Land parcel identification system pilot project in Ukraine

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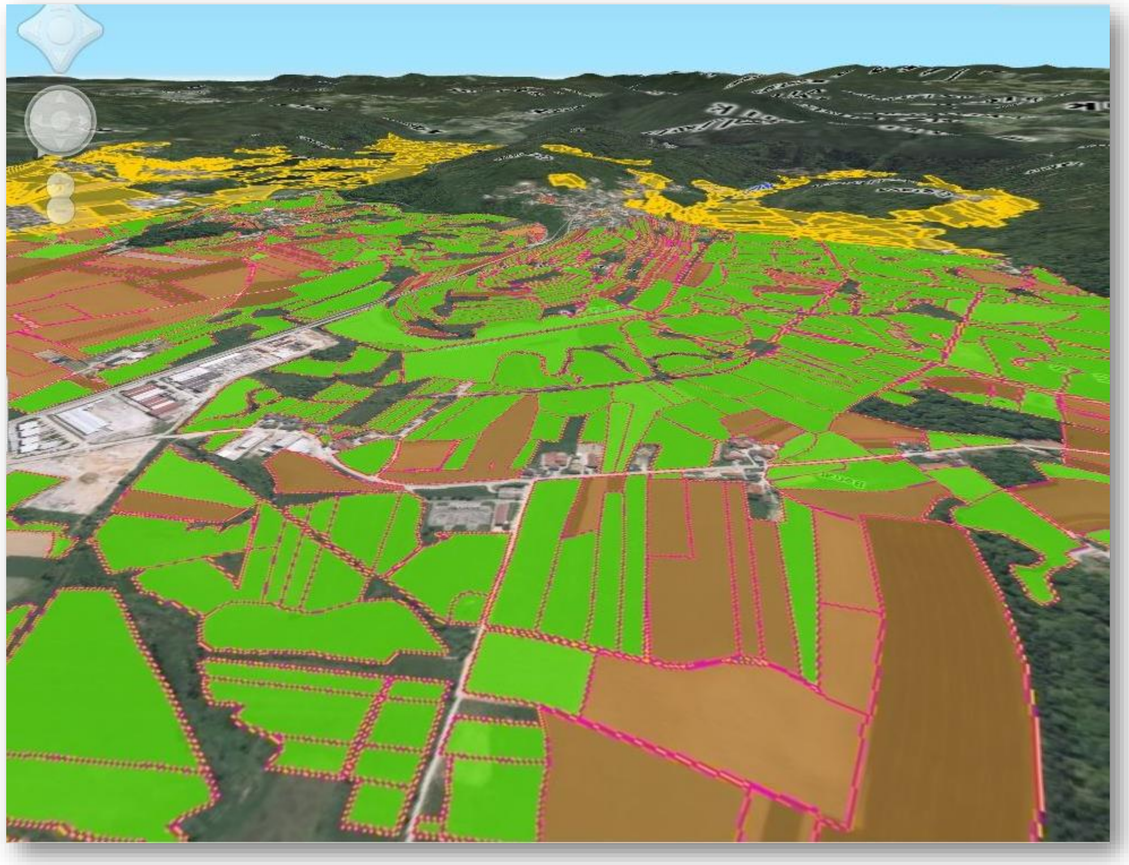
Land Parcel Identification System Pilot in Ukraine

- Started in March 2024
- Part of the World Bank project “Supporting Transparent Land Governance in Ukraine” (2016-now)

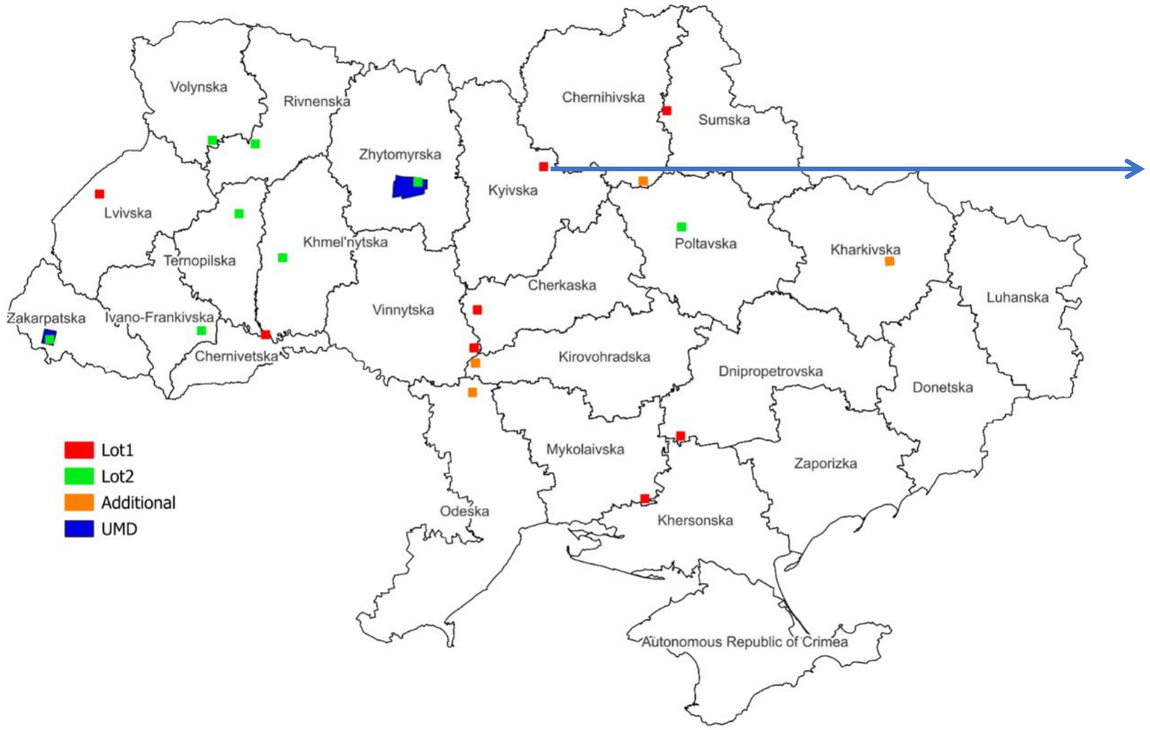
The pilot project’s **goal** is

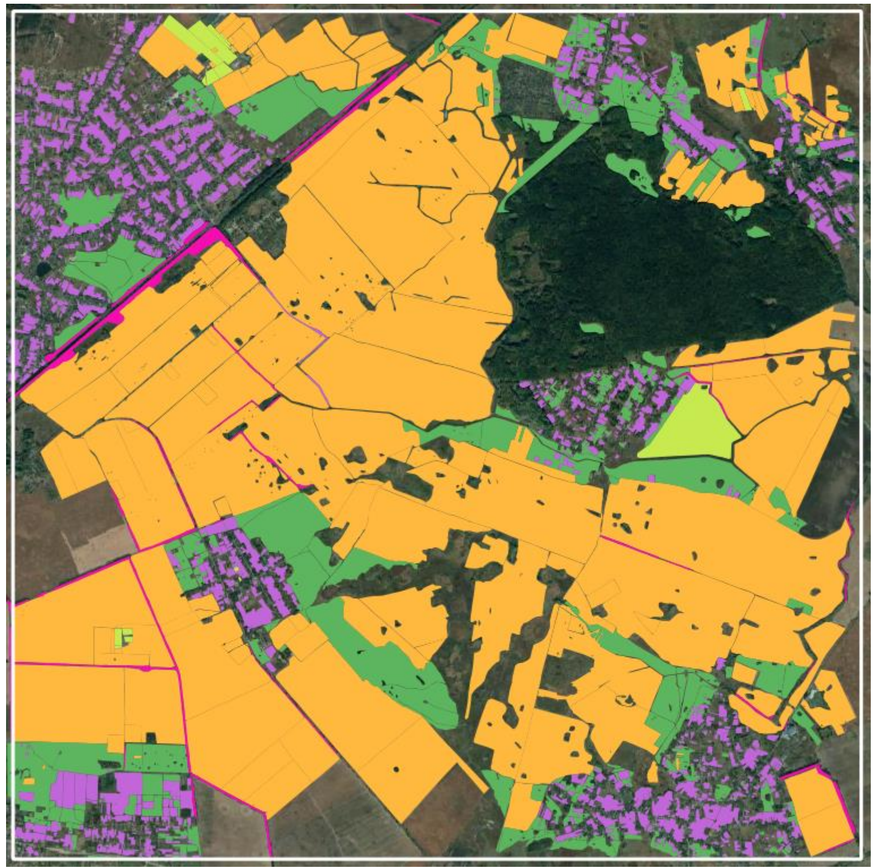
- To demonstrate effectiveness and accuracy of LPIS data (delineation)
- To create preconditions for transparent functioning of agricultural land markets to encrease efficiency of resource usage and provide a basis for investments in the rural sector **in Ukraine**.



What we have

- 14 selected zones 10 km×10 km in different oblasts (NUTS2 administrative level)
- Maxar VHR ortho-imagery for 14 pilot zones, pansharpened 0.3 – 0.5 meters spatial resolution and < 12 degree off nadir, and early spring period (2022 and 2023)
- Crop maps for 2019 – 2023 as basic products





LPIS Specification

- Arable land
- Personal farming
- Permanent crop
- Permanent grassland
- Agroforestry

Used Maxar Satellite Imagery

Oblast	Date	Mean Off Nadir Angle	Spatial resolution
Kyivska	28.02.2022	3,8	0,5
Vinnytska	03.05.2023	4,5	0,2999
Kirovogradska	03.05.2023	4,9	0,2999
Odeska	03.05.2023	5,3	0,2999
Chernihivska	16.06.2023	5	0,2999
Chernivetska	05.06.2023	12,8	0,2999
Lvivska	13.06.2022	2	0,5
Dnipropetrovska	10.05.2022	5,9	0,5
Sumska	03.07.2022	2,2	0,5
Mykolaivska	10.04.2022	4,4	0,5
Cherkaska	03.05.2023	4,3	0,2999
Kharkivska	20.03.2022	9,6	0,5
Zakarpatska	04.05.2023		0,2999

Maxar satellite data example for Sumska oblast

https://www.maxar.com/maxar-intelligence/products/satellite-imagery

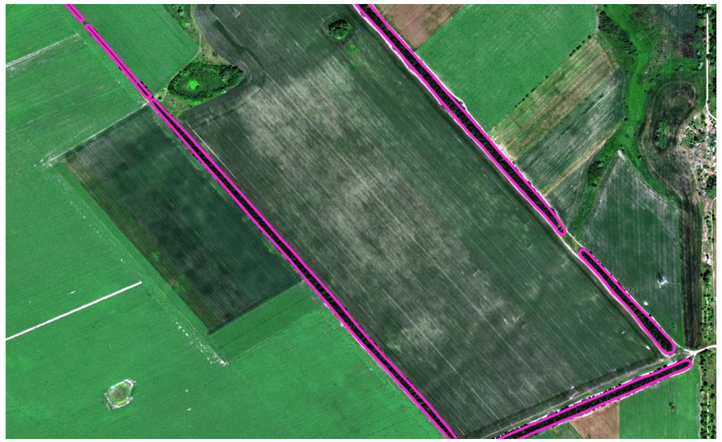
Classes for delineation - examples

Arable land

Personal farming

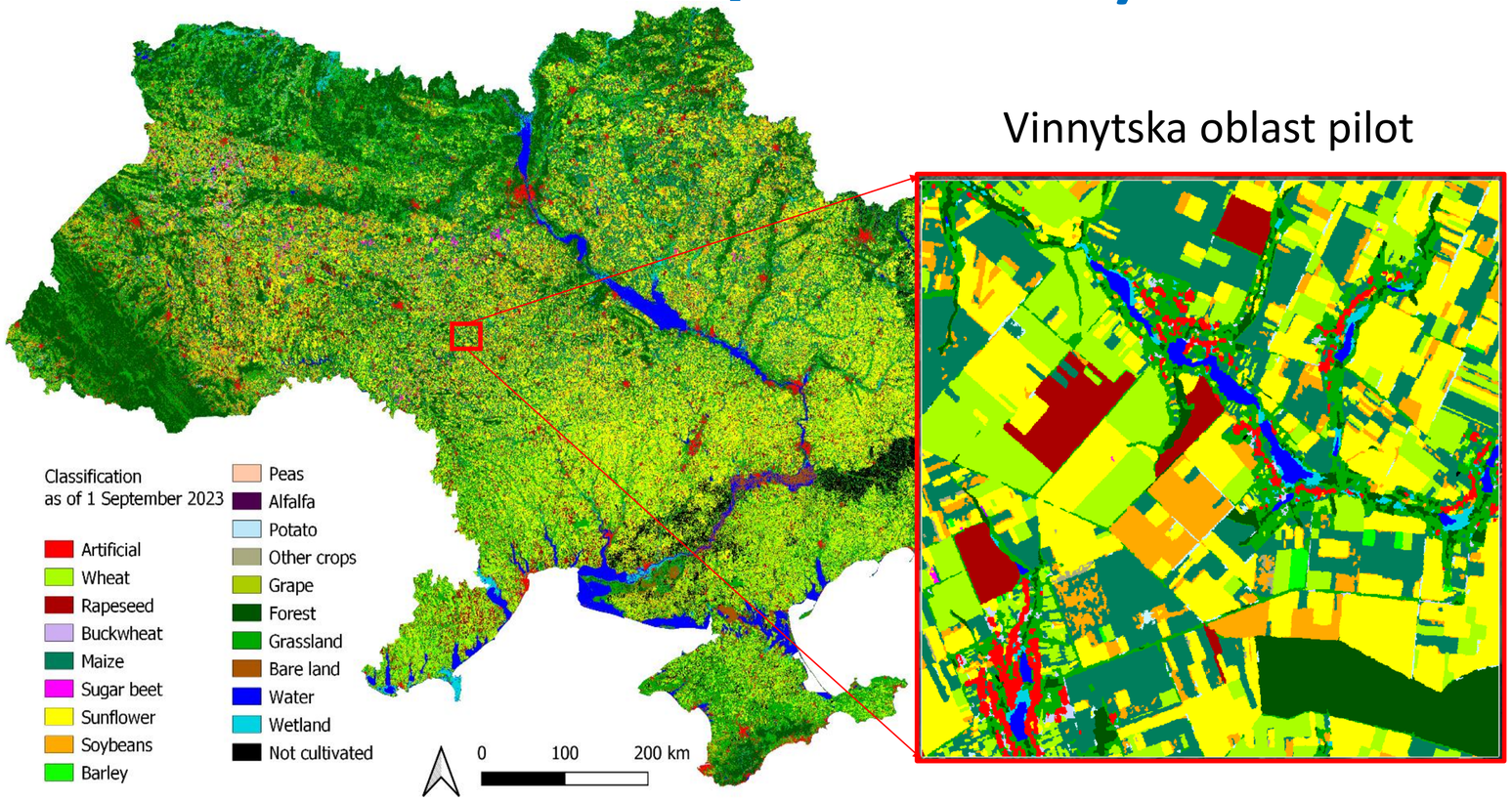
Permanent crops (gardens)

Agroforestry



Permanent grassland

Crop Classification Maps in Ukraine under support of JRC and World Bank (2017-now) as reference data



Vinnytska oblast pilot

Class	PA	UA	F1
Artificial	88,7	81,9	85,2
Wheat	98,7	90,6	94,5
Rapeseed	96,1	98,6	97,3
Buckwheat	54,8	92	68,7
Maize	93,6	91,3	92,4
Sugar beet	95,7	93,2	94,5
Sunflower	98,6	97,6	98,1
Soybean	88,8	88,5	88,7
Other crops	75,1	67,5	71,1
Forest	100	97,8	98,9
Grassland	90,9	85,9	88,3
Bareland	72,6	85	78,3
Water	100	99,4	99,7
Wetland	94	92,7	93,4
Barley	62,7	90,1	73,9
Peas	80,9	100	89,5
Alfalfa	29,3	87,5	43,8
Grape	87,6	51,2	64,7
Not cultivated	88,2	96,6	92,2
Potato	72,8	18,9	30,1
Overall Accuracy	OA = 93,1%		

Cloud-Based Technologies for Data Processing in Ukraine: International Context Shelestov A., Yailymov B., Yailymova H., Nosok S., Piven O., Lecture Notes in Networks and Systems, vol 548. **2023**. Springer, Cham. https://doi.org/10.1007/978-3-031-16368-5_5

Cloud Approach to Automated Crop Classification Using Sentinel-1 Imagery. A. Shelestov, M. Lavreniuk, V. Vasiliev, L. Shumilo, A. Kolotii, B. Yailymov, N. Kussul, H. Yailymova, *IEEE Transactions on Big Data. **2020**. Vol. 6, No. 3. 572-582 pp. DOI: 10.1109/TBDATA.2019.2940237*

Deep Learning Classification of Land Cover and Crop Types Using Remote Sensing Data. N. Kussul, M. Lavreniuk, S. Skakun, A. Shelestov. *IEEE Geoscience and Remote Sensing Letters. **2017**. Vol. 12. No. 5. P. 778 – 782. DOI: 10.1109/LGRS.2017.2681128.*

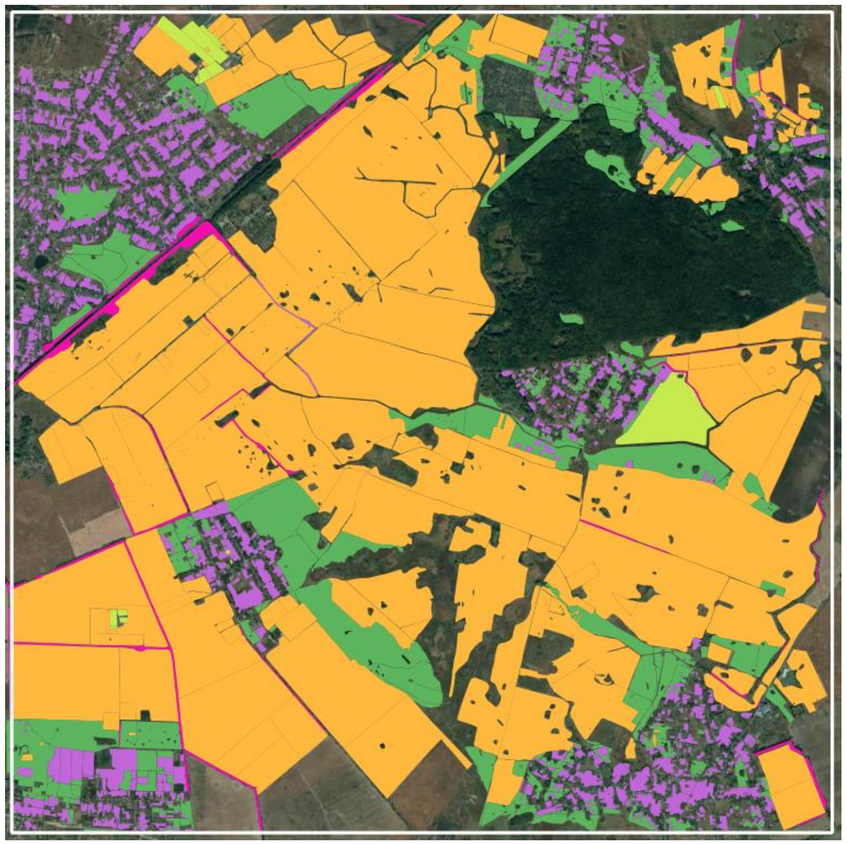
Attributes description (LPIS Spec.)

Attribute index	Attribute	Description	Mode of insertion
RPid	RP identifier	System numbering	automatic
MEA	Maximum eligible area	Area determined from geometry of the polygon in m2 rounded to meter	automatic
PRD	Production date	Date of dataset production	manual
VAD	Validation date	Date single RP validation	manual
ORGA	Area of organic production	Area under organic production determined from geometry of at least one GSA polygon in m2 rounded to meter	automatic
IRRA	Irrigated area	Area under irrigation determined from geometry of at least one GSA polygon in m2 rounded to meter	automatic
RC	Grassland category	1 - 90%-100% grasses estimated to be present in the block, 0.8 - 70%-90% grasses estimated to be present in the block, 0.6 - 50%-70% grasses estimated to be present in the block 0 - 0%-50% grasses estimated to be present in the block	manual

Block’s examples

Kyivska oblast
1305 polygons

- Arable land [171]
- Personal farming [815]
- Permanent crop [16]
- Permanent grassland [246]
- Agroforestry [57]



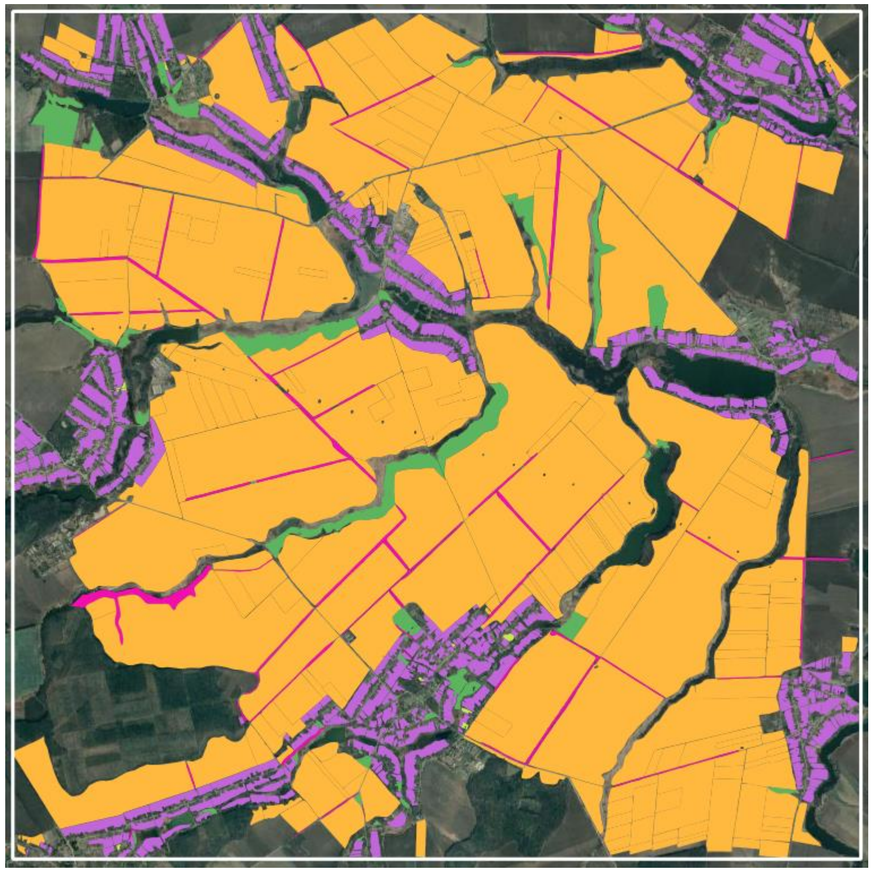
Sumska oblast
1157 polygons

- Arable land [145]
- Personal farming [895]
- Permanent crop [5]
- Permanent grassland [15]
- Agroforestry [97]

Block’s examples

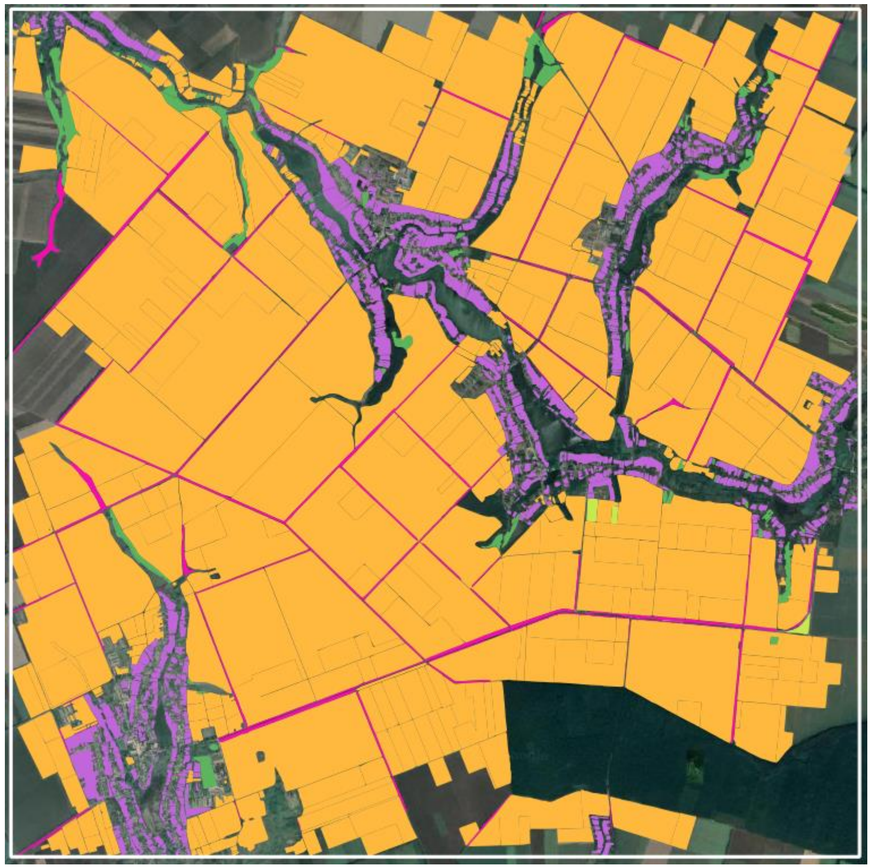
Cherkaska oblast
970 polygons

- Arable land [275]
- Personal farming [547]
- Permanent crop [12]
- Permanent grassland [44]
- Agroforestry [92]



Vinnytska oblast
1401 polygons

- Arable land [453]
- Personal farming [721]
- Permanent crop [5]
- Permanent grassland [65]
- Agroforestry [157]

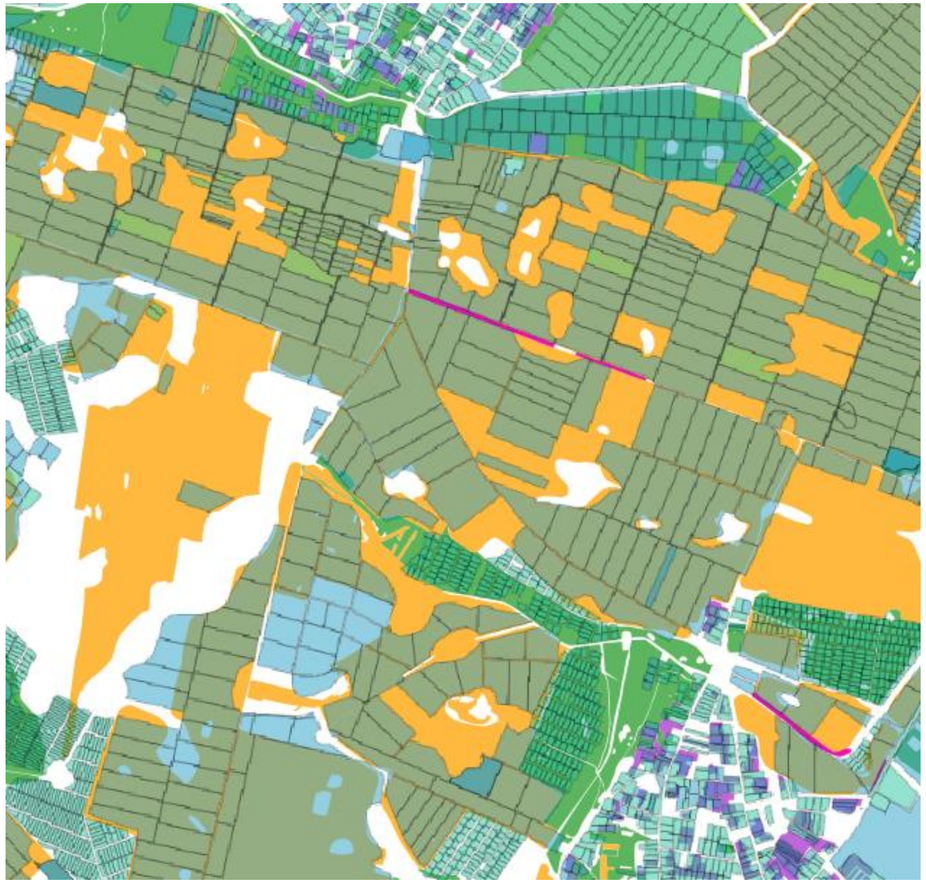


Comparison with national cadaster (1)

- Significant areas of unregistered territories in the cadaster

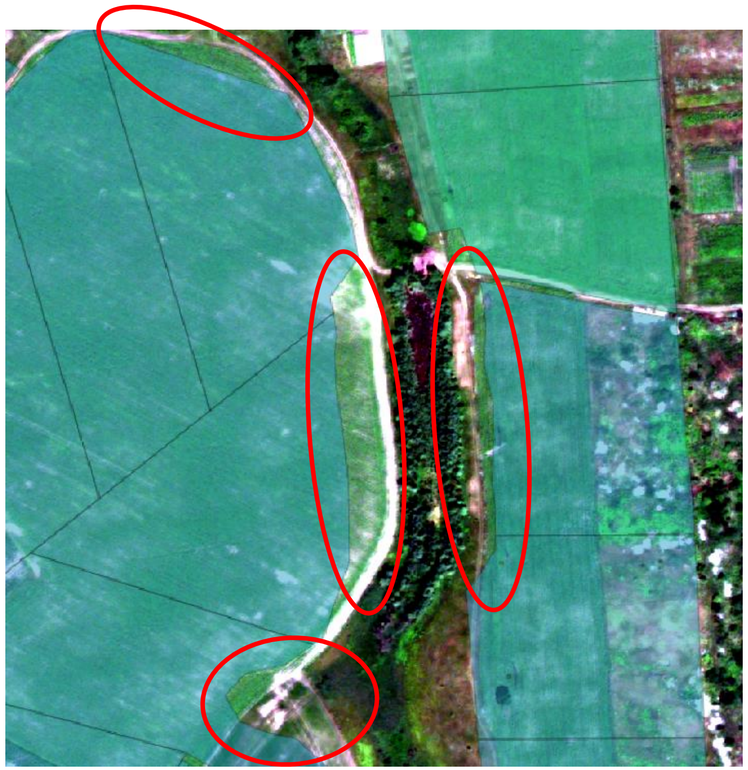
Unregistered Personal farming (violet)

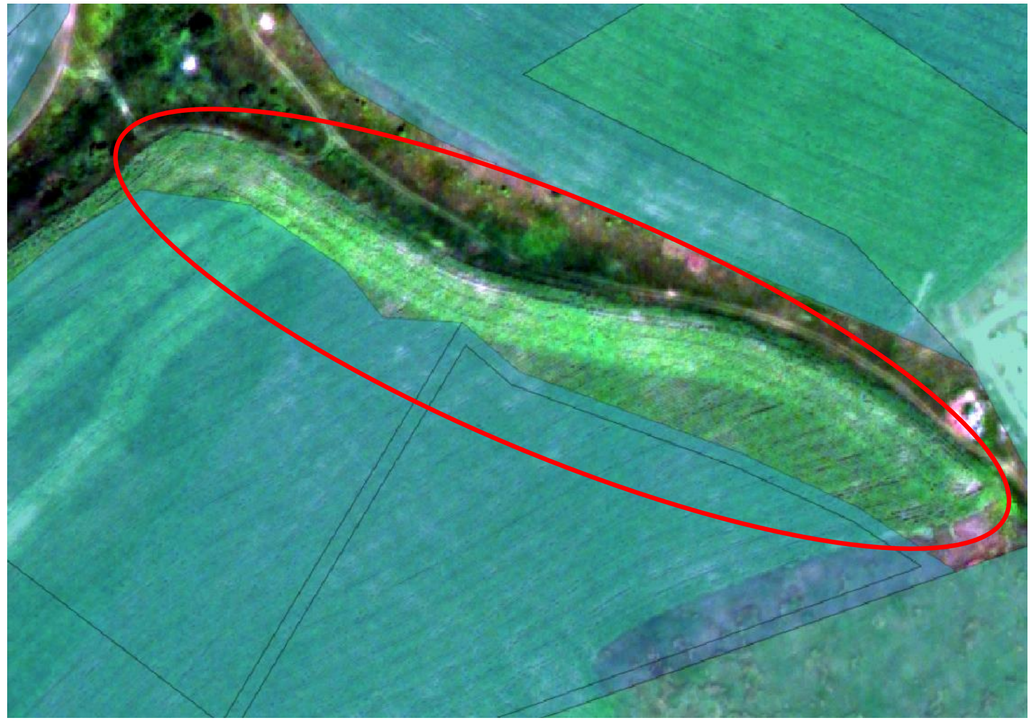
Unregistered Arable land (orange)



Comparison with national cadaster (2)

- Contours in the cadaster – could be inaccuracy in cadaster or illegal expansion of the agricultural fields



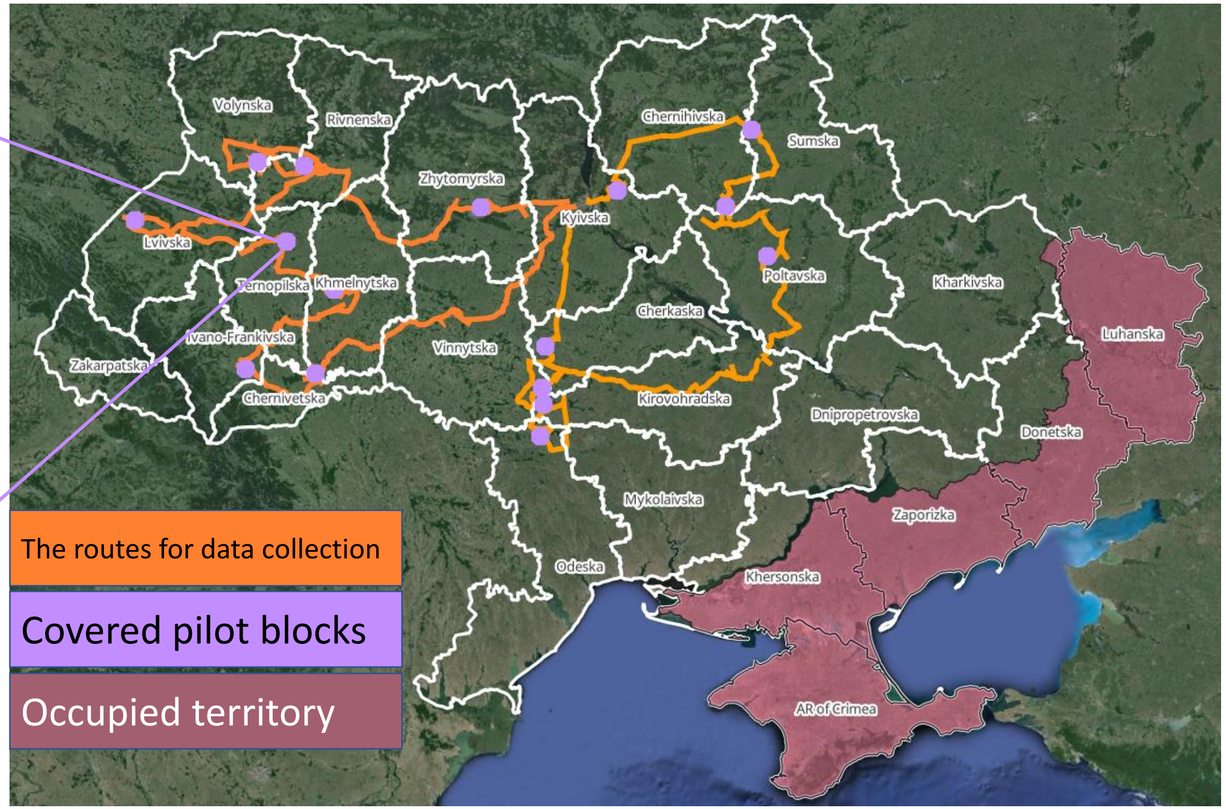


Maxar, 03 Jul 2022, Sumska oblast

In-situ data collection in 2024

The data collection route length - **4600 km**
The number of collected fields - **7500 fields***
16 blocks were visited during ground survey
*the number of collected fields is preliminary, currently digitization of the fields is still in progress

Example of the route within the block (Ternopilska oblast)



Ways Forward

- Finalization of other pilot blocks delineation
- Extension of the Pilot results to the level of a larger administrative unit (district or oblast)
- Further analysis and comparison of the cadaster with the obtained contours
- Classification of small fields based on received ground-truth data
- Development of statistical methods for estimating the area of small fields throughout Ukraine

Thank you for your attention!

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