# Rapid Crop area Estimates combining an area frame survey with Satellite image analysis for Moldova

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# Copernicus4GEOGLAM Services

## Crop Mapping Service

- Georeferenced in-situ data of crop type;
- Crop area estimates + CV (from in-situ data, and regression);
- Cropland map;
- Crop type map;
- Accuracy assessment of the maps.

## Validation Service

- Georeferenced in-situ data of land-cover/commodities of interest;
- VHR interpreted sample areas;
- Accuracy assessment of the map.

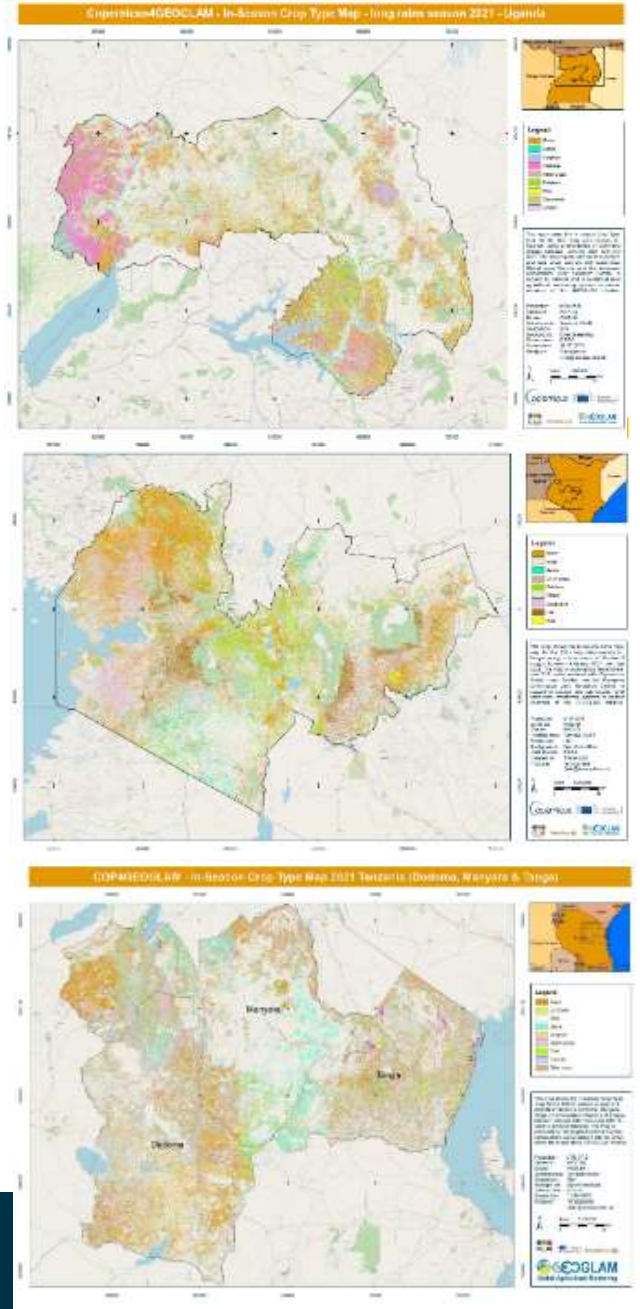
# Past and current activities

## Countries involved in Copernicus4GEOGLAM Phase1 (2021-2024):

- Kenya and Tanzania (2020-2021/2022-2023, **Crop Mapping**)
- Uganda (2020-2021, **Crop Mapping**)
- Ivory Coast (2022-2023, **Validation Service**)
- Yemen (2024, **Crop mapping**)

## Current activity in Copernicus4GEOGLAM Phase2 (2024-2027):

- Mozambique - Zambezia province (2025, **Crop Mapping)**
- Moldova (2025, **Crop Mapping)**
- Zambia (2026-27, **Crop Mapping in prep.)**
- Cameroon (2024-25, **Validation Service** from Phase1)
- Honduras (2025-26, **Validation Service)**



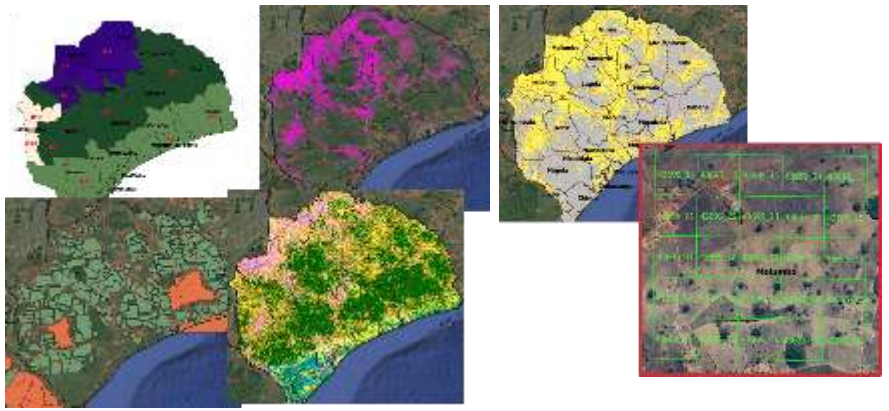
# Crop Type Mapping Workflow

## Feasibility Study

## Field Campaign

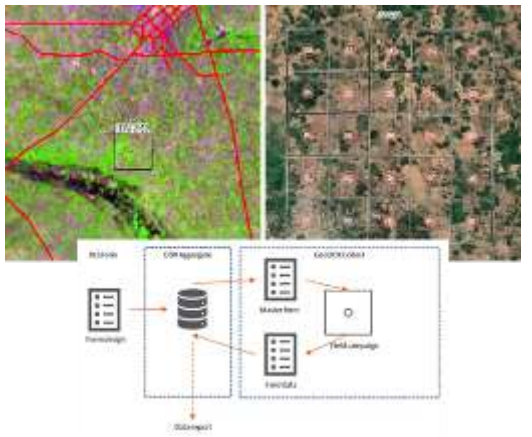
## EO processing & Classification

**Example: MOZAMBIQUE**



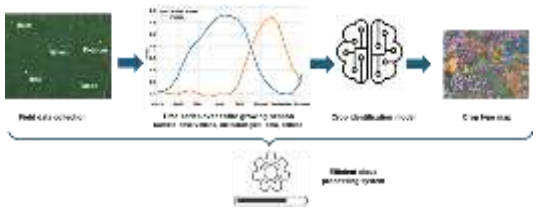
**Identification of the Area Of Interest (AOI) & Crop Classes**

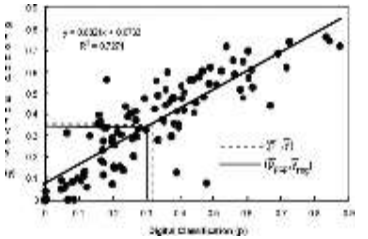
**Stratification & Sampling design**



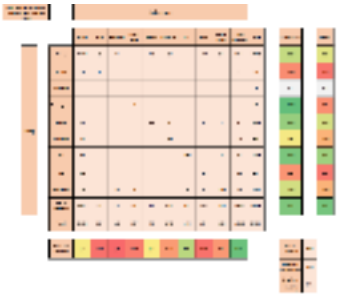
**Field Data Collection**

**Direct expansion: area estimates**





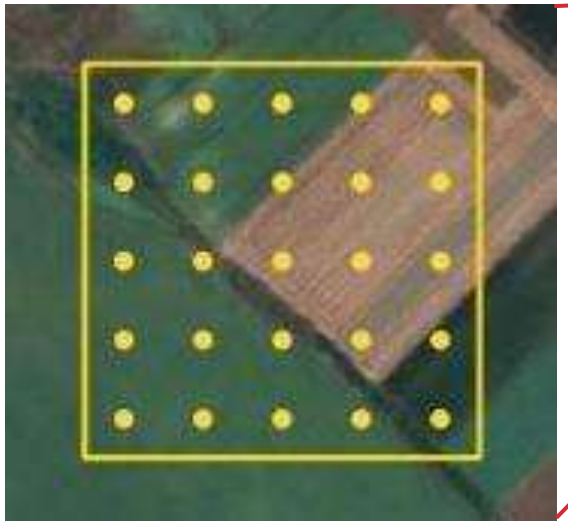
**EO data processing (S-1, S2) + Final Area Estimates**

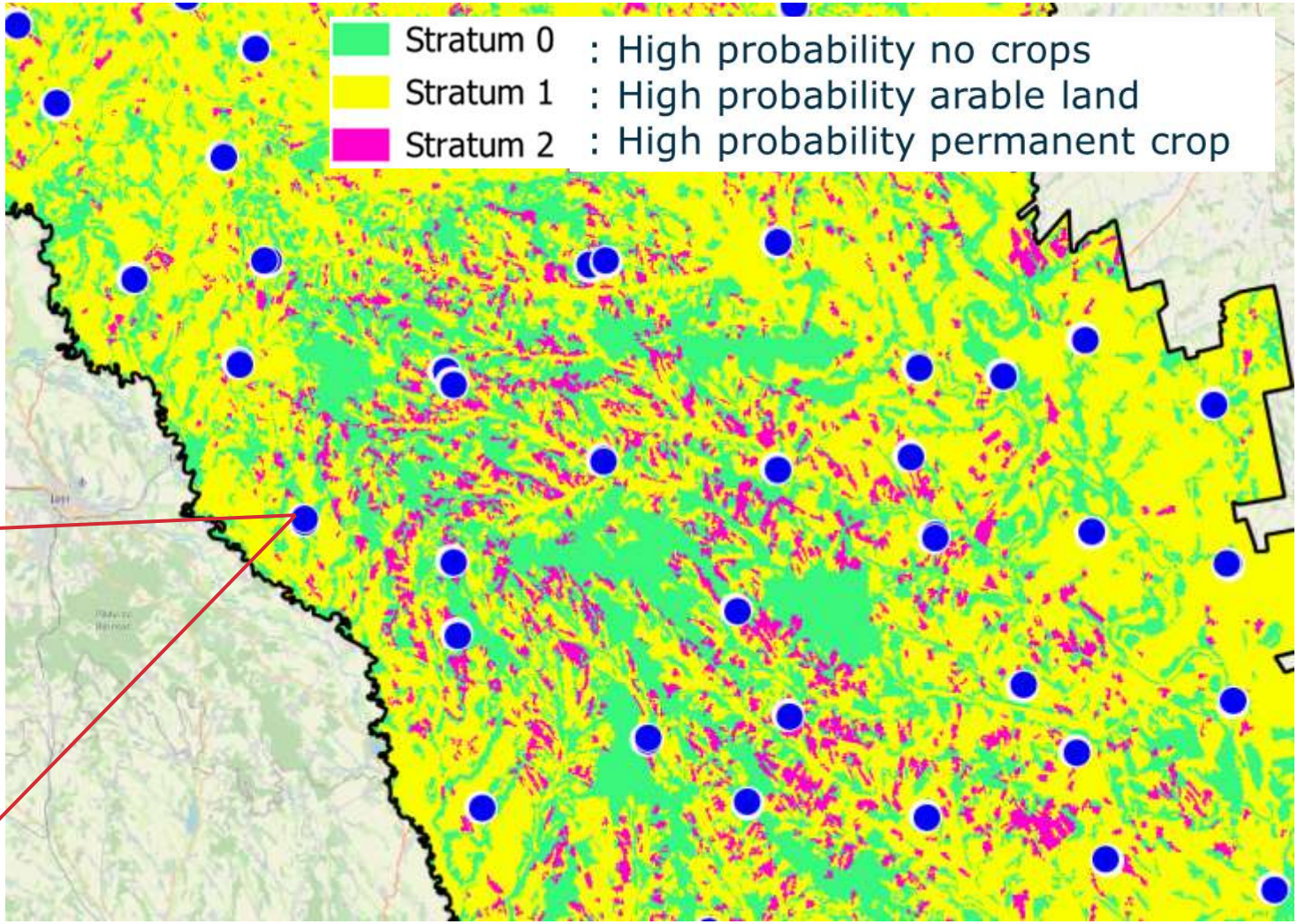


**Accuracy Assessment of Crop Maps**

# Stratification and Sampling Design

- **Stratification aimed to reduce timing and cost**
- **Probability sampling - Two-stage clustered sample**
  - 1st stage: Primary Sample Units (PSU) – selected grid cells
  - 2nd stage: Secondary Sample Units (SSU) – 25 points per PSU





# Field Campaign Preparation & Implementation

Technical setup:

- Digital data collection via Kobo Toolbox and ODK
- Raster tiles for offline navigation (VHR & S2)
- GNSS and photo-enabled smartphones/tablets

Field Visit

- Training of enumerators
- During growing season before harvest
- Back-up sample units available

Quality control

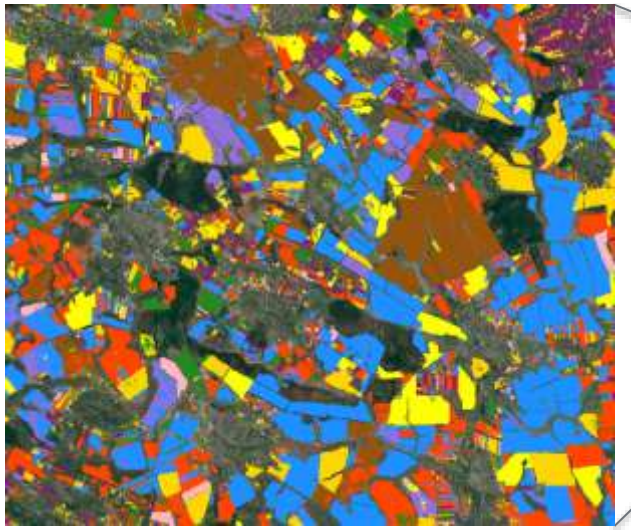
- Near-Real time quality control via dashboards
- Messaging groups

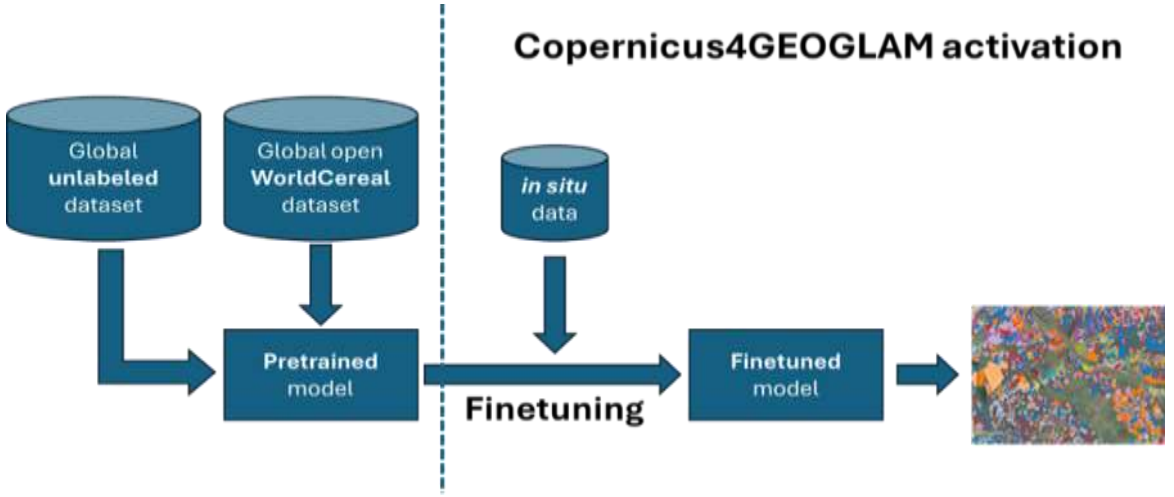
# Crop Mapping

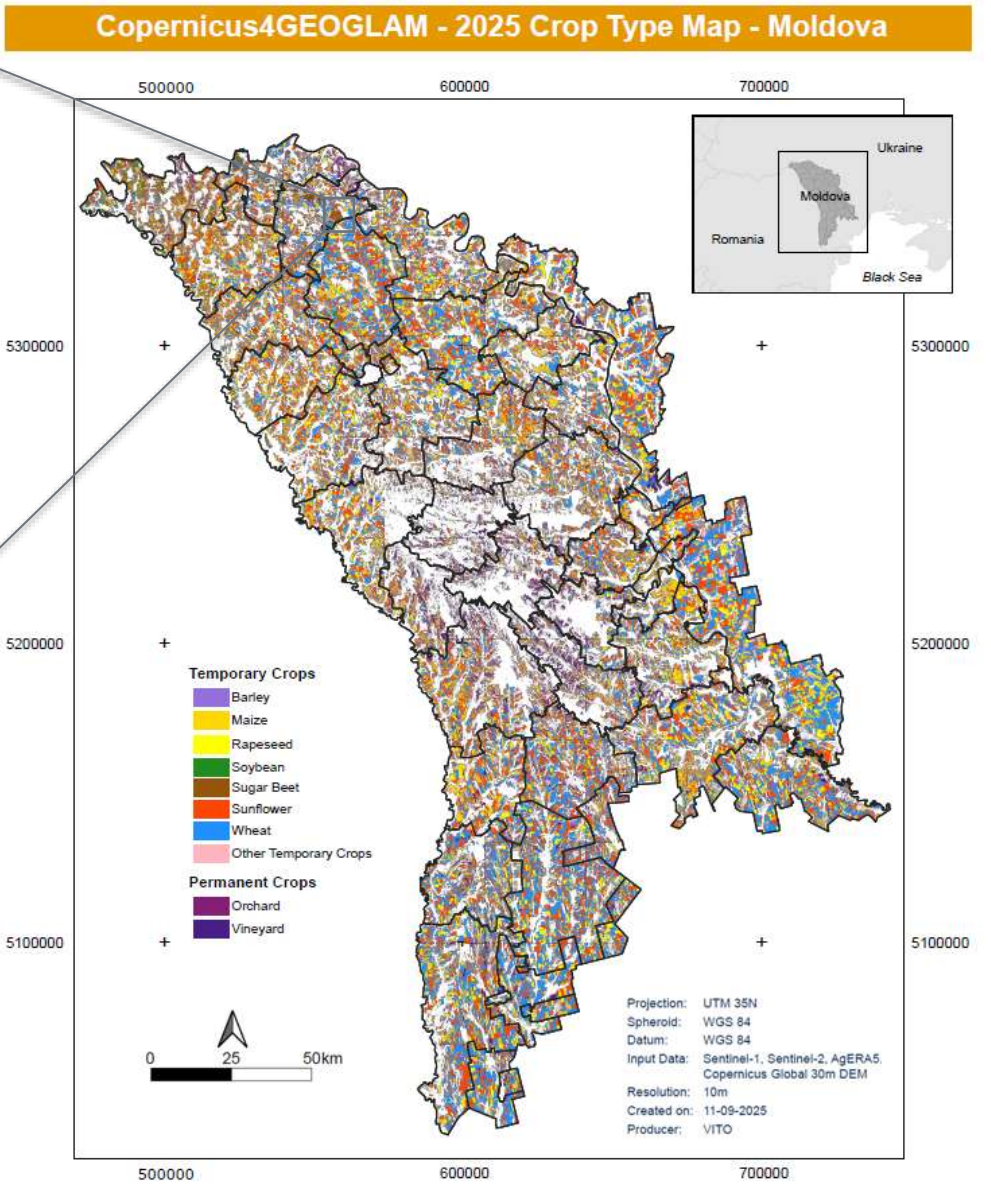
- Prepare collected field data and pair with satellite observations
- Presto model finetuning on agreed classes (*exclude mixed cropping*)

→ Pixel Embeddings

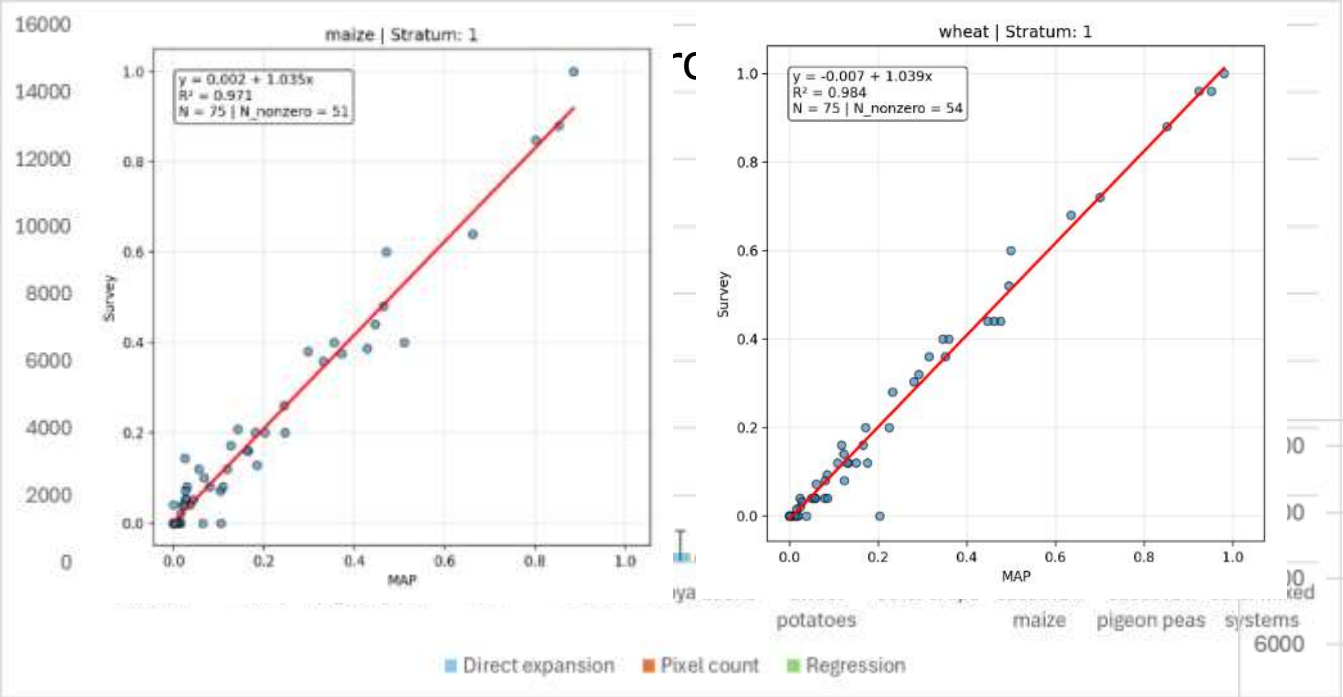
- Train CatBoost classifier
- Run inference for full regions

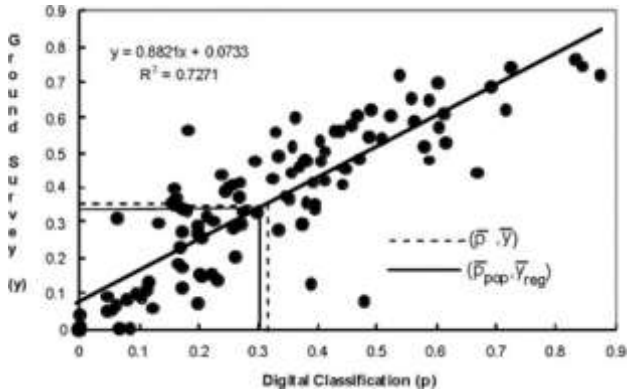




# Crop estimates by Regression analysis

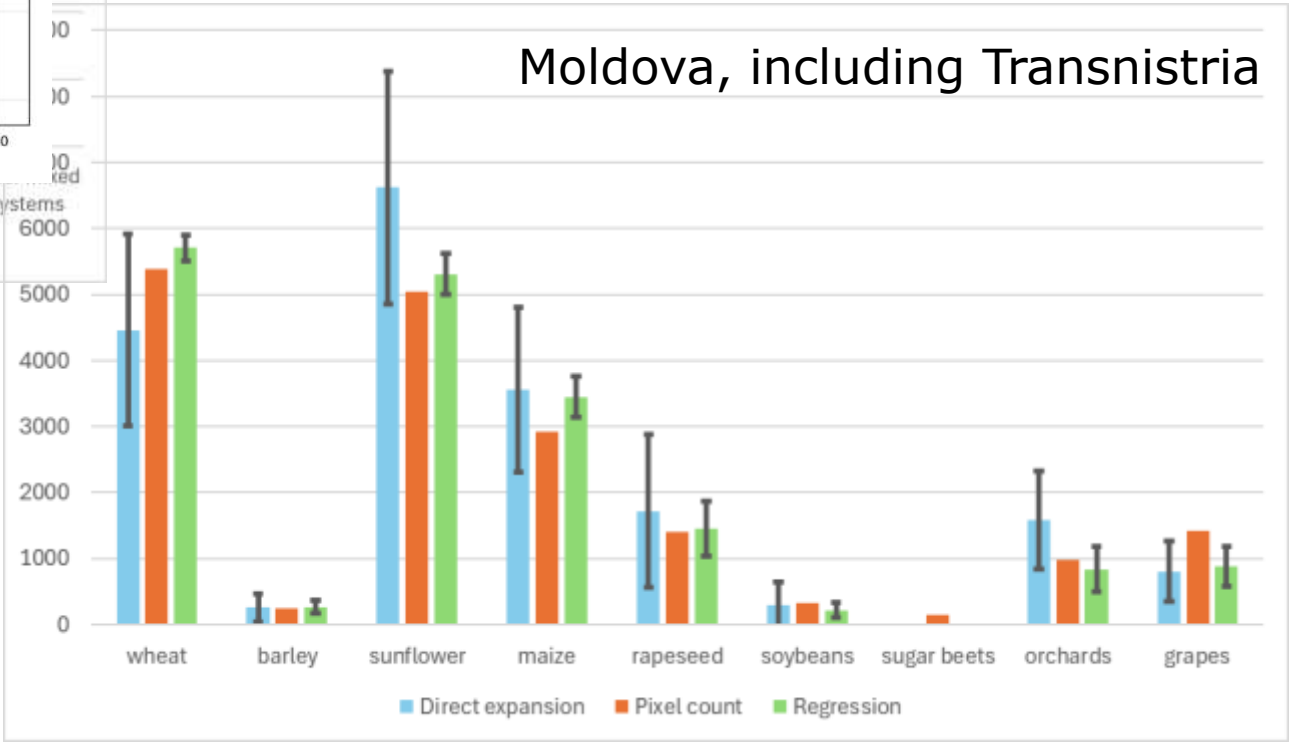



$$y_{reg} = \bar{y} + b * (\bar{p}_{pop} - \bar{p})$$

$$n_{reg} = \frac{1}{1 - r_{py}^2}$$

- Direct expansion area estimates available based on field data alone
- Improved estimates using regression analysis ($y_{reg}$)
- Level of improvement assessed with relative efficiency ($\mu_{reg}$)
- Factor by which the field sample needs to be increased to reach the same precision: 3 to > 100 in Moldova



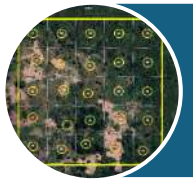
# Crop area estimates (km2)

| | Moldova incl. Transnistria | Moldova excl. Transnistria | | Transnistria |
|---|---|---|---|---|
| | Regression | Regression | NBSM | Regression |
| wheat | 5708 | 4730 | 3876 | 978 |
| barley | 267 | 254 | 556 | 13 |
| sunflower | 5307 | 4539 | 4140 | 769 |
| maize | 3447 | 3119 | 4190 | 327 |
| rapeseed | 1449 | 1188 | 989 | 261 |
| soybeans | 216 | 209 | 197 | 7 |
| sugar beets | | | 109 | |
| orchards | 836 | 789 | 1169 | 47 |
| grapes | 878 | 822 | 1090 | 57 |
| **ALL AG** | **18592** | **16013** | **16562** | **2580** |

# Milestones and future plans

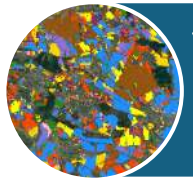
| Service | country | Milestone \ Status | Next steps |
|---|---|---|---|
| Crop mapping | Mozambique (Zambezia province) | Completed – final results presented to the country in December 2025. | New implementation in progress to produce a revised crop type map in collaboration with ITC. |
| Crop mapping | Moldova | Completed – final results presented to the country in January 2026. | LPIS support by JRC. |
| Validation Service – cocoa map | Cameroon | Interim report. | FAO working on a revised version of the map following JRC recommendations. |
| Validation Service – coffee map | Honduras | Field campaign completed. | Validation soon completed. |
| Crop mapping | Zambia | Request of service from country received by JRC. Definition of country needs and datasets. | Feasibility Study to be launched in April. |
| Validation Service – LC classification | Cote d'Ivoire | Under discussion with national institutions. | Request of service by the country. |

# Main Findings



Similar Sampling design applied in Mozambique and Moldova (as well as in Kenya, Tanzania and Uganda)

Field campaign implementation much easier in Moldova than in African landscapes



Very high classification accuracies leads substantial reduction in crop area estimate uncertainties

A priori knowledge of distribution for small area crops is required to apply a suitable stratification as for Sugar beet in Moldova

Crop mapping can successfully provide estimates over inaccessible areas, e.g. Transnistria

# Thank you for your attention




Crop Mapping for GEOGLAM Country Level Support