GROUP ON EARTH OBSERVATIONS

OPEN DATA & OPEN KNOWLEDGE Workshop

- Statistical data for validation of Land use land cover

(FAO-EOSTAT)

GROUP ON EARTH OBSERVATIONS

Problem, Objective, and Approach

Problem: Collecting and predicating real time crop location and yield is difficult and expensive.

Support countries' capacity to consistently collect agricultural statistics through integrated earth observation data, physical modeling, and ground truth data collection.

Objective

Provide a free tool, publicly hosted for sustainable utility with pilot in-country collaboration and capacity building.

Approach

EO-STAT

17 Countries

Country	Crop Type 10m	Crop yield 10m	Field boundaries	Land Cover	In Situ data
Afghanistan	X	X	X	X	FAO
Bolivia	X	X	X		X
Cameroon	X	X			X
Chile	X	X	X		X
Colombia	X	X	X		X
Ecuador	X	X			X
El Salvador	X	X			FAO
Gabon	X	X			X
Guatemala	X	X	X	X	X
Mali	X	X			FAO
Mozambique	X	X	X	X	FAO
Peru	X	X			X
Rwanda	X	X	X	X	FAO
Senegal	X	X			FAO
Lesotho	X	X	X	X	FAO
Uganda	X	X			FAO
Zimbabwe	X	X	X	X	FAO

In-situ data – the weak link

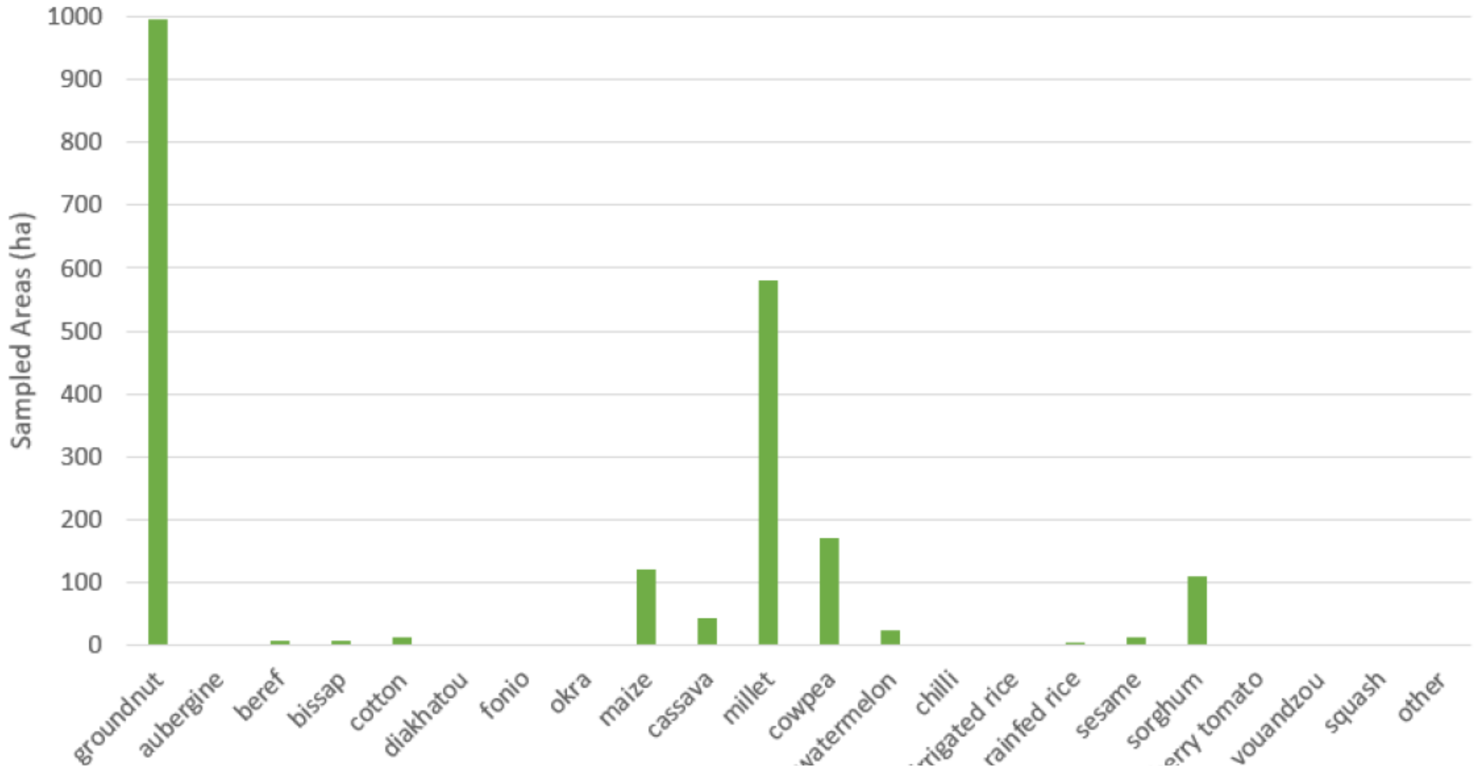
- <u>Crop type mapping</u>

  - Limited availability of in-situ data of adequate quality in countries
  - High dependency of supervised classification methods on large amounts of in-situ data of adequate quality, while this resource is rare to find in countries
  - Low transferability of training data and models to different agricultural epochs and to different countries
  - High cloud coverage in specific climatic zones which impairs the use of optical satellite data

- <u>Crop yield forecasting and Mapping</u>

  - Traditional methods of yield estimation depend on crop cutting but they lack rigorous and standardized protocols for harmonized data collection. Yield forecasts based on limited number of crop cutting remains **highly uncertain due to the large spatial variability of samples.**

  - EO models based on regressions of crop yields on vegetation indexes derived from Satellite images have low accuracy



Unbalanced sampling: oversampling of dominant crops and under sampling of minor crops, resulting in low accuracy of maps

- **Crop type mapping**

  - **Limited availability of in-situ data of adequate quality in countries**
  - High dependency of supervised classification methods on large amounts of in-situ data of adequate quality, while this resource is rare to find in countries
  - Low transferability of training data and models to different agricultural epochs and to different countries
  - High cloud coverage in specific climatic zones which impairs the use of optical satellite data

- **Crop yield forecasting and Mapping**

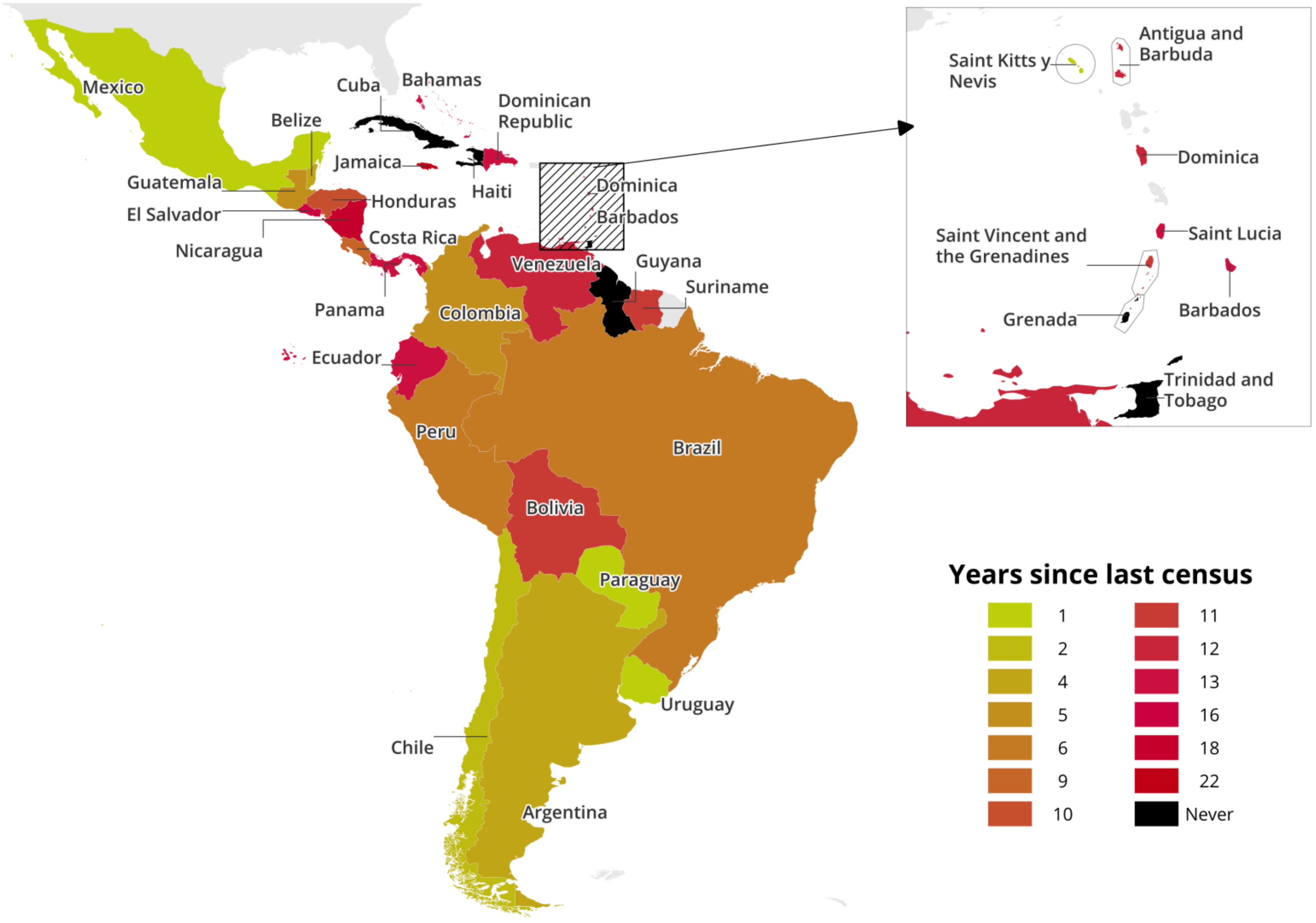
  - Traditional methods of yield estimation depend on crop cutting but they lack rigorous and standardized protocols for harmonized data collection. Yield forecasts based on limited number of crop cutting remains **highly uncertain due to the large spatial variability of samples.** Crop cuts are often not georeferenced
  - EO models based on regressions of crop yields on vegetation indexes derived from Satellite images have low predictive power

sampling density of 1 observation per sq. km can provide a sampling rate of 1 % of the JECAM site area.

farming and in developing countries

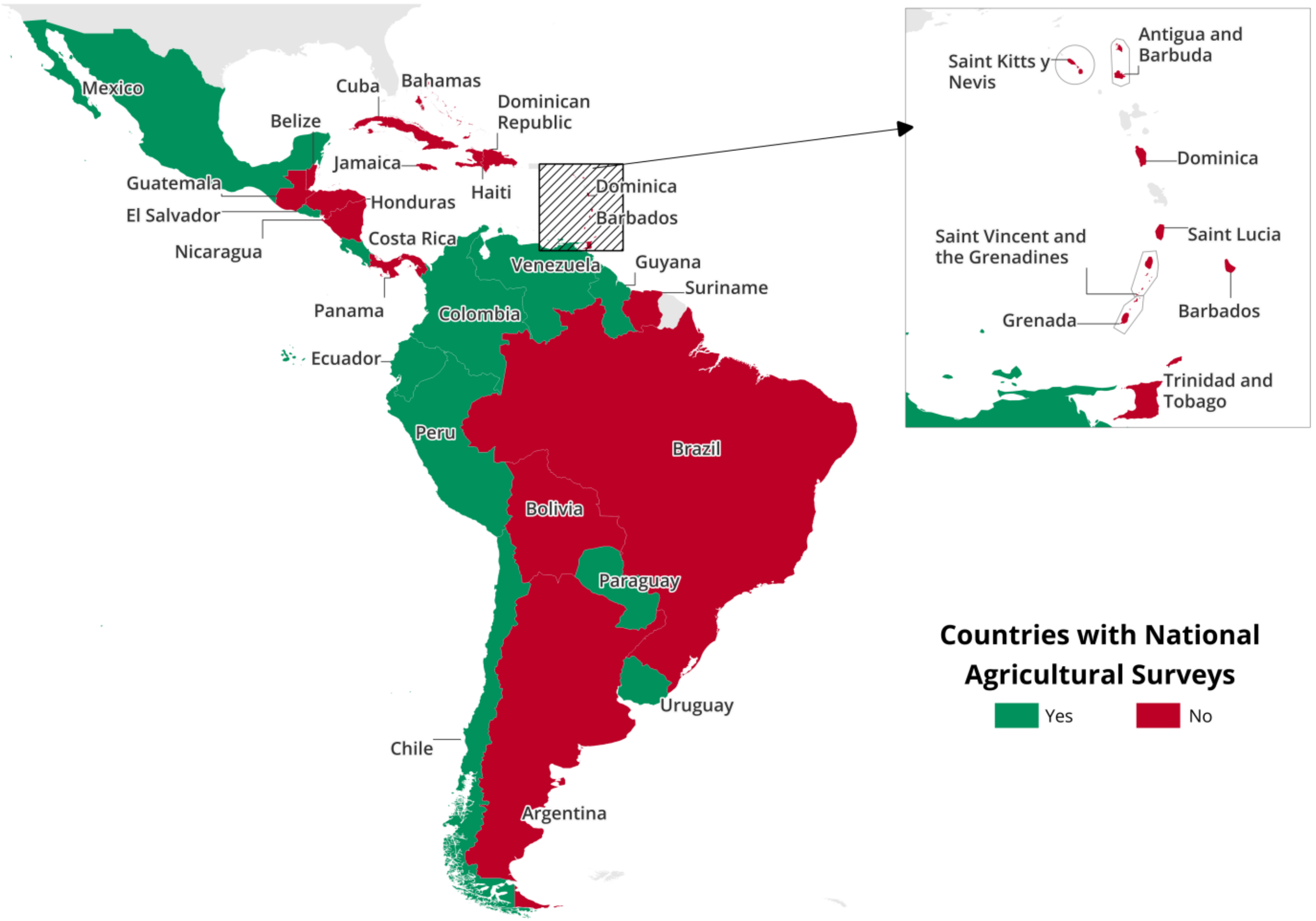
Agricultural Census in Latin America and Caribbeans

2/3 of the LAC countries do not have updated structural information on the agricultural sector for more than 10 years



Agricultural surveys

Only 1/3 of the LAC countries have implemented a national agricultural survey in the last 3 years.

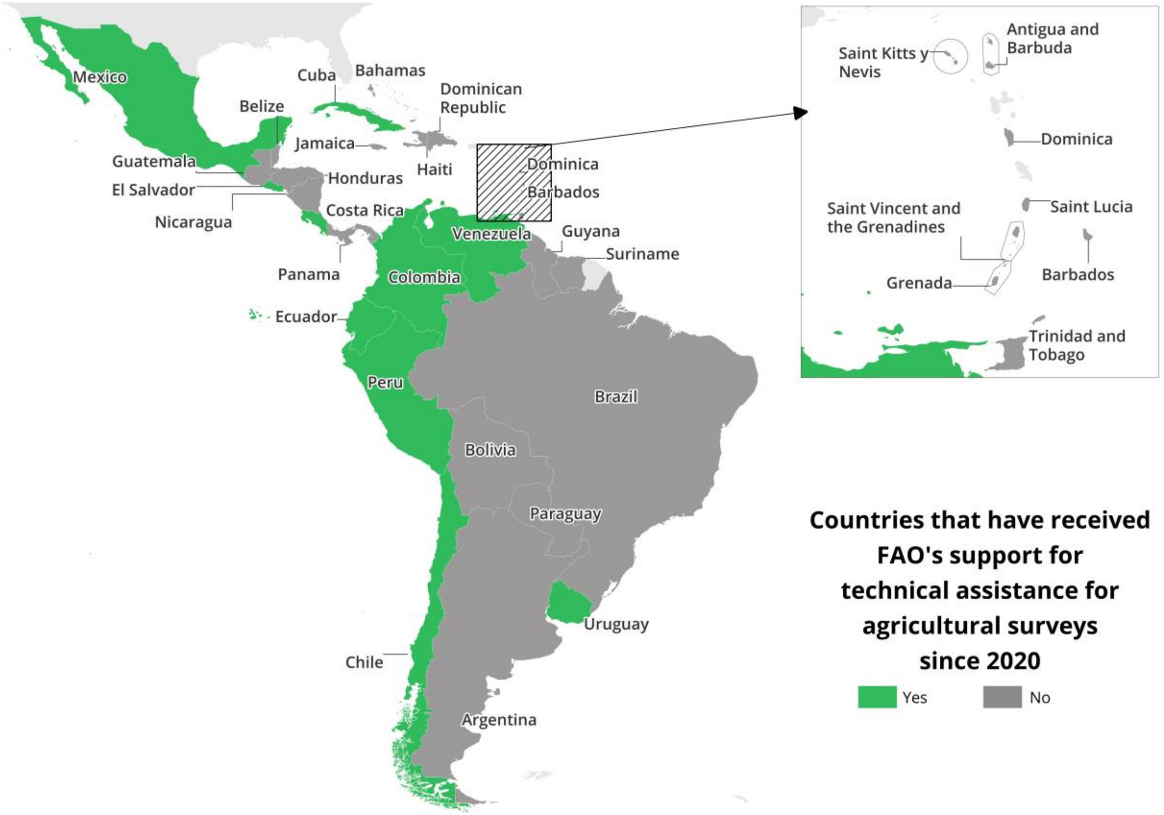


FAO support in censuses and surveys

GROUP ON EARTH OBSERVATIONS

FAO has supported 11 countries in agricultural surveys since 2020.

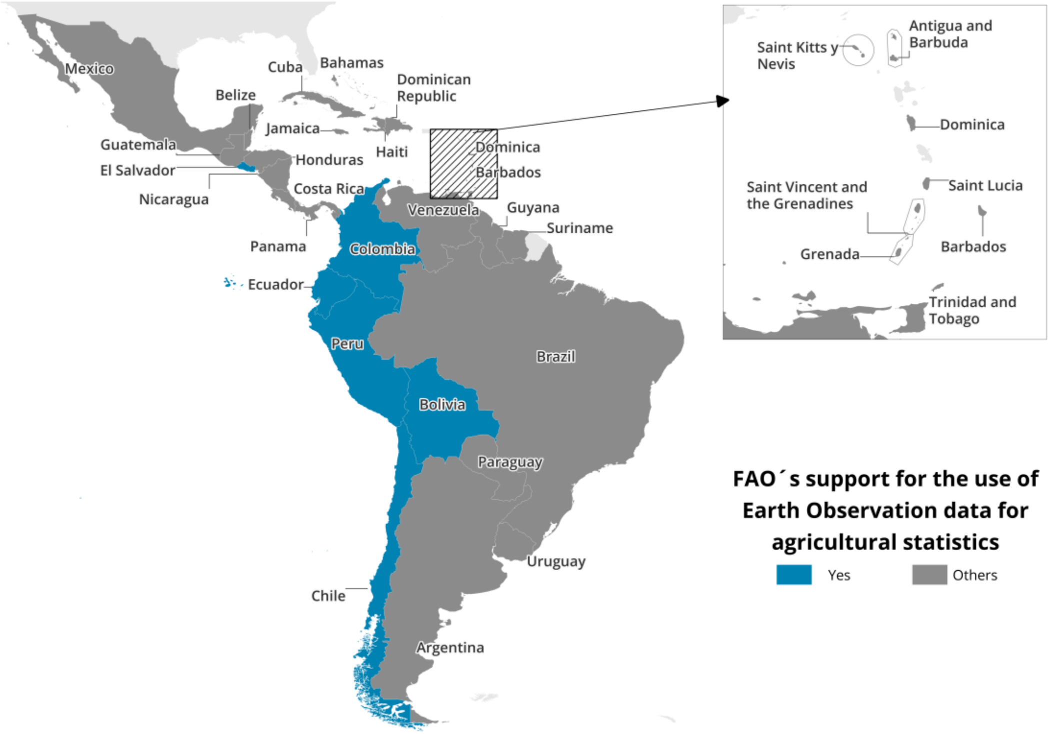
...and 13 in agricultural censuses since 2020.

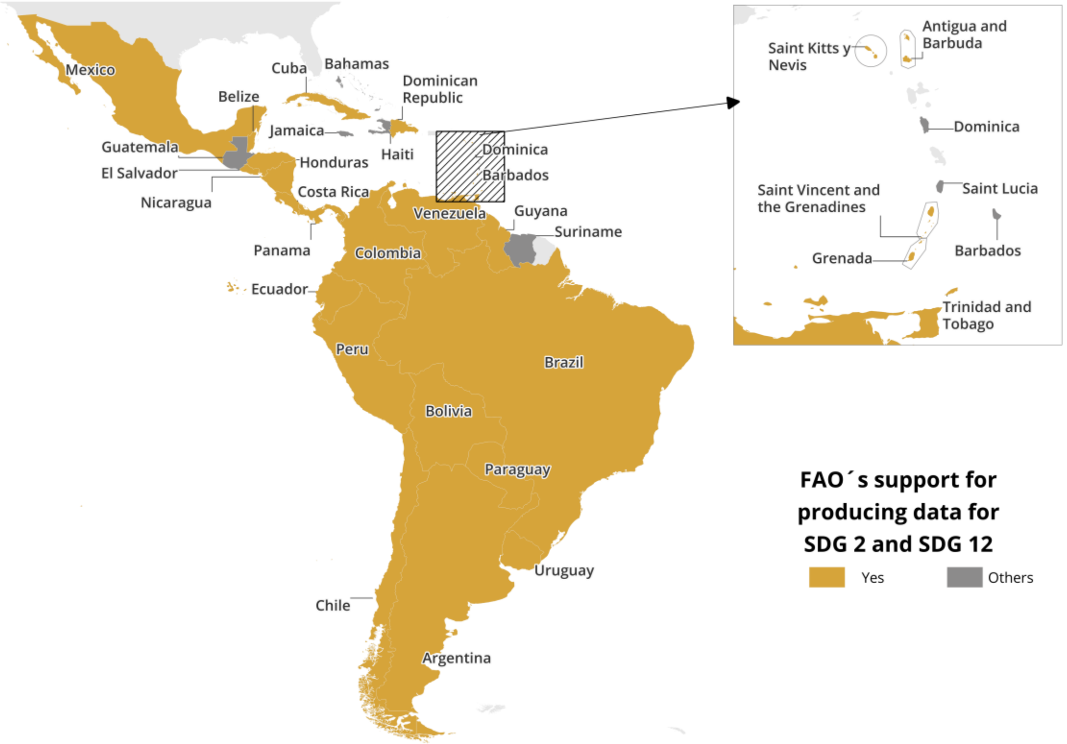


FAO support on specific issues

6 countries in the region are receiving support in the use of earth observation data for agricultural statistics through EOSTAT

25 countries have received support in the generation of SDG data in the last 3 years.

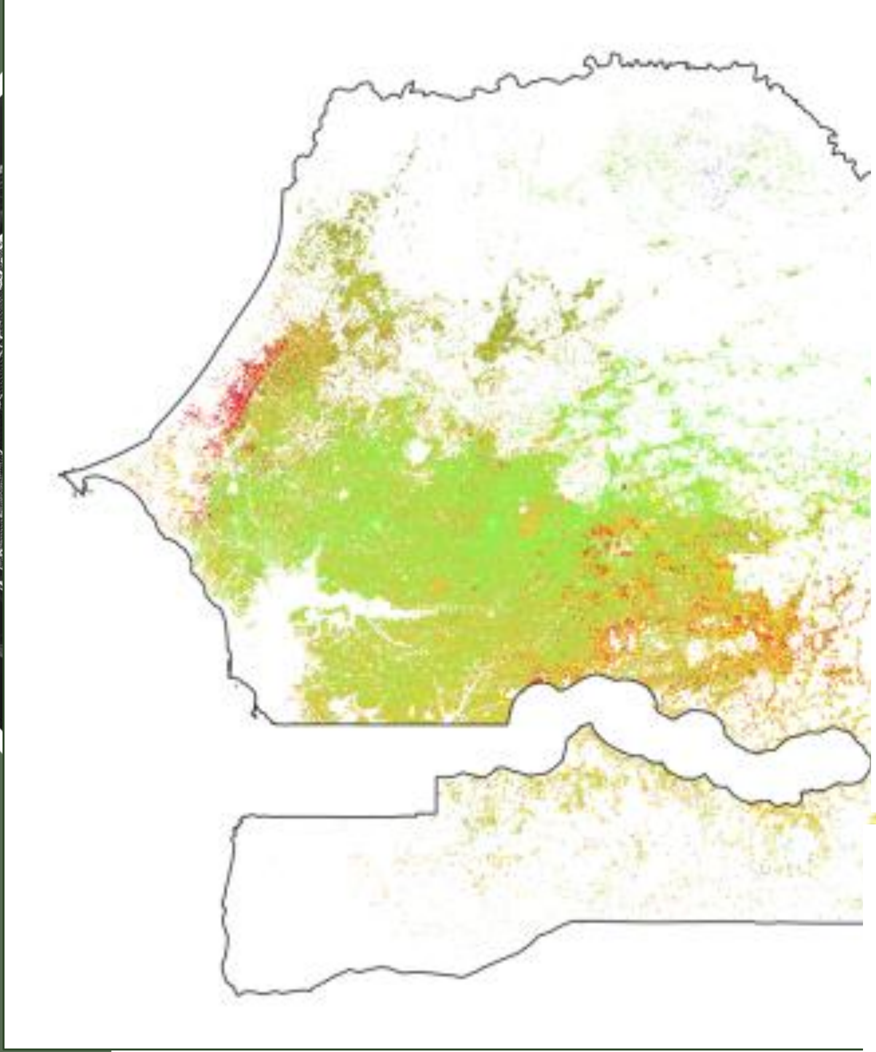




Senegal 2018, National Crop Type map 10m

GROUP ON EARTH OBSERVATIONS

Crop Acreage Statistics



	Cropland		Non cropland	
	hectares	%	hectares	%
Country	4574698	23	15111467	77
Dakar	3140	6%	53488	94%
Diourbel	390382	80%	95664	20%
Fatick	349713	51%	335104	49%
Kédougou	4404	0%	1690633	100%
Kaffrine	1019187	90%	112242	10%
Kaolack	428419	79%	112312	21%
Kolda	157542	11%	1222859	89%
Louga	563763	23%	1902177	77%
Matam	447582	16%	2351109	84%
Sédhiou	50679	7%	684390	93%
Saint-Louis	65970	3%	1959737	97%
Tambacounda	760424	18%	3525889	82%
Thiès	330131	50%	333853	50%
Ziguinchor	3360	0%	732009	100%

	Crop area indicator (ha)
Groundnut	1.510.958
Maize	484.534
Millet	2.077.798
Cowpea	210.070
Sorghum	192.582

VALIDATION OF RESULTS

GROUP ON EARTH OBSERVATIONS

	Groundnut	Maize	Millet	Cowpea	Sorghum	Other crops	
Groundnut	13172	289	233	178	79	184	93%
Maize	578	1110	284	0	136	162	49%
Millet	631	600	6282	87	193	88	80%
Cowpea	329	19	81	1203	1	20	73%
Sorghum	106	651	162	0	590	42	38%
Other crops	959	46	239	257	104	2076	56%
	83%	41%	86%	70%	53%	81%	78%

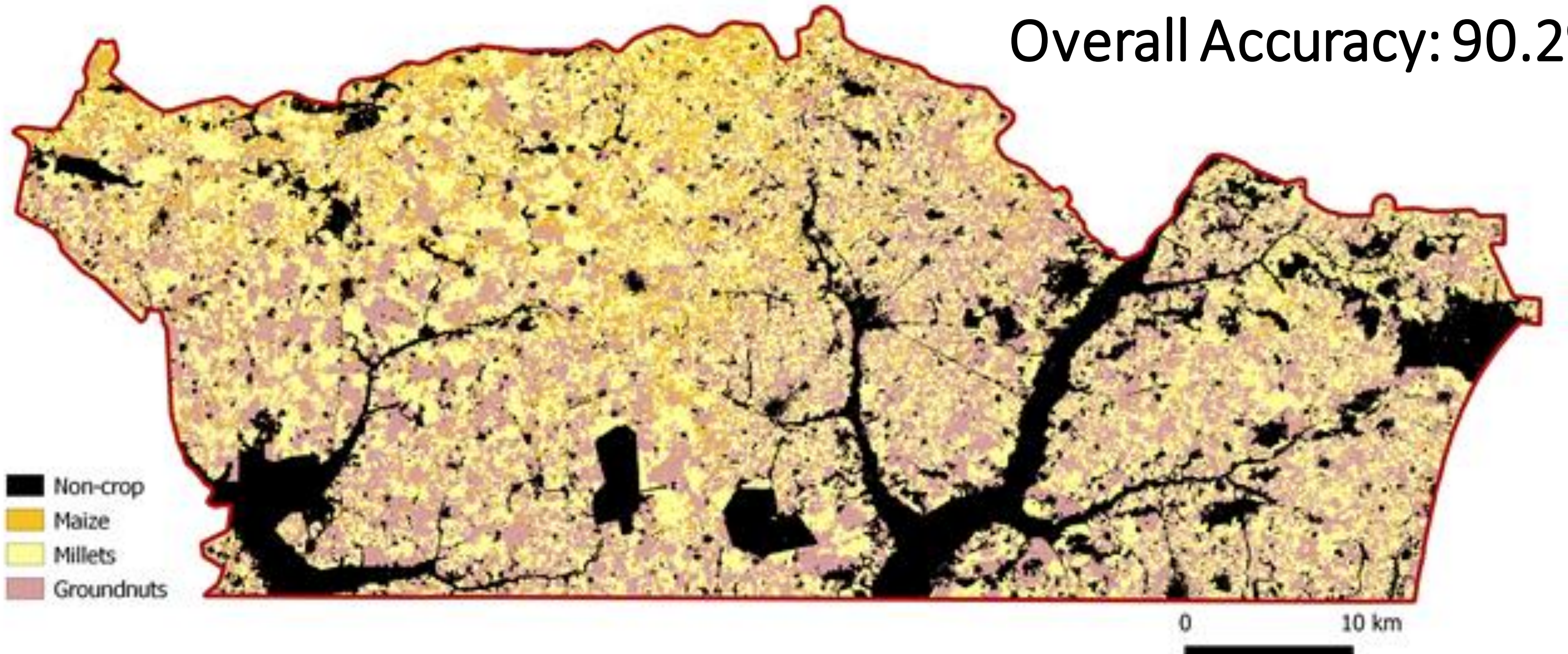
Pilot survey in Nioro distict 2021

An optimized field survey protocol was implemented during the AAS 2021 in one district (NIORO) leading to higher quaility in-situ data, leading to higher accuracy in crop type map

Expressed in number of pixels

		Field survey						
		Non crop	Maize	Millet	Groundnut	UA	Contaminations (%)	Omissions (%)
Crop type map	Non crop	2169	84	95	58	90.15	20.49	9.85
	Maize	0	596	17	11	95.51	17.34	4.49
	Millet	378	19	2742	14	86.96	6.10	13.04
	Groundnut	181	22	66	3210	92.27	2.52	7.73
	PA	79.5	82.7	93.9	97.5			

Overall Accuracy: 90.2%

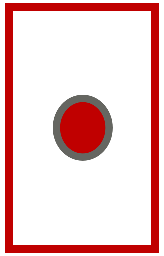


Senegal - List Frame

RECOMMENDATIONS ENDORSED BY DAPSA AND IMPLEMENTED IN THE AAS 2022/2023

Recommendations derived from pilot survey implemented in Nioro district during the AAS 2021:

- Geo-reference parcel boundary with GPS
- Add additional GPS point in the middle of the parcel with the tablet and the Survey Solutions software
- GPS point in the crop-cutting plot



MALI – AREA FRAME

Recommendations based on a design independent

- Stratification based on cropping intensity (0% - 3
ESA WorldCover land cover map
- Random selection of 300 segments (500m X 600m
- Manual digitizing (on-screen) of homogenous
imagery for each segment
- MapMe, used for the teams navigation (driving to
- - ODK Collect, used to collect field data (answerin
- - Qfield, used to assess the crop block/parcel bou

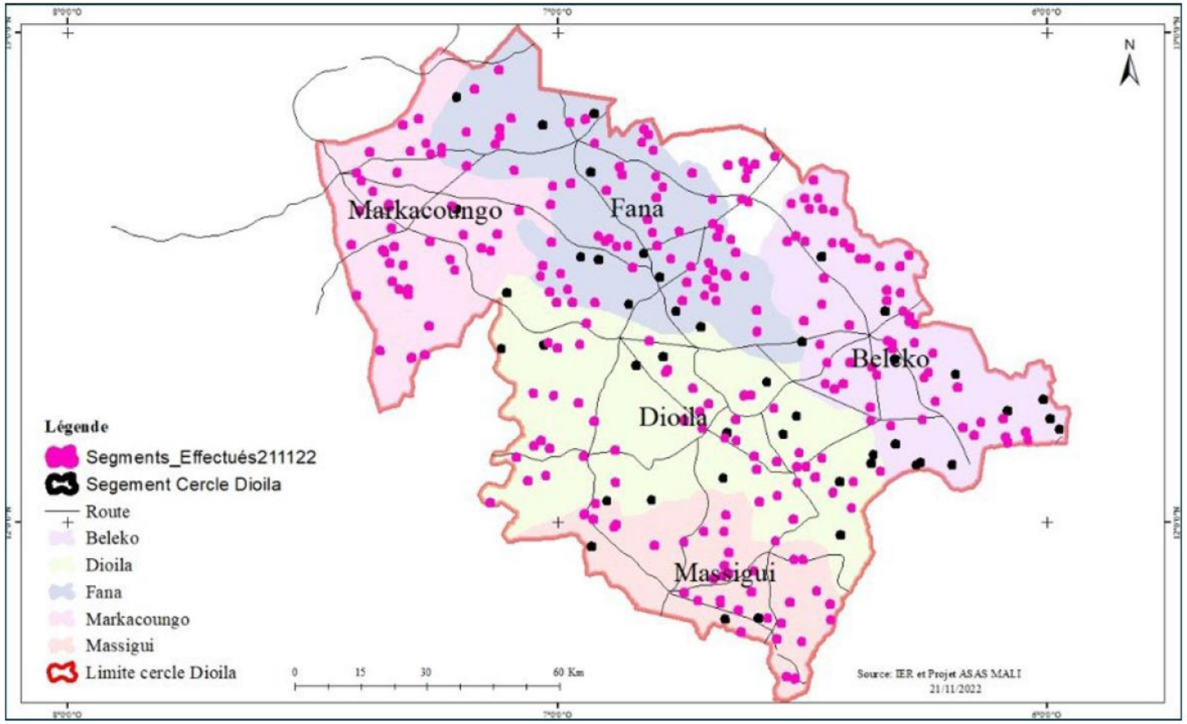
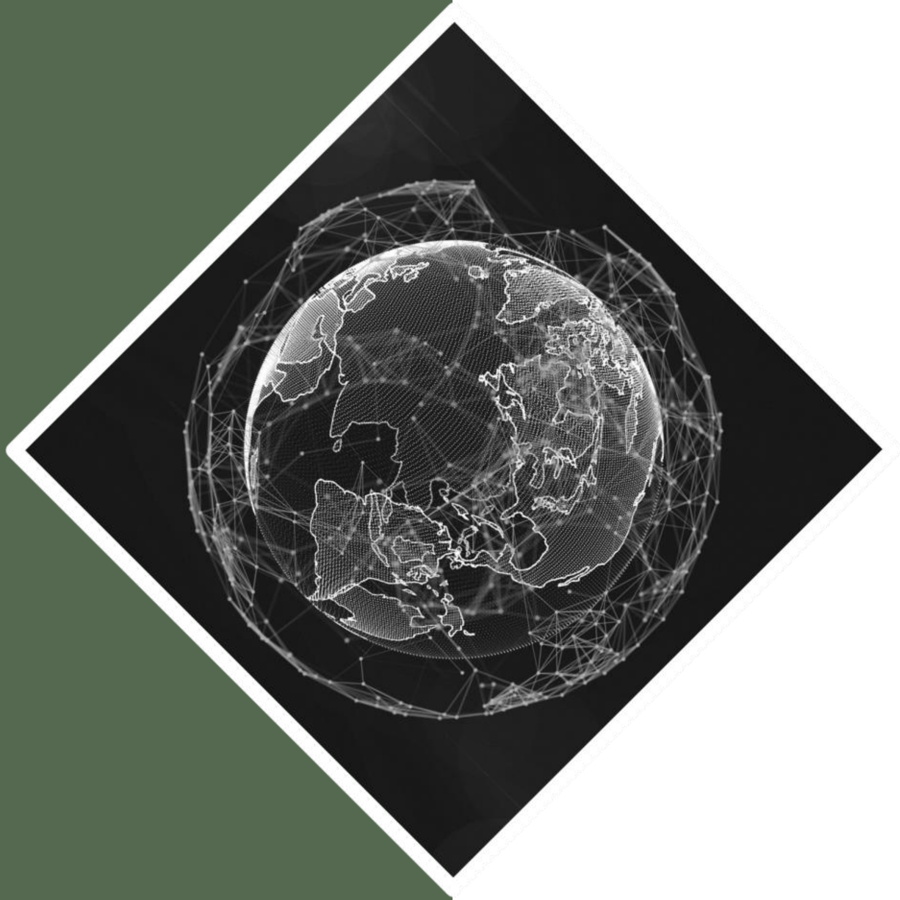


Figure 21. Localization of the segments visited by the end of November 2022



Next steps

- Collaborate with GEOGLAM In-situ
- Optimized Agricultural Survey design guidelines for EO
- Continue collaboration with Countries to make the link between the geospatial and the statistical community
- Work with countries to obtain permission/agreements for sharing in-situ data

THANK YOU

Lorenzo.desimone.org