



# Utilizing Machine Learning for Land Cover / Land Use Change analysis in Ukraine

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# Our expertise

- Satellite monitoring
- Machine learning on satellite data
- Land cover/land use
- Geospatial intelligence

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Journals & Magazines > IEEE Geoscience and Remote Se... > Volume: 14 Issue: 5

## Deep Learning Classification of Land Cover and Crop Types Using Remote Sensing Data

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### Abstract

### Abstract:

Document Sections

Deep learning (DL) is a powerful state-of-the-art technique for image processing including remote sensing (RS) images. This letter describes a multilevel DL architecture that targets land cover and crop type classification from multitemporal

# EO4UA and OCRE4Ukraine



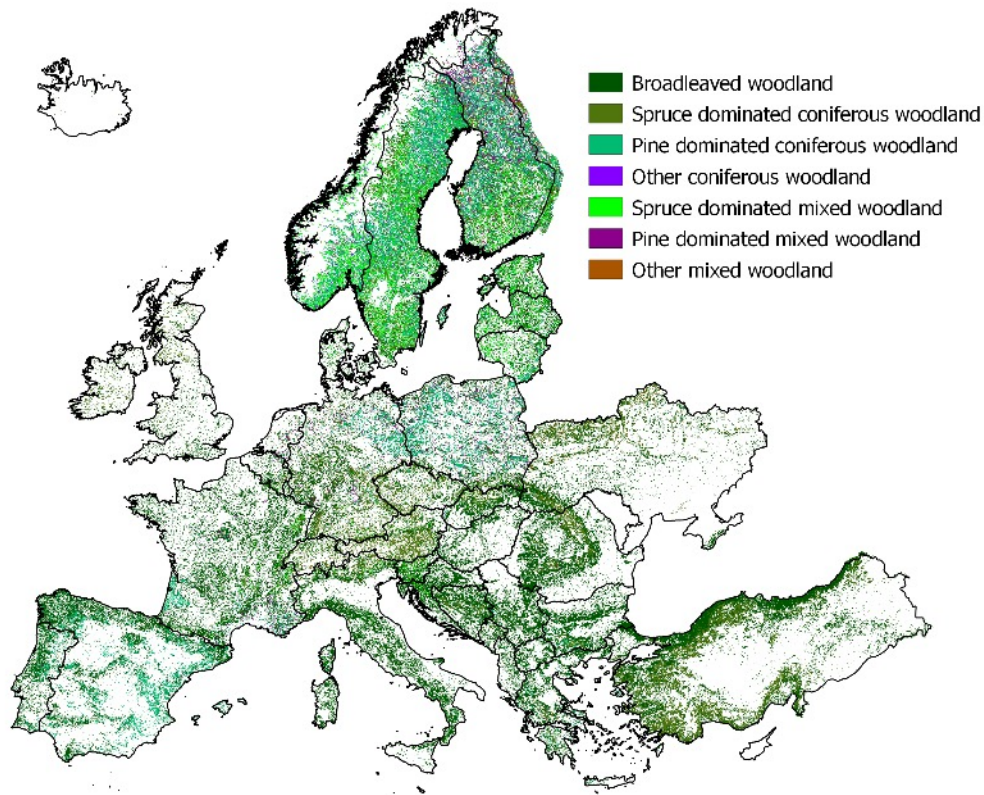
- **EO4UA** - Free platform for sharing data and products on CREODIAS
  - Initiator - CloudFerro
  - Partners – public and private institutions
- **OCRE4Ukraine** – project within EU Open Cloud for Research Environment
- Project: “Quantifying war damage in Ukraine based on EO data in support of EO4UA”





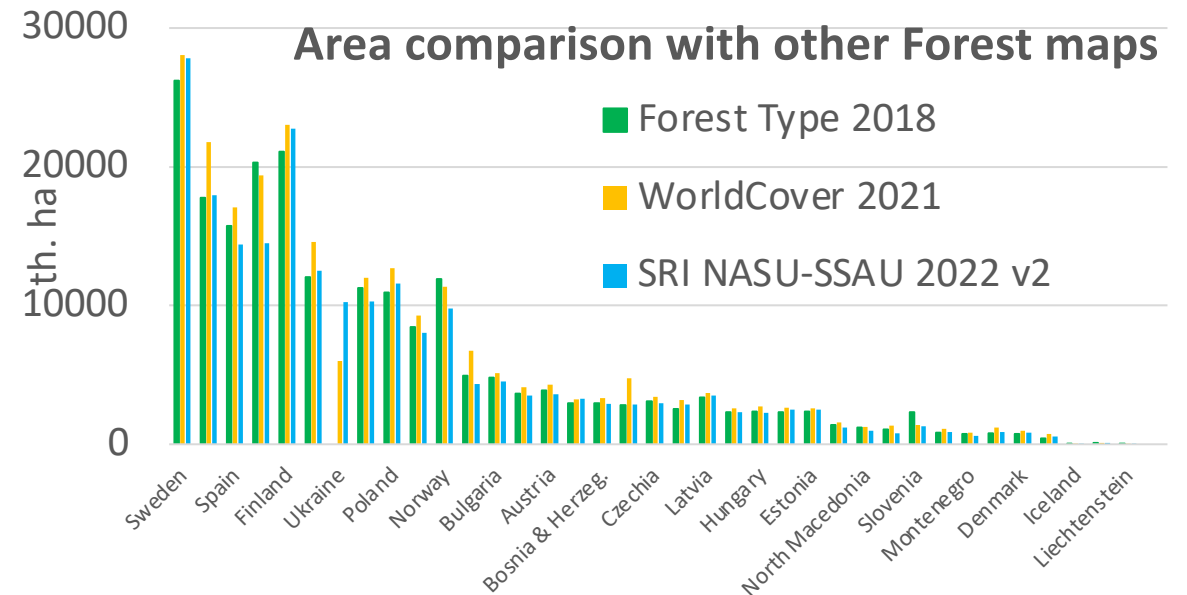
# Horizon Europe SWIFTT project

Title: “Satellites for Wilderness Inspection and Forest Threat Tracking”  
 Forest type map for Europe (37 countries) for 2022



### Data used

- Sentinel-1,2 time series (2022)
- Modified [LUCAS Copernicus 2018 dataset](#)



Links: [ESA WorldCover 2021 map](#), [Forest Type 2018 map](#)



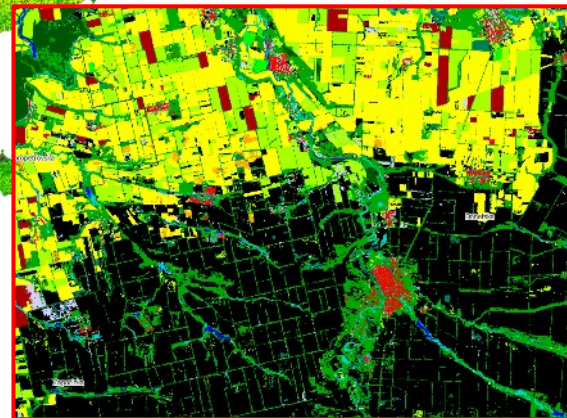
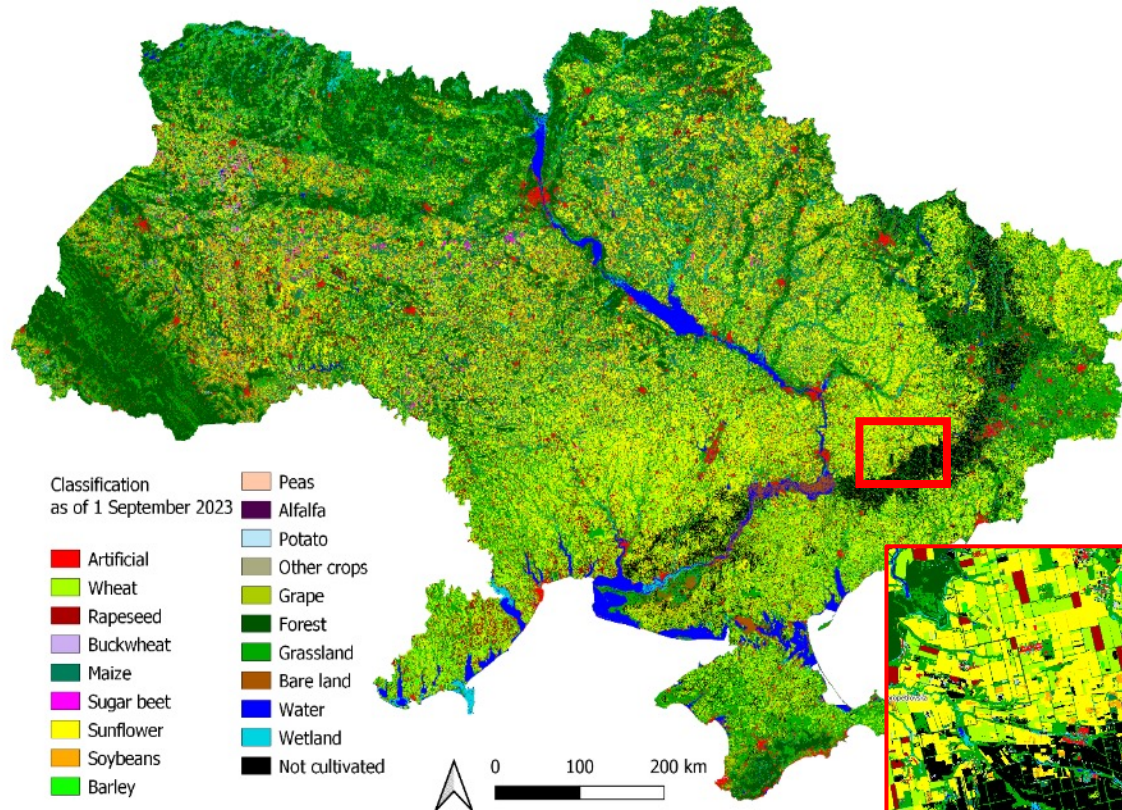
# Classification in CREODIAS Cloud

Ukraine 2023



CREODIAS

powered by CloudFerro



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
<b>Overall Accuracy</b>	<b>OA = 93,1%</b>		



# In-situ data collection (2021 & 2023)

2021: ~6500 km

2023: ~4018 km

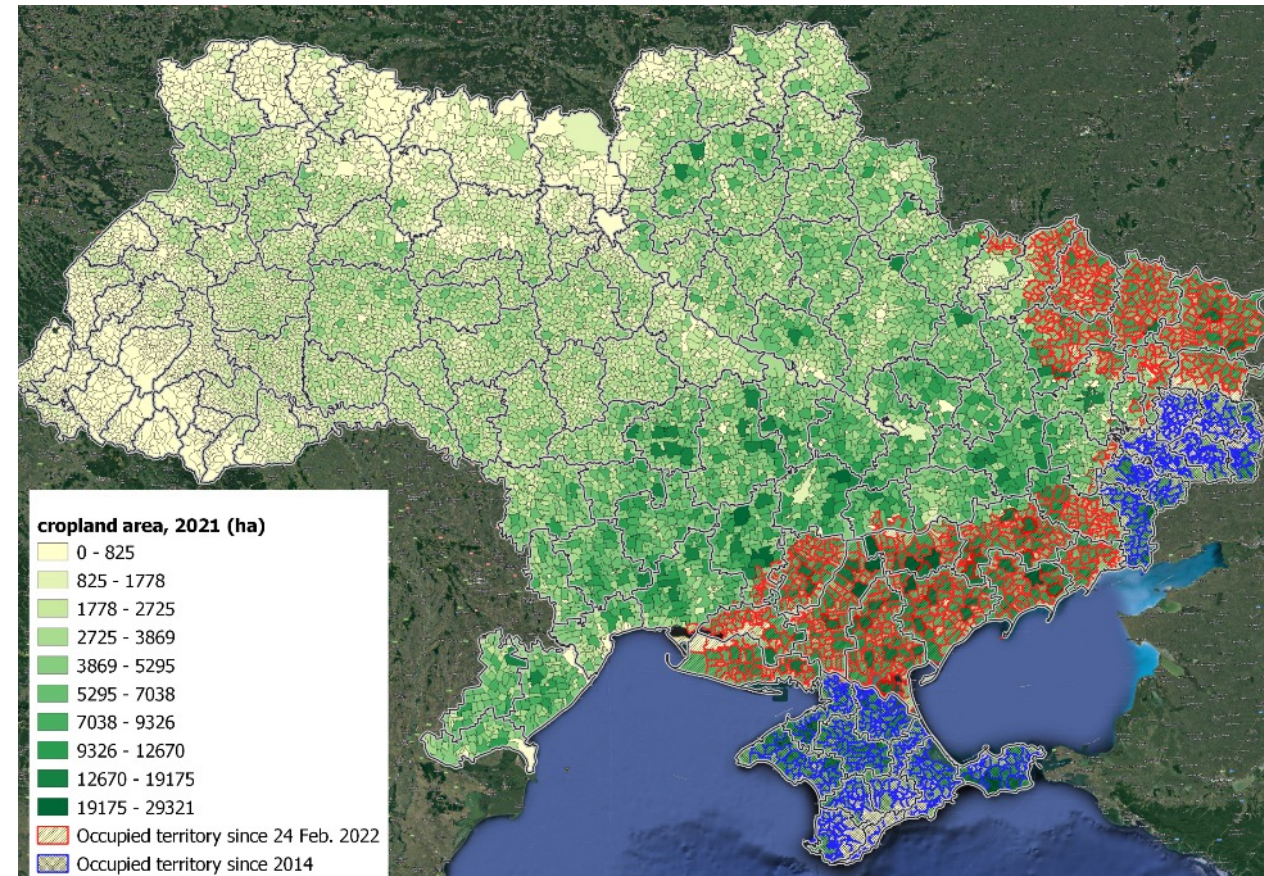




# Assessment of areas of cropland under occupation (2022)

In MLN ha	Occupied since 2014	Occupied since 24 Feb. 2022	Not occupied	Total MLN ha
<b>Cropland</b>	<b>1,73</b> (5.6%)	<b>5,70</b> (18.3%)	23,58 (76.1%)	31,00
<b>Winter crops 2022</b>	<b>0,59</b> (6.6%)	<b>2,05</b> (22.9%)	6,33 (70.5%)	8,97

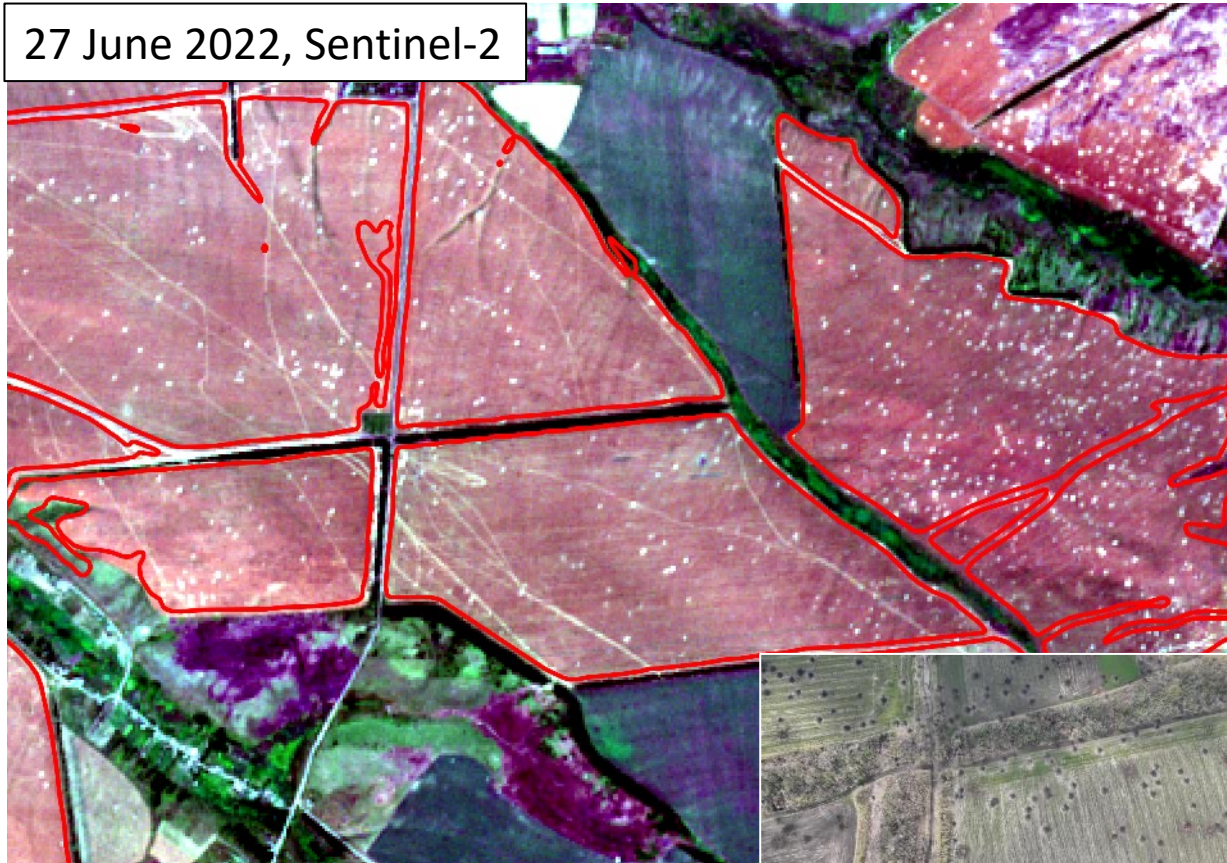
Total **occupied** cropland is **5.7 MLN ha**



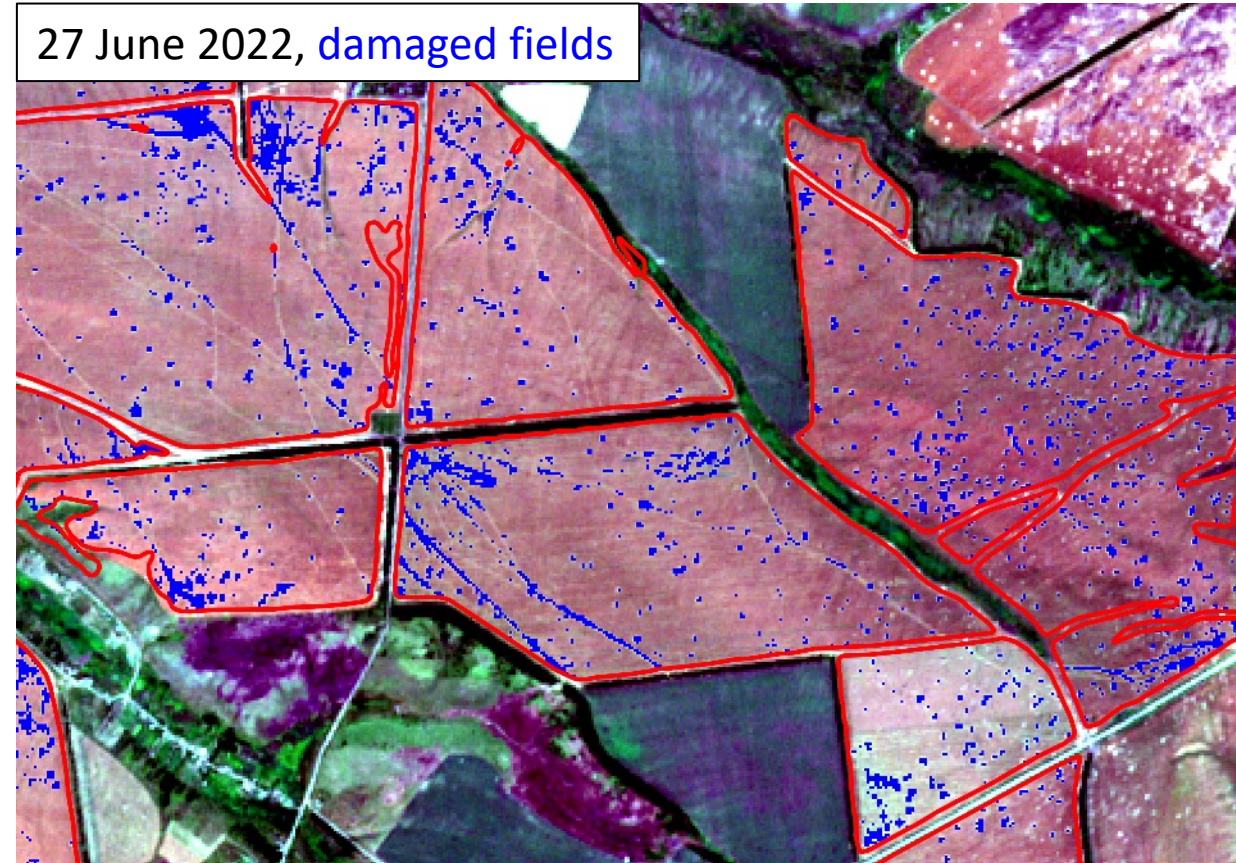


# Damages for agricultural fields

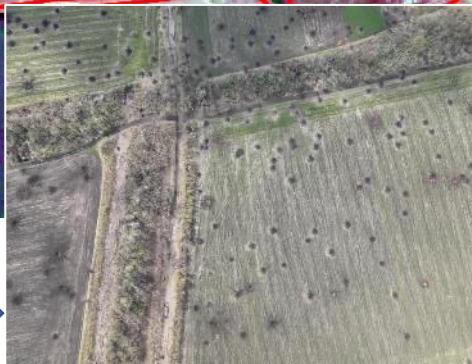
27 June 2022, Sentinel-2



27 June 2022, damaged fields



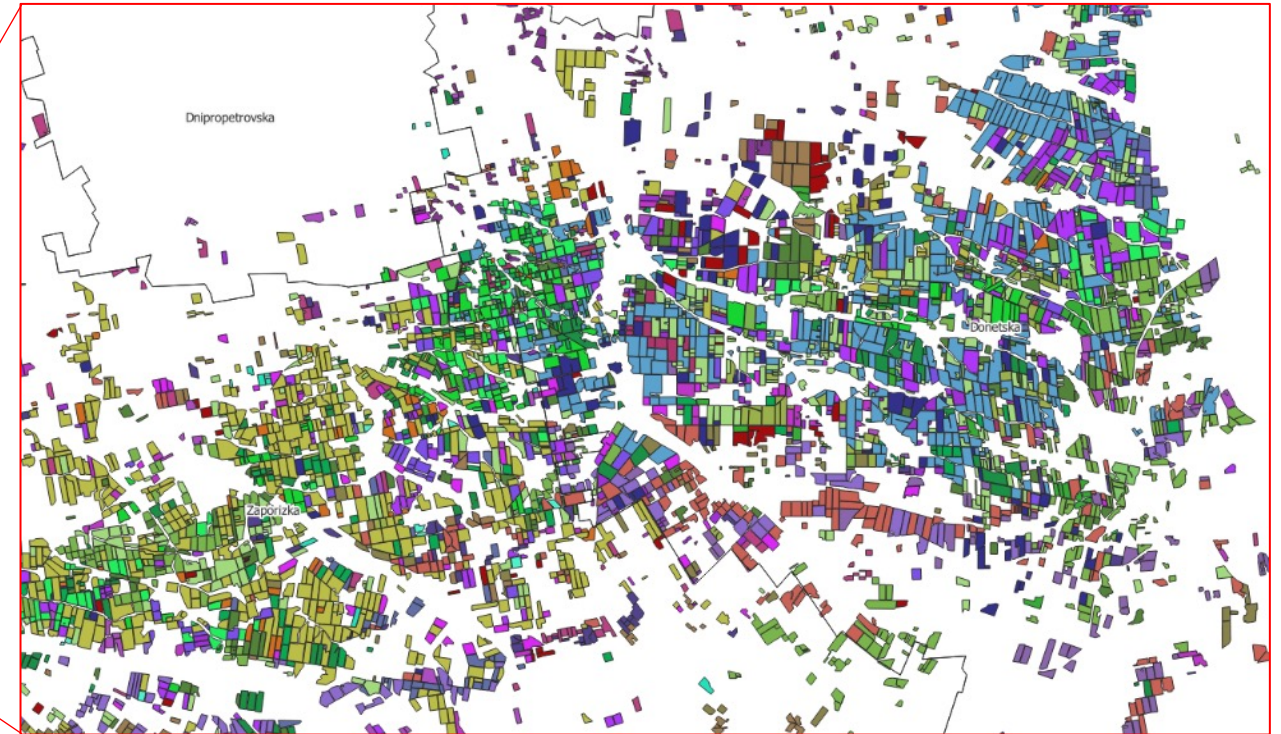
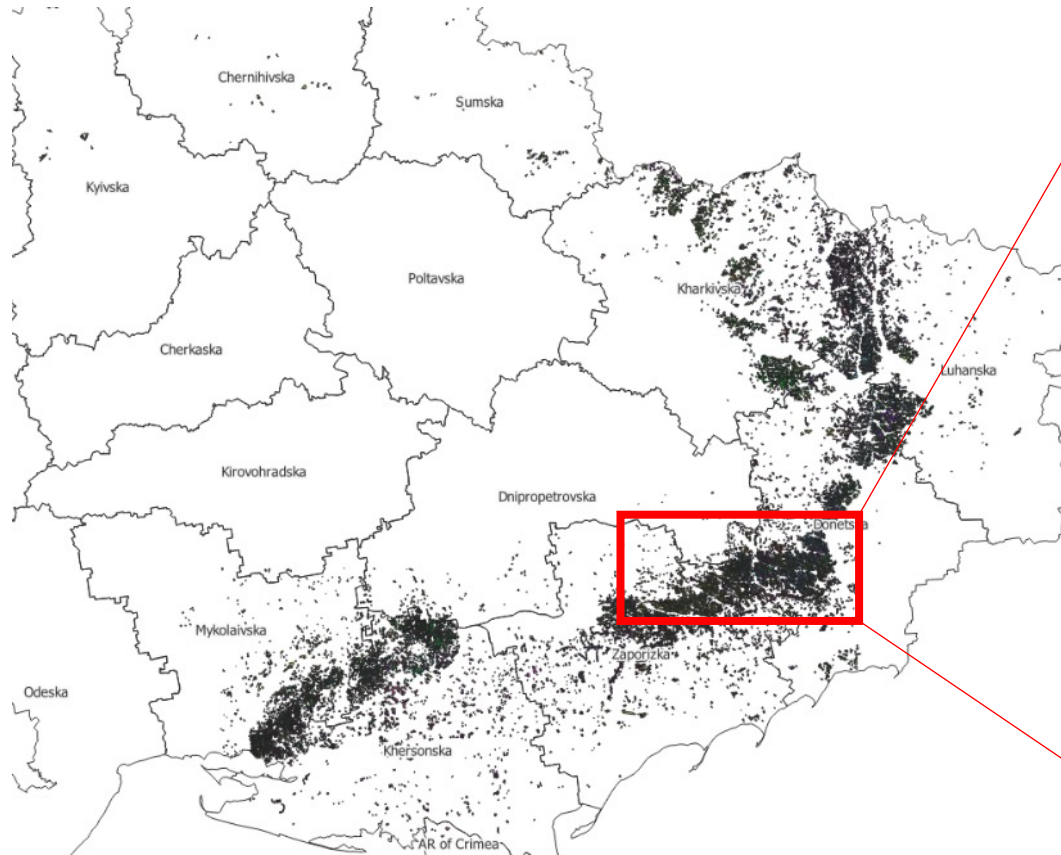
An example of craters from a drone







# Damaged agricultural fields as a result of hostilities (2022 – 2023)

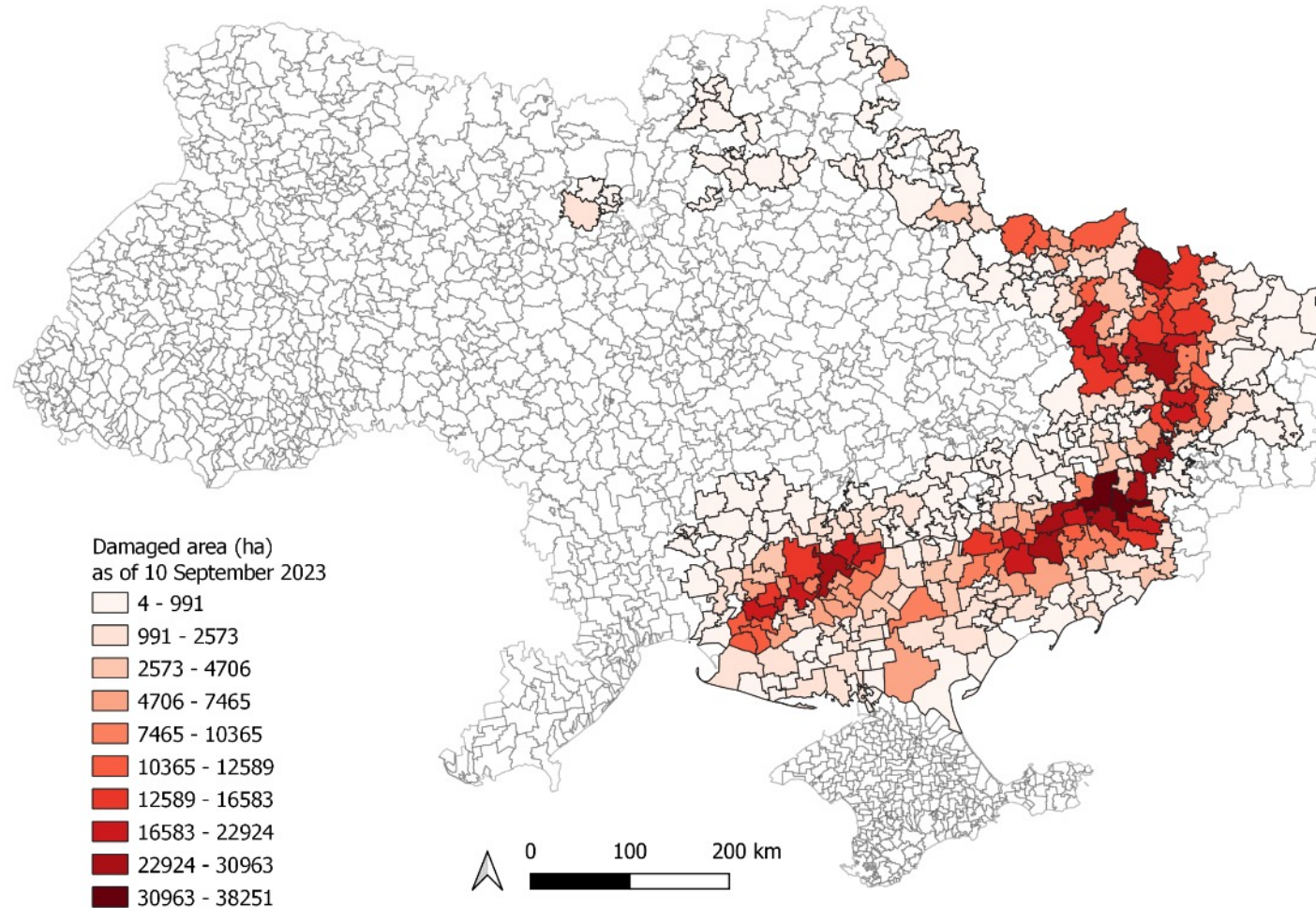






# Damaged cropland

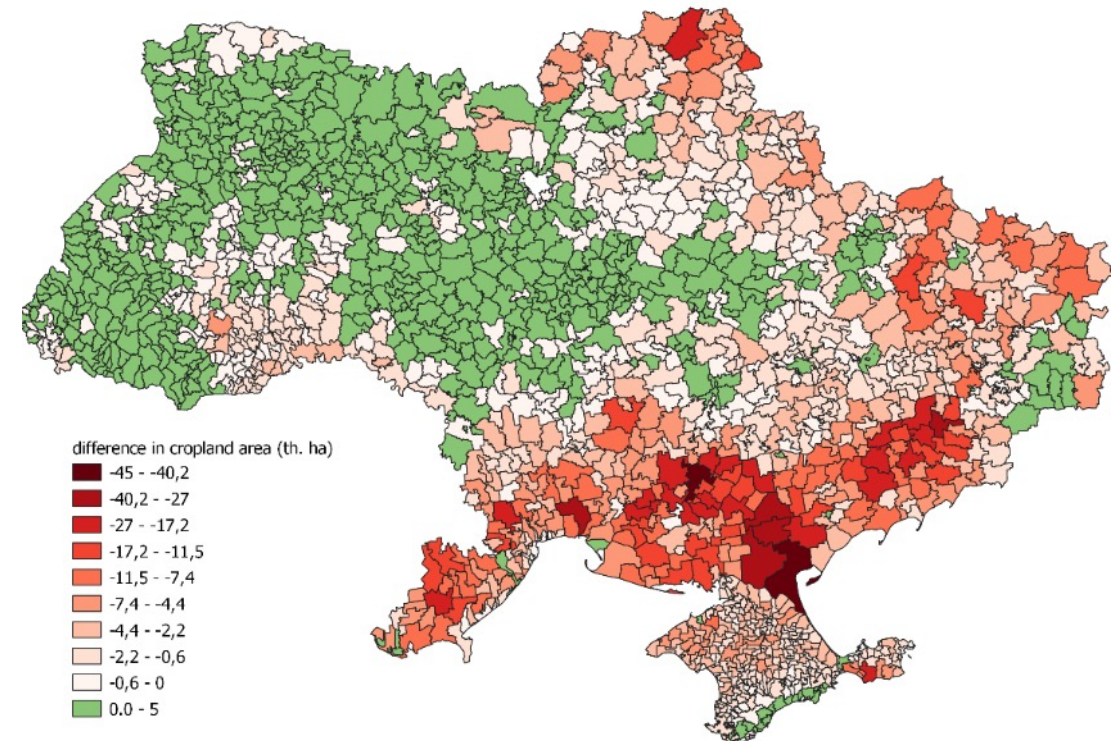
Total directly damaged area is **1.4 MLN ha** (as of 10 September 2023)





# Cropland difference between 2021 & 2022

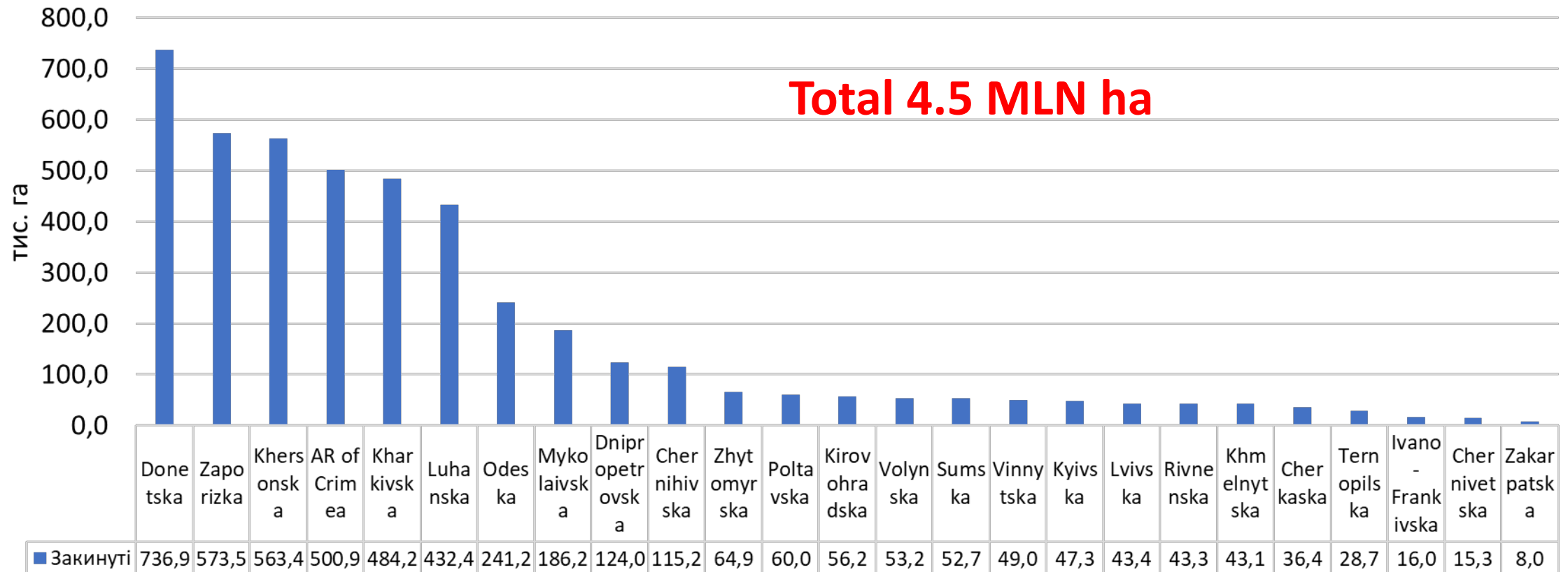
	Cropland 2021, th ha	Cropland 2022, th ha	Difference in Cropland area, th ha	Difference in Cropland area, %
<b>AR of Crimea</b>	1182,67	650,6	-532,1	-45,0
<b>Khersonska</b>	1765,72	1115,1	-650,6	-36,8
<b>Zaporizka</b>	1968,60	1556,5	-412,1	-20,9
<b>Odeska</b>	2071,75	1678,6	-393,1	-19,0
<b>Donetska</b>	1364,92	1109,7	-255,3	-18,7
<b>Chernivetska</b>	257,35	213,6	-43,8	-17,0
<b>Mykolaivska</b>	1770,21	1475,7	-294,5	-16,6
<b>Sumska</b>	1256,47	1140,1	-116,4	-9,3
<b>Luhanska</b>	1171,90	1066,9	-105,0	-9,0
<b>Kharkivska</b>	1872,06	1740,8	-131,2	-7,0
<b>Chernihivska</b>	1401,22	1318,4	-82,9	-5,9
<b>Dnipropetrovska</b>	2068,38	1984,2	-84,1	-4,1
<b>Kirovohradska</b>	1783,98	1748,9	-35,1	-2,0
<b>Ivano-Frankivska</b>	281,28	277,6	-3,6	-1,3
<b>Ternopil'ska</b>	874,31	863,6	-10,8	-1,2
<b>Khmelnitska</b>	1234,85	1222,9	-11,9	-1,0
<b>Poltavska</b>	1798,63	1785,1	-13,5	-0,8
<b>Kyivska</b>	1200,51	1202,5	2,0	0,2
<b>Vinnitska</b>	1615,31	1632,1	16,7	1,0
<b>Cherkaska</b>	1218,88	1233,2	14,3	1,2
<b>Lvivska</b>	606,43	627,6	21,2	3,5
<b>Volynska</b>	524,71	543,9	19,2	3,7
<b>Zhytomyrska</b>	885,33	918,1	32,8	3,7
<b>Rivnenska</b>	504,27	533,0	28,7	5,7
<b>Zakarpatska</b>	76,85	83,7	6,8	8,9
<b>Ukraine total</b>	<b>30756,58</b>	<b>27722,3</b>	<b>-3034,2</b>	<b>-9,9</b>



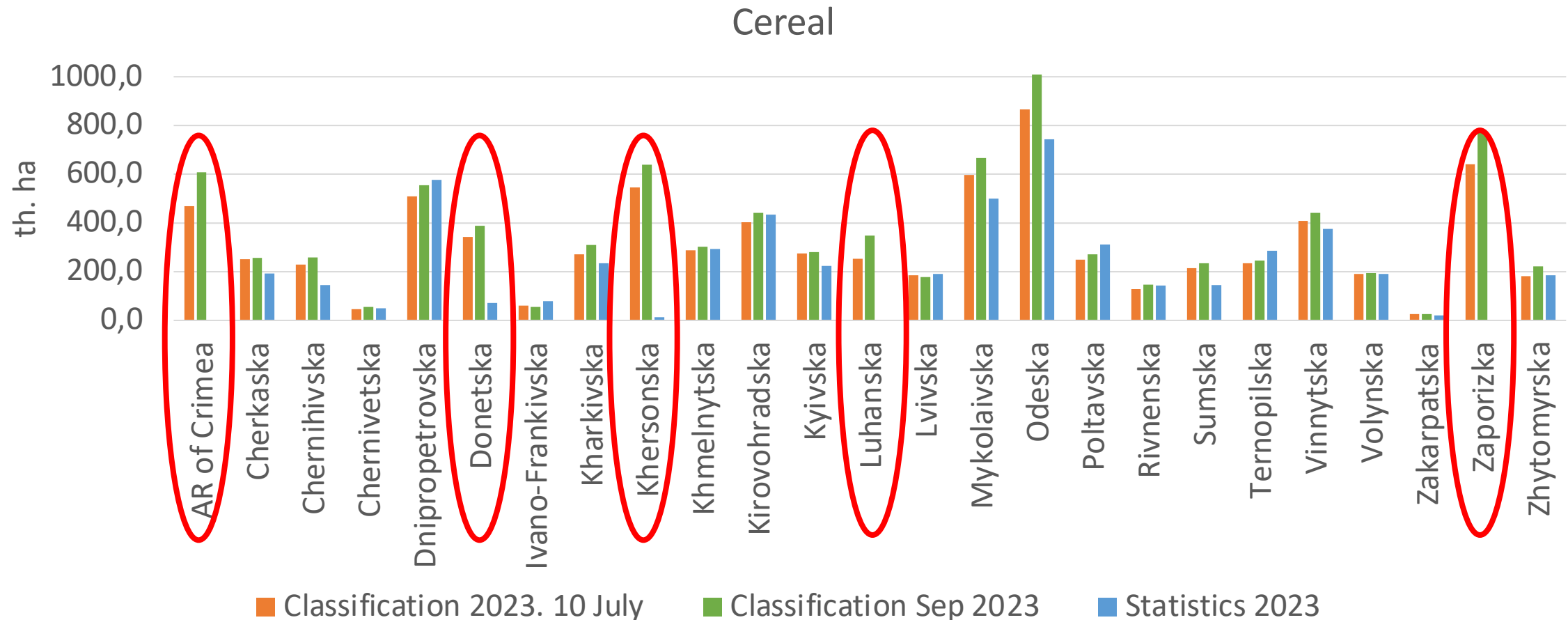




# Uncultivated agricultural fields in 2023 comparing to 2021



# Cultivated areas comparing to statistics (2023)







# World Bank & EU project

- Pilot project: Monitoring the impact of support programs on the production activities of the recipients of support
- 5 districts (2023)
- 4532 subsidized fields
- **89%** of the fields with subsidies are sown with agricultural crops

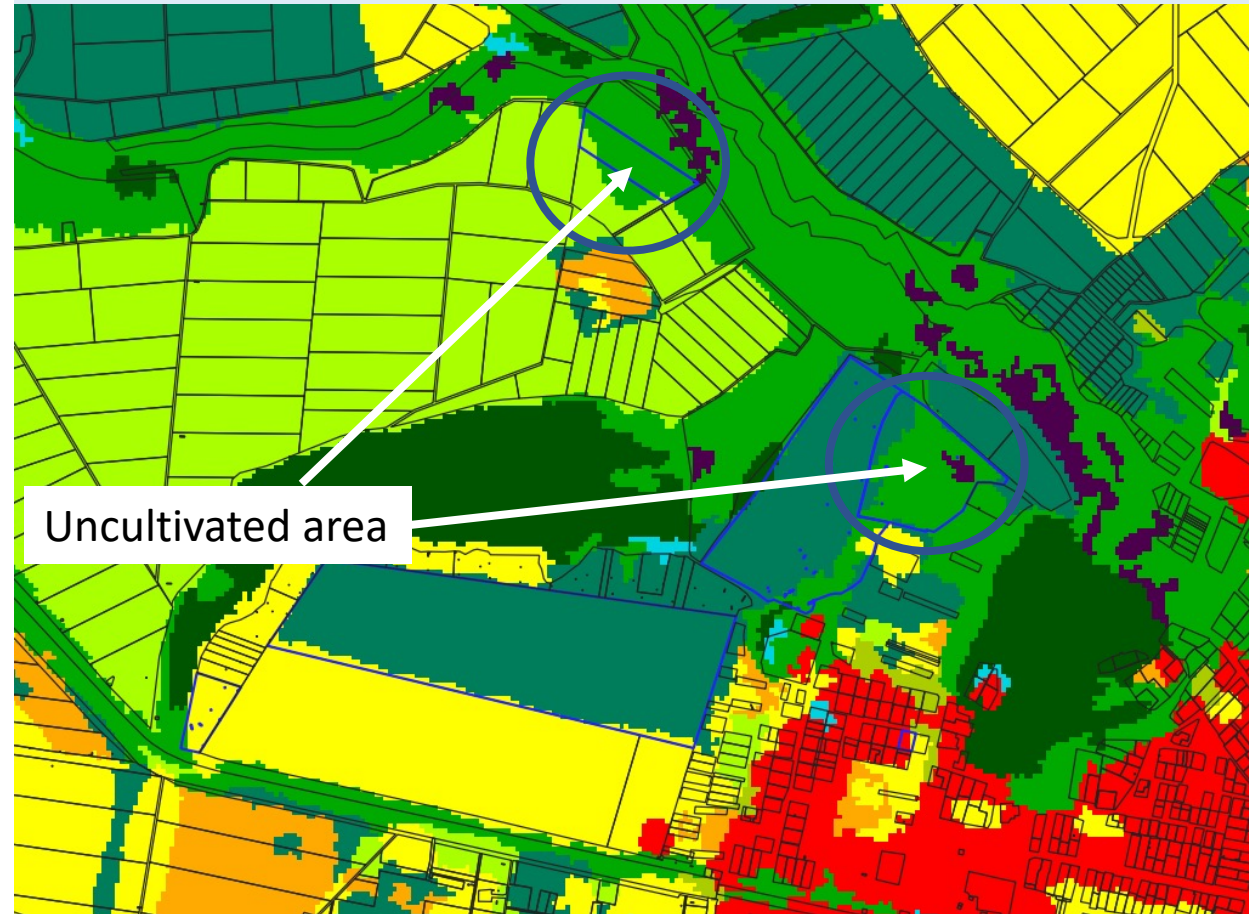


# Control of subsidies

Checking whether the parcel has been cultivated this year  
(Sentinel-2 satellite image)



Map of land cover types and crop types

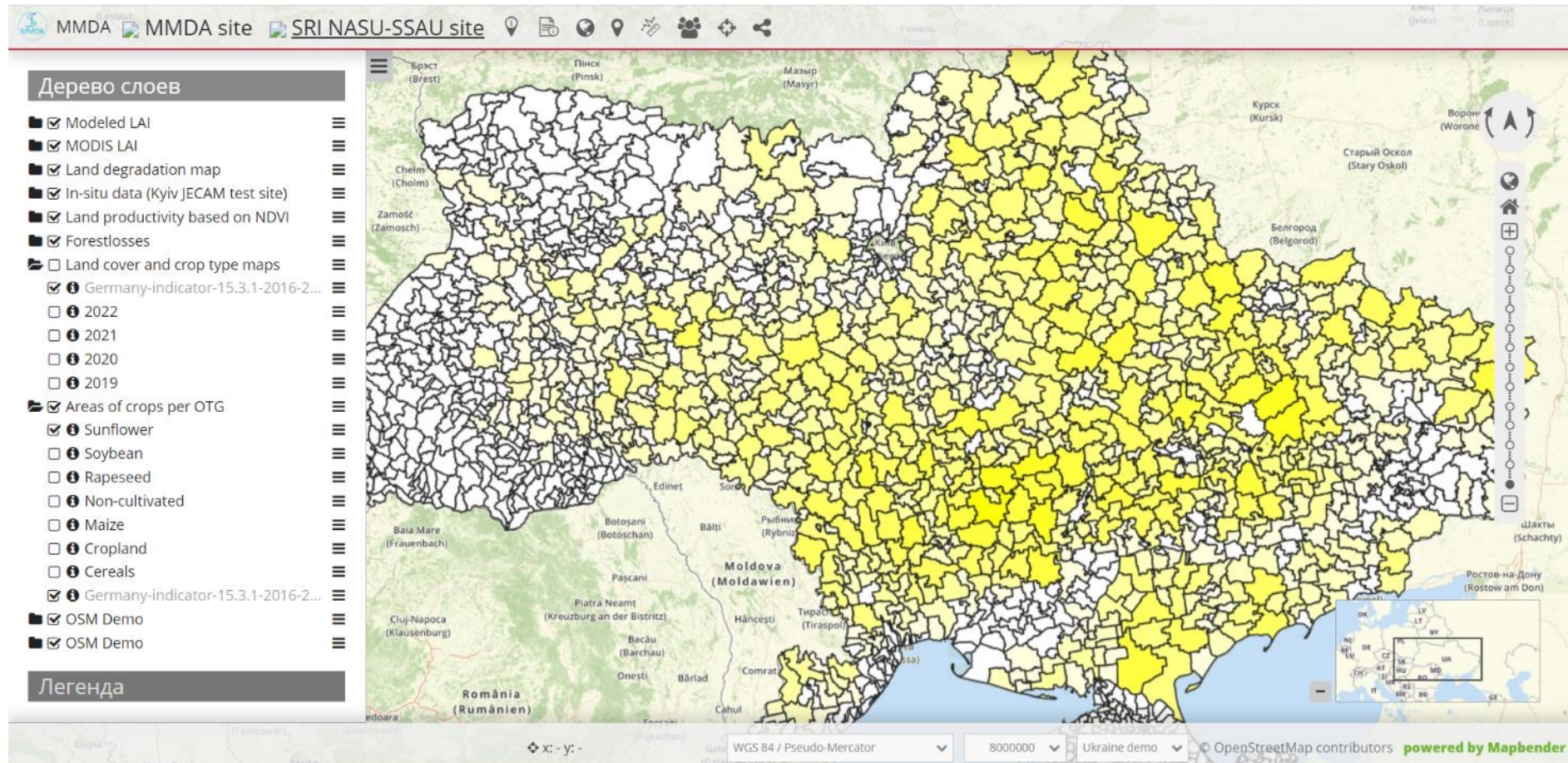


Granted subsidy

No subsidy provided



# H2020 e-shape project Geoportal



[http://64.225.134.208/mapbender/application/mapbender\\_ukraine\\_demo](http://64.225.134.208/mapbender/application/mapbender_ukraine_demo)





**Thank you!**

