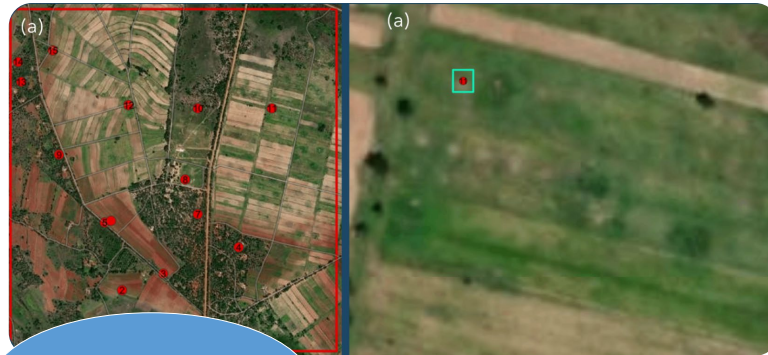
Survey & data QA
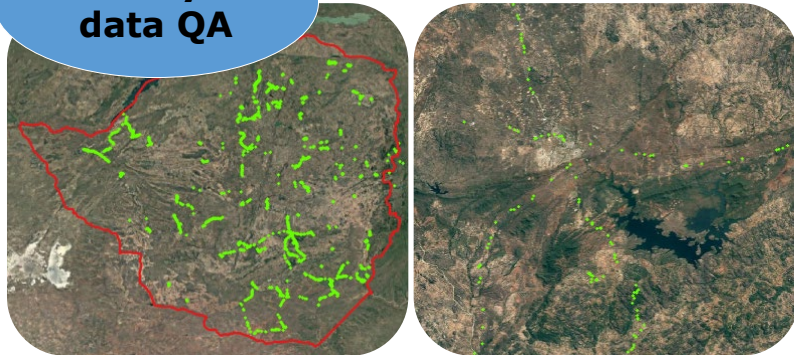
Opportunistic survey for mapping purposes
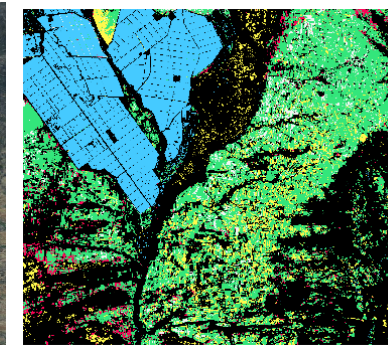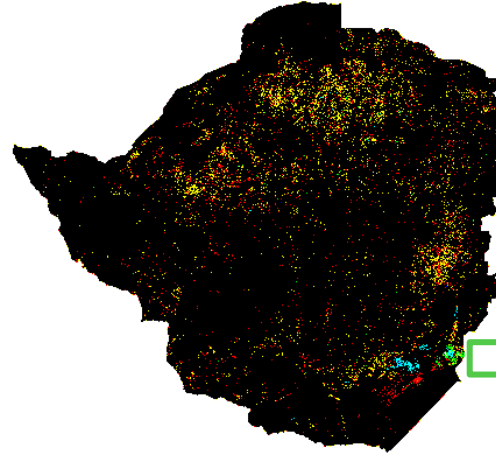
Class
- Non crop
- Leguminous crops
- Banana
- Maize
- Sorghum
- Millets
- Cabbage
- Tomato
- Soy bean
- Round nut
- Oilseed crops
- Potato
- Sugar cane
- Cotton
- Tobacco

Area estimation for Maize - Millets - Sorghum - Zimbabwe
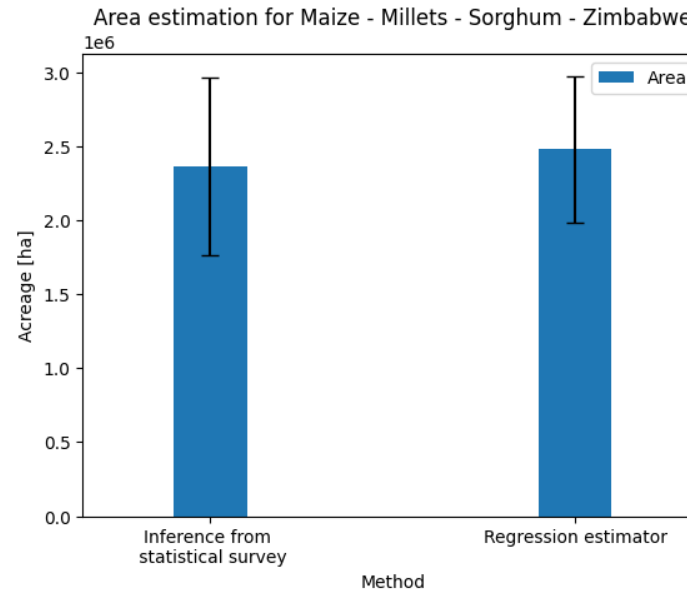
Estimates aligned with figures from AGRITEX (Department of Agricultural, Technical and Extension Services, responsible for providing technical support and advice to farmers)

Cost efficiency

Statistics timeliness

Sen4Stat implementation for 6 countries and Sen4Stat feasibility for 12 countries

Webinar outline

- Sen4Stat overview

- Sen4Stat demonstration worldwide

- **User's perspectives: the case of PRDP, Philippines**

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- Questions and answers

https://prezi.com/view/f23NsQKEjL8KUmf5fX8g/
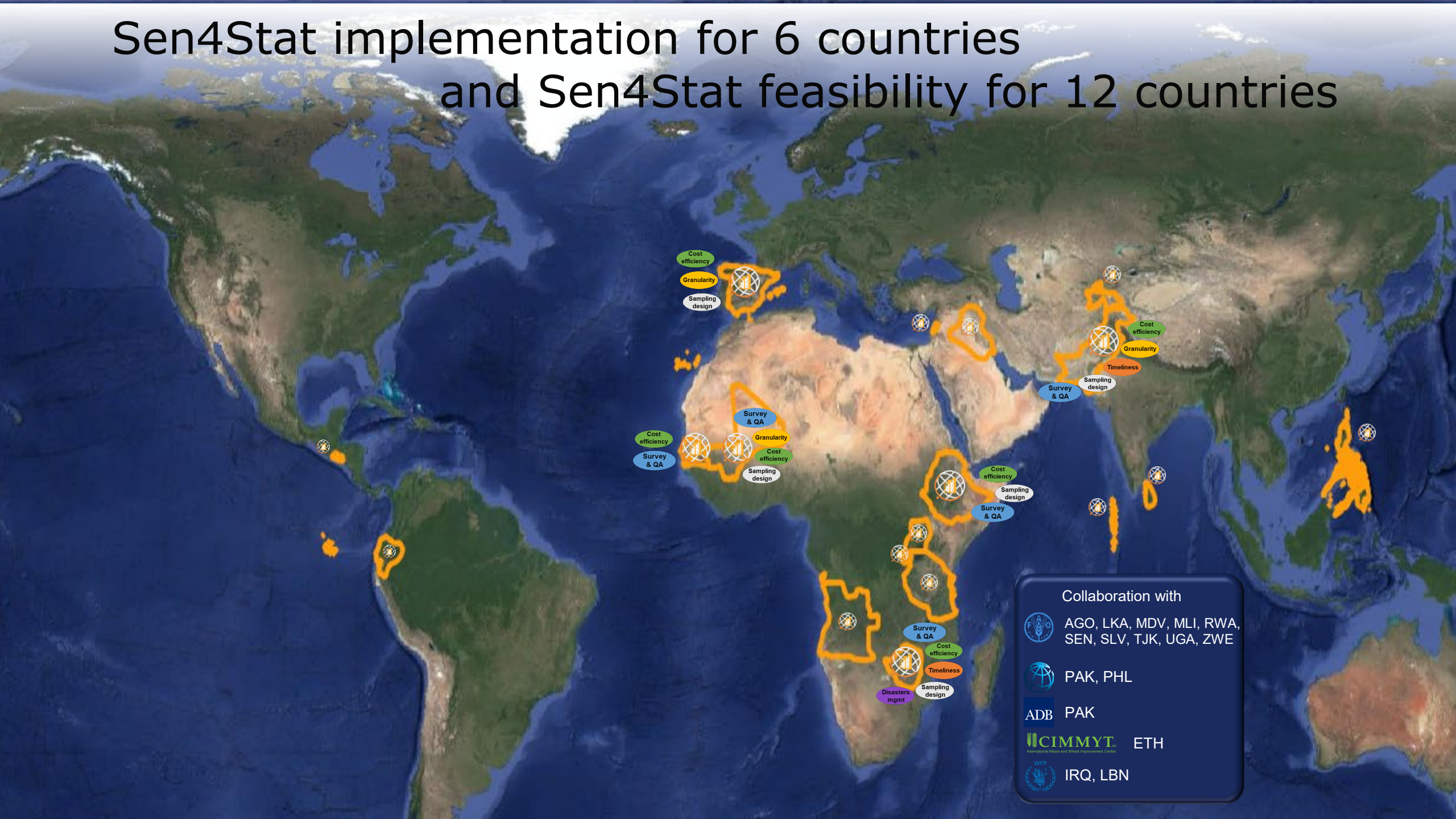
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- **What's next?**

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esa

ESA SEN4STAT
SENTINELS FOR AGRICULTURAL
STATISTICS

https://www.esa-sen4stat.org

Development and demonstration of agricultural Earth Observation (EO) products and workflows based on the Sentinel missions of the European Union (EU) Copernicus program which support the agricultural statistics and can be integrated in the National Statistical Offices (NSO) environment

SYSTEM DOWNLOAD →

User Stories

- SENEGAL Prototype
- SPAIN Prototype
- SPAIN Cycle 1 Demo

News

- Reinforcement of datasets – A challenge
- Sen4Stat concept paper
- Overview of Sen4Stat
- Sen4Stat use cases

Team

- UCLouvain - Université Catholique de Louvain
- CS GROUP - Romania
- CLS
- UPM - Universidad Politécnica de Madrid

Forum / Resources / Contact

- Sen4Stat Community
- Sen4Stat Ressources
- Contact us

Visit our forum and resources section

Forum / Resources / Contact

Visit Sen4Stat Community!

TO SEN4STAT FORUM
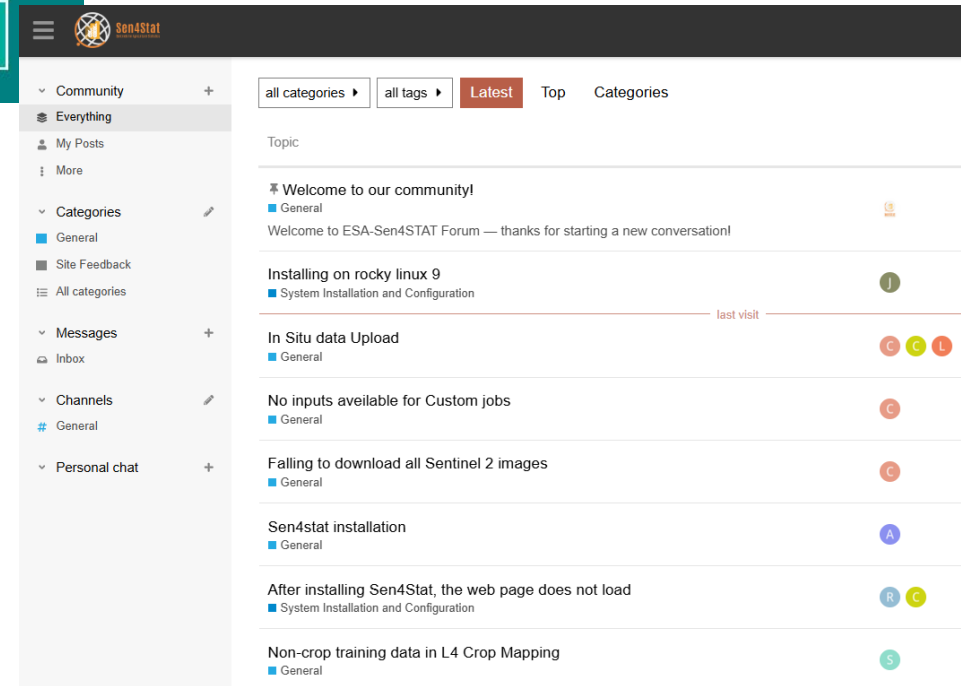
Access Sen4Stat Ressources!

CLOUD ACCESS

Contact Us!

CONTACT

Sen4Stat

- ⌄ Community   +
  - 🗇 Everything
  - 👤 My Posts
  - ⋮ More
- ⌄ Categories   ✏
  - ■ General
  - ■ Site Feedback
  - ≡ All categories
- ⌄ Messages   +
  - 📥 Inbox
- ⌄ Channels   ✏
  - # General
- ⌄ Personal chat   +

all categories ▸ all tags ▸   **Latest**   Top   Categories

Topic

📌 Welcome to our community!
■ General
Welcome to ESA-Sen4STAT Forum — thanks for starting a new conversation!

Installing on rocky linux 9
■ System Installation and Configuration

last visit

In Situ data Upload
■ General

No inputs aveilable for Custom jobs
■ General

Falling to download all Sentinel 2 images
■ General

Sen4stat installation
■ General

After installing Sen4Stat, the web page does not load
■ System Installation and Configuration

Non-crop training data in L4 Crop Mapping
■ General

UCLouvain

- Sen4Stat @Living Planet Symposium (Austria, June 2025)

- Sen4Stat stakeholder meeting in Brussels (Belgium) on 28-29 August

- Sen4Stat @AFCAS in Tunis (Tunisia) on 24-28 November 2025

African Commission on Agricultural Statistics (AFCAS), 29th Session

(Tunisia), 24/11/2025 - 28/11/2025

https://www.fao.org/africa/events/events-detail/africa-commision-on-agricultural-statistics-(afcas)--29th-session/en

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- **Questions and answers**