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The National Centre for Research and Development

Changes in forest cover in Ukraine since 2020 based on Sentinel-2 data – results of the InCoNaDa+UA project

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InCoNaDa+UA - Objectives

Objective 1 - detecting the land cover changes
The land cover change algorithm, developed within InCoNaDa project, will be applied over the period 2020-2022 for the selected regions in Ukraine.

- the verification of the automatically detected changes from the first stage is crucial and will be performed by researches from Ukraine, based on the national datasets.
- Tuning algorytm for the landscape in Ukraine.
- To perform the independent verification and accuracy assessment of the land cover changes

Objective 2 - mapping forest cover over the selected regions of Ukraine following the methodology developed in the InCoNaDa project.

- to prepare the reference datasets and carry out an independent verification of forest cover map
- to compare the results with the forest class from the Land cover map derived as part of the Copernicus Global Land Monitoring Service

The land cover changes and forest cover map will be made available to the public as the WMS service at freely accessible portal.

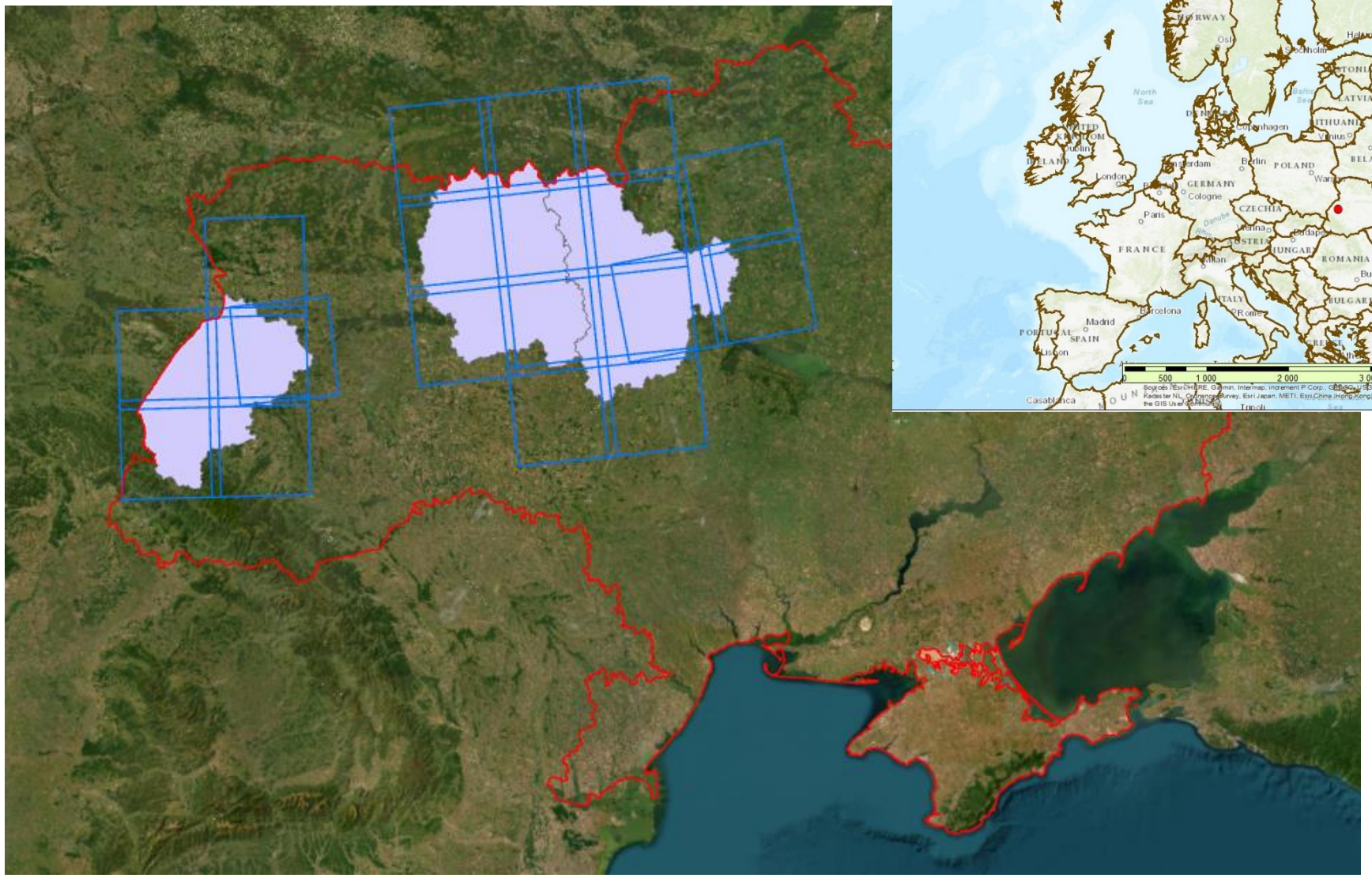
Study areas:

- Lviv region – 21 832 sq.km
- Kyiv region – 28 131 sq. km
- Zhytomyr region – 29 832 sq. km

TOTAL – 79 795 sq.km

Sentinel-2 data for the year 2020 :

- in total 20 S-2 granules

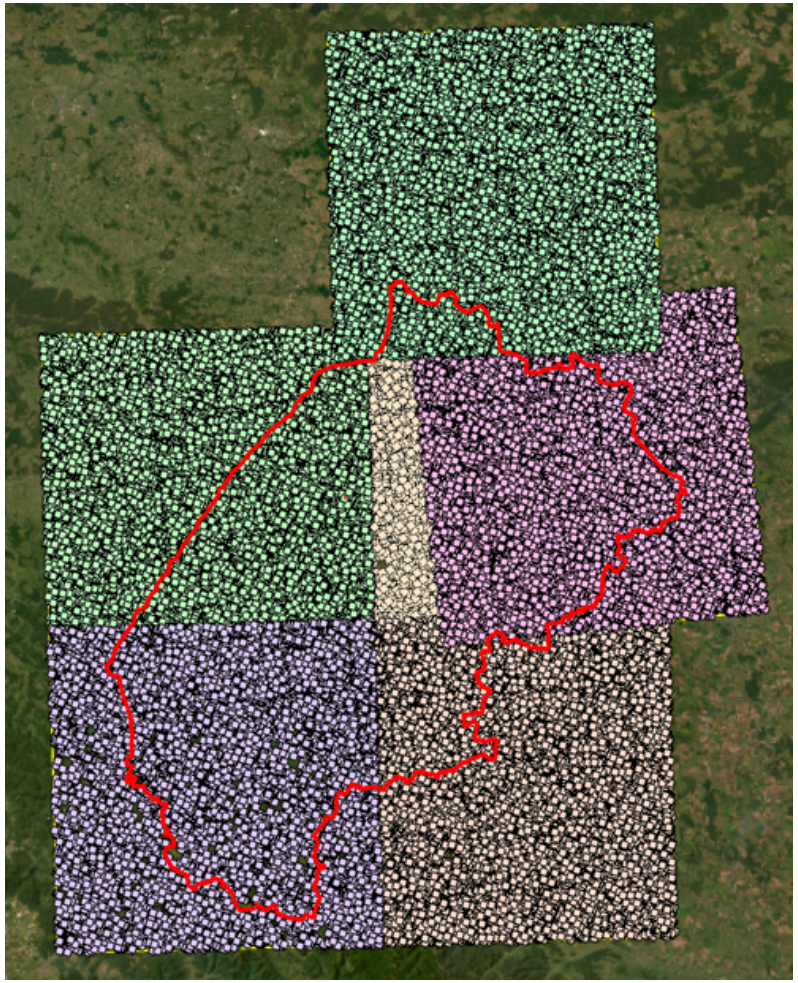


python™

CREODIAS

Reference points for classification

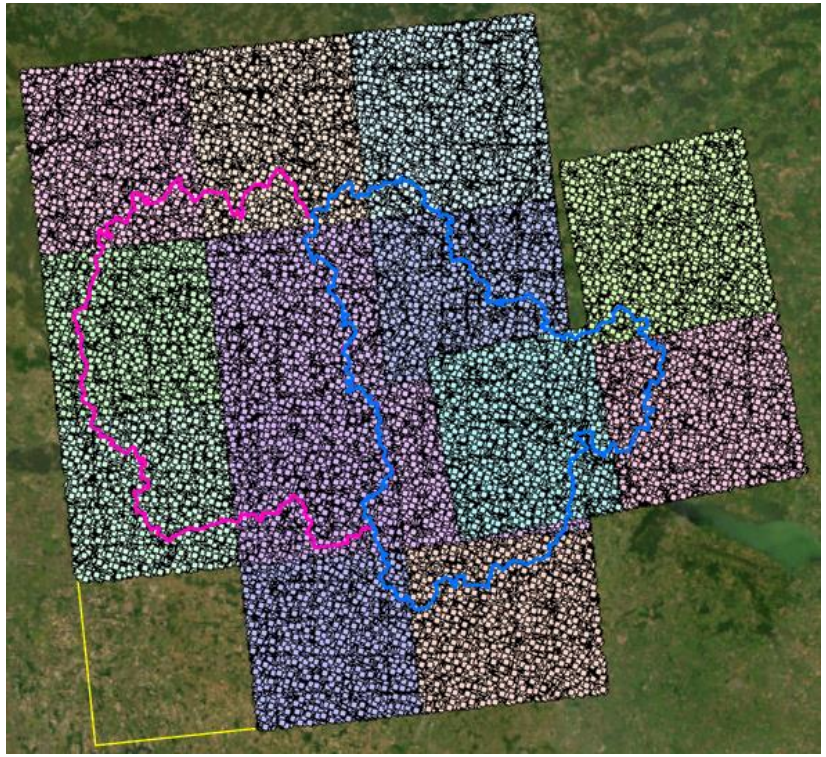
Lviv region
>0,5 mil.points



Random Points Rules:

- Points distributed randomly over the entire area of granules,
- 10 m internal buffer of reference dataset to avoid misclassification on the edges,
- 2 points per 1 km^2 of reference data
- 20 m minimum distance between points,
- a minimum of 200 points for one class,
- points for forest classes and non-forest classes.

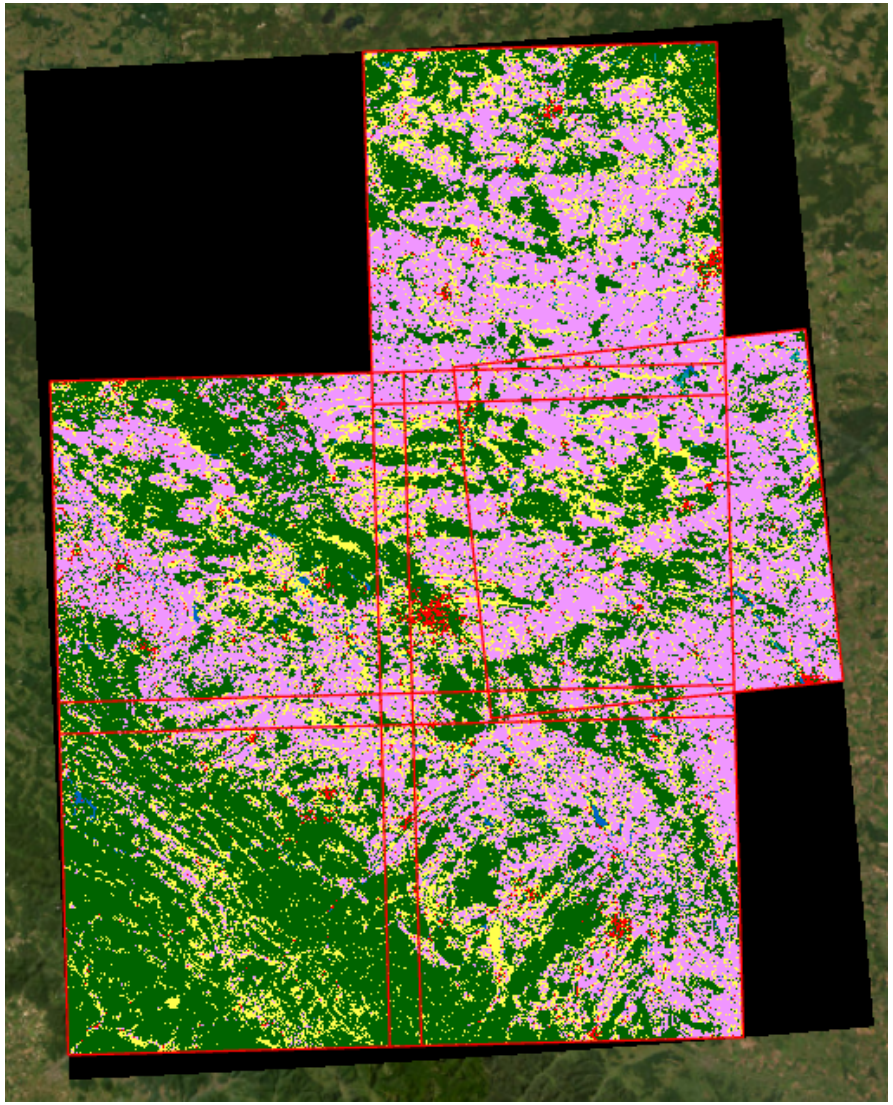
Kyiv and Zhytomyr region
>1,5 mil. points



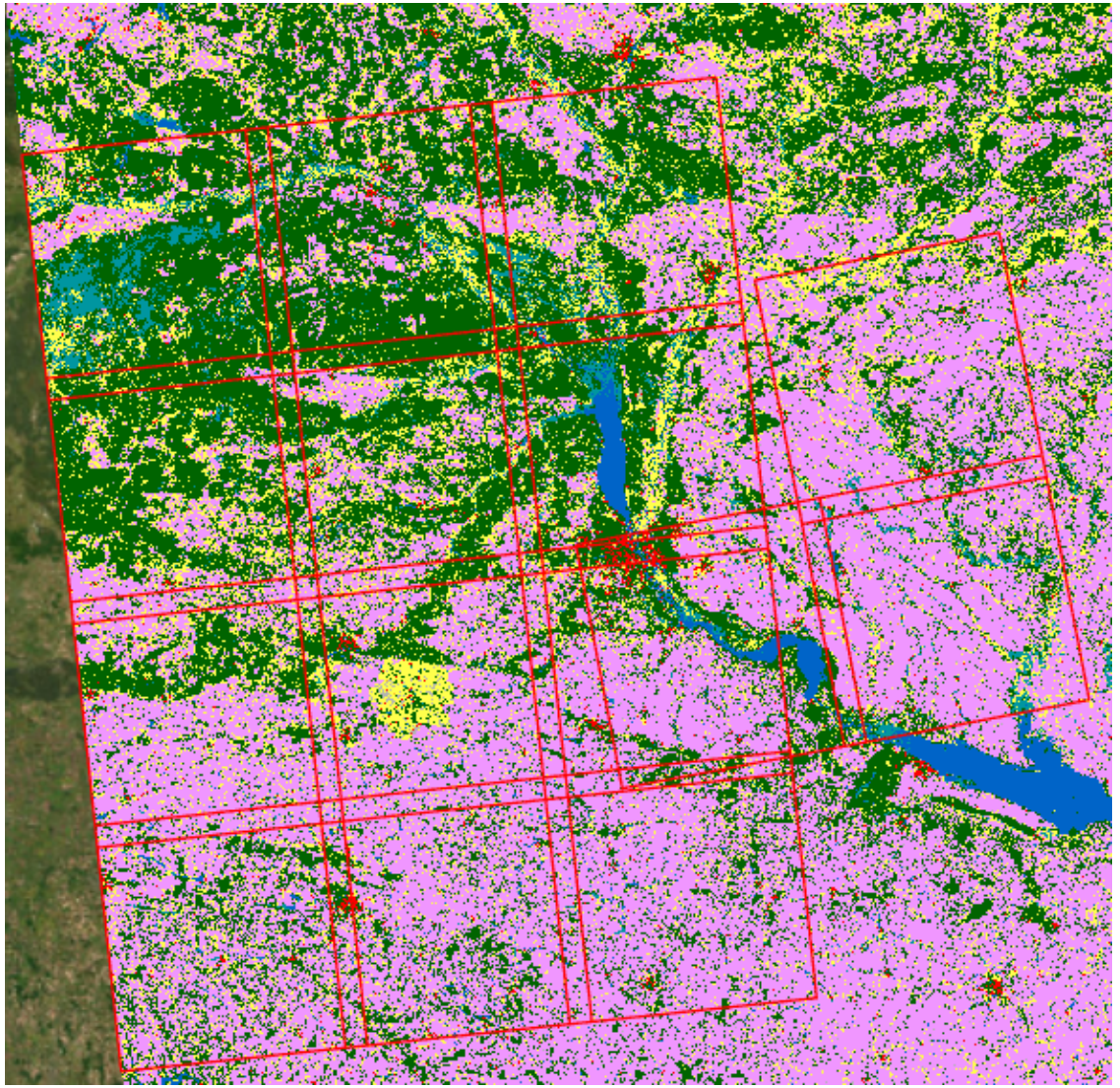
Creating reference points for classification

ESA World Cover 2020

Lviv region

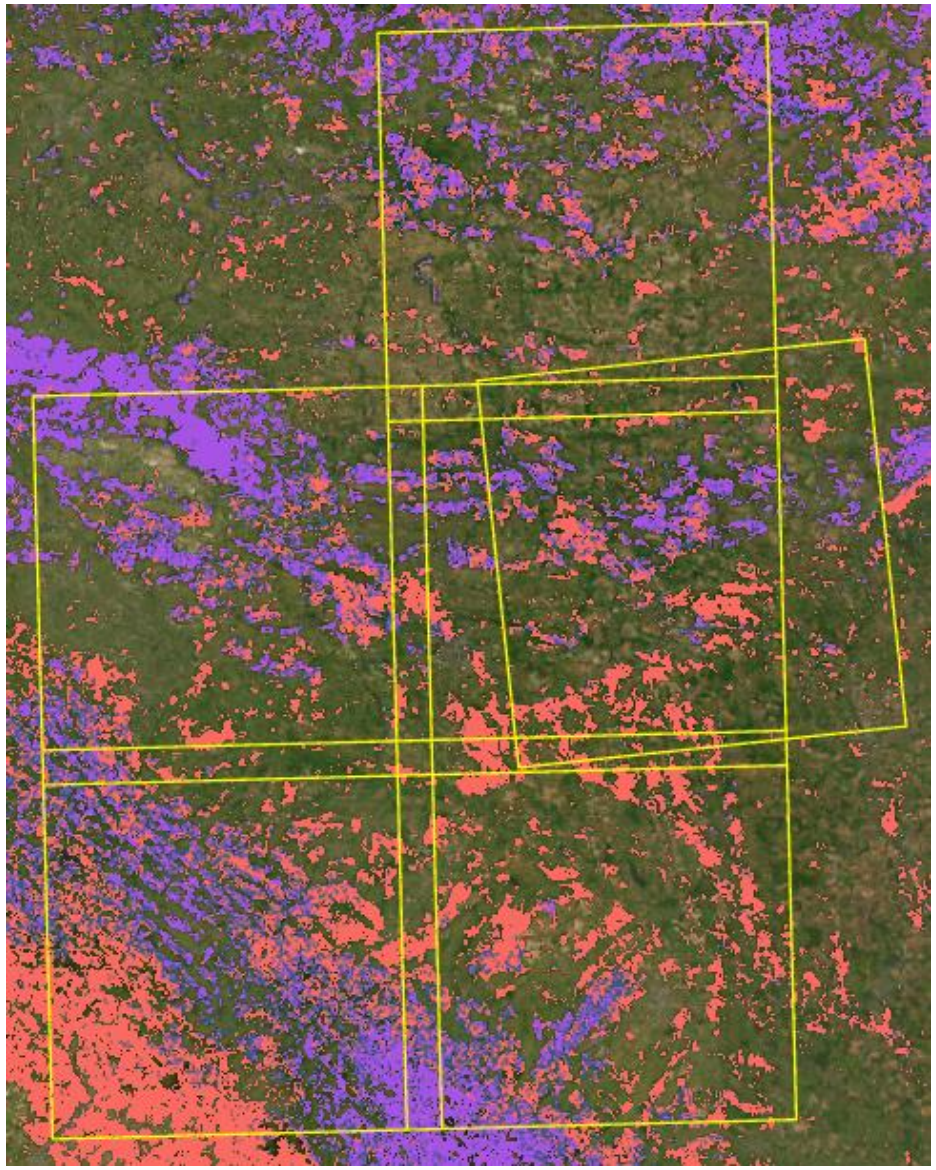


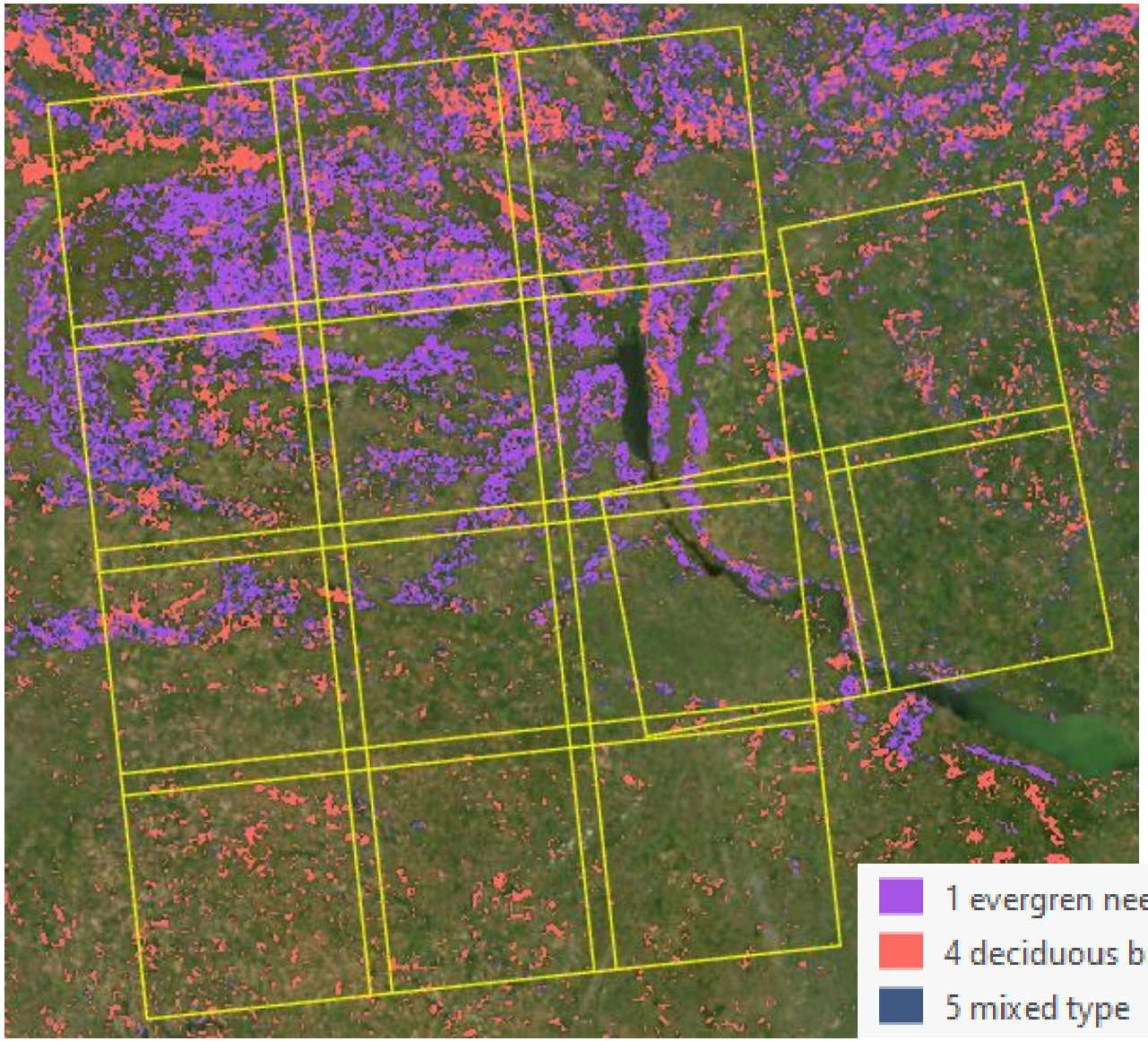
Kyiv and Zhytomyr region



Creating reference points for classification

Copernicus Global Land Cover Map – forest types





Sentinel-2 data

Lviv region

Sentinel-2 images					
34UFA	**34UFV**	**34UGA**	**34UGB**	**34UGV**	**35ULR**
06.04.2020	01.07.2019	06.04.2020	06.04.2020	06.04.2020	06.04.2020
23.09.2020	06.04.2020	23.09.2020	14.08.2020	10.09.2020	06.08.2020
11.05.2021	23.09.2020	10.07.2020	23.09.2020	29.08.2020	15.09.2020
	11.05.2021			15.09.2020	

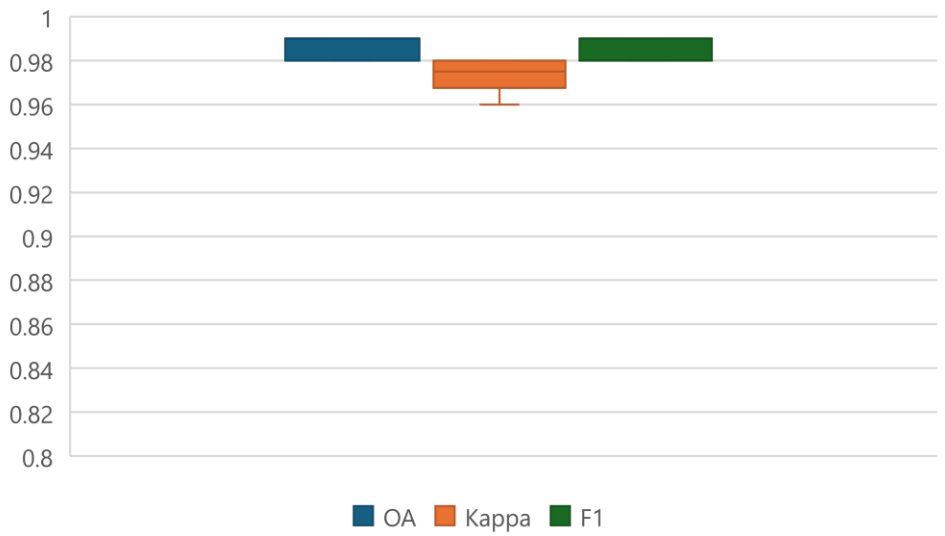
Data were downloaded from Creodias platform.

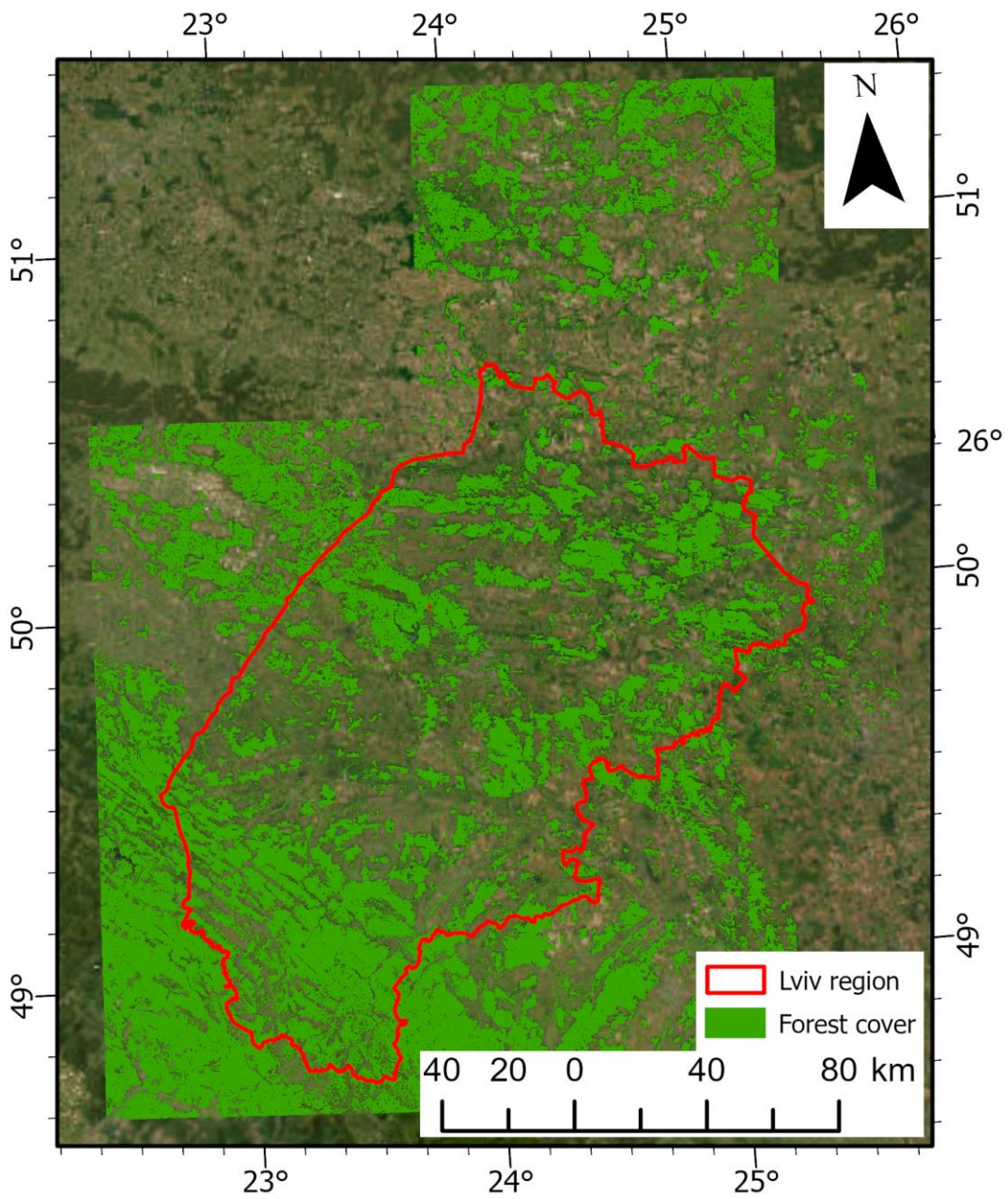
Kyiv and Zhytomyr region

Sentinel-2 images						
35UPQ	**35UPR**	**35UPS**	**35UPT**	**35UQQ**	**35UQT**	**36UUA**
26.06.2020	04.05.2020	12.09.2020	10.04.2020	02.04.2020	05.04.2020	02.04.2020
08.08.2020	08.08.2020	22.09.2020	22.09.2020	26.06.2020	11.06.2020	11.06.2020
12.09.2020	12.09.2020	10.05.2021	08.08.2021	06.07.2020	11.07.2020	26.06.2020
10.05.2021	22.09.2020	09.07.2021	10.05.2021	30.08.2020	30.08.2020	11.07.2020
24.06.2021	10.05.2021	08.08.2021	15.06.2019	14.09.2020	22.09.2020	30.08.2020
35UQR	**35UQS**	**36UVA**	**36UVB**	**35UNT**	**35UNS**	**35UNR**
02.04.2020	12.04.2020	12.04.2020	12.04.2020	08.04.2020	03.04.2020	05.04.2020
11.06.2020	11.06.2020	11.06.2020	26.06.2020	12.06.2020	12.06.2020	08.08.2020
26.06.2020	26.06.2020	26.06.2020	05.08.2020	06.08.2020	16.08.2020	12.09.2020
11.07.2020	11.07.2020	11.07.2020	30.08.2020	15.09.2020	25.09.2020	22.09.2020
30.08.2020	30.08.2020	30.08.2020	19.09.2020			
14.09.2020	14.09.2020	19.09.2020				

Forest cover classification

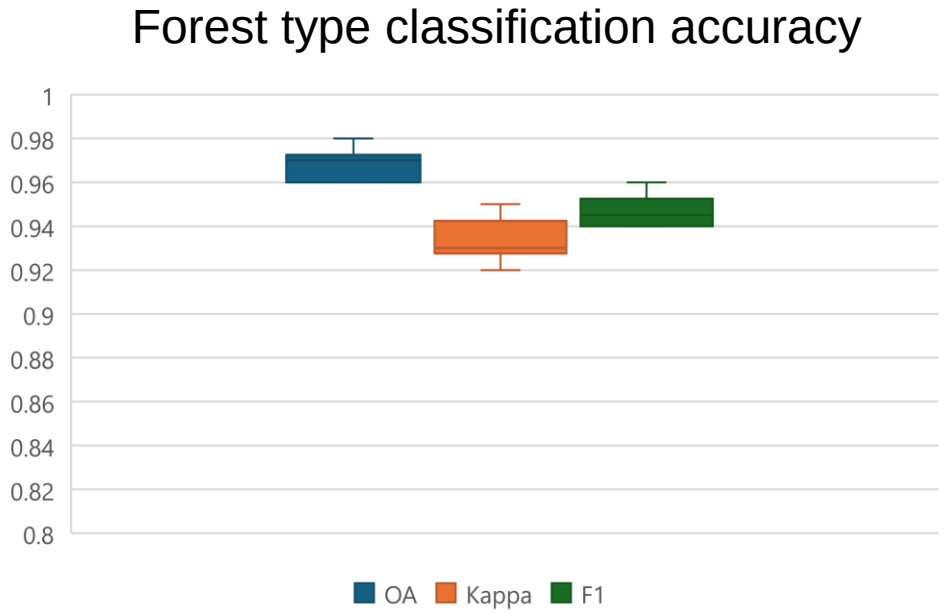
Lviv region

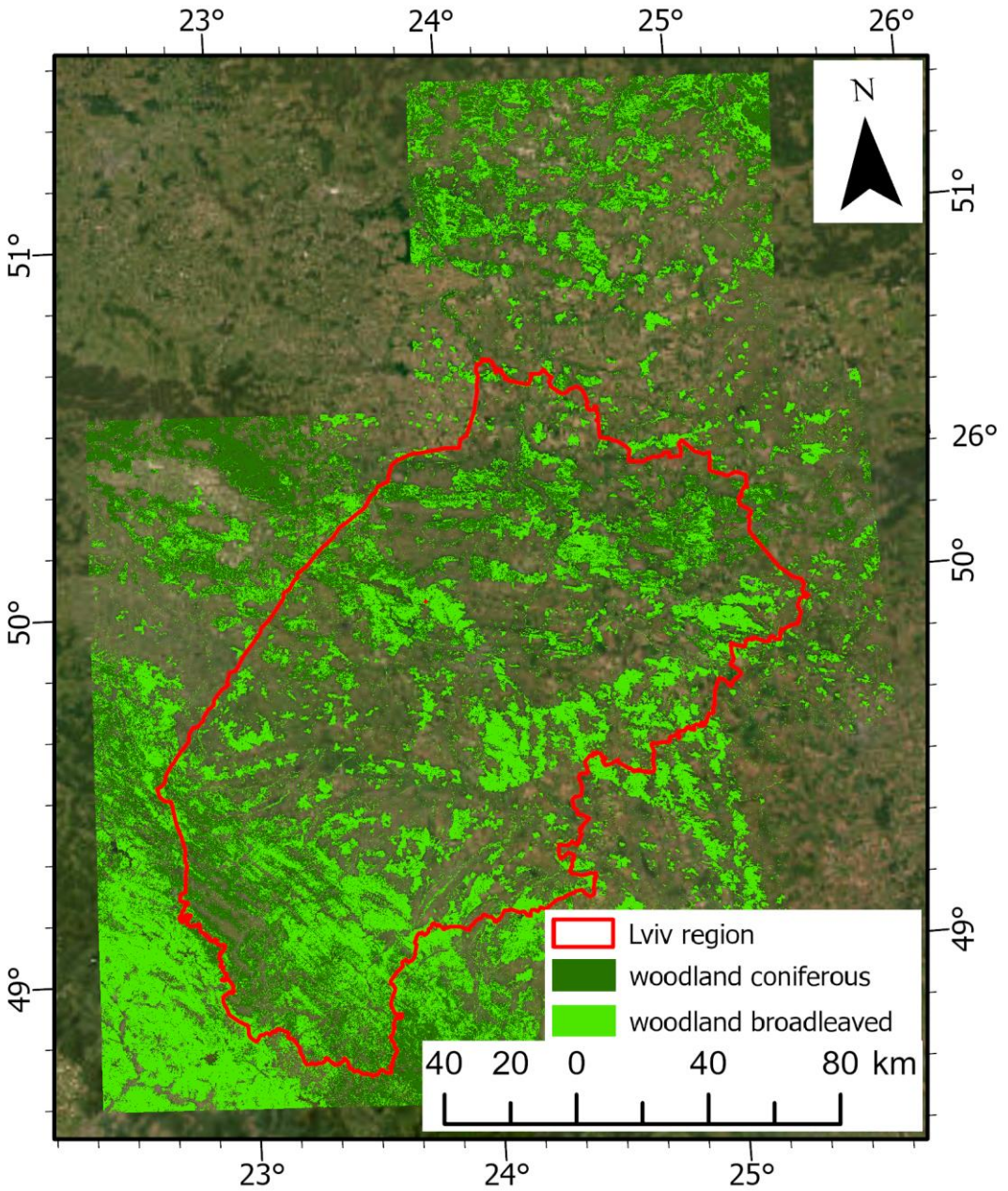




Forest type classification

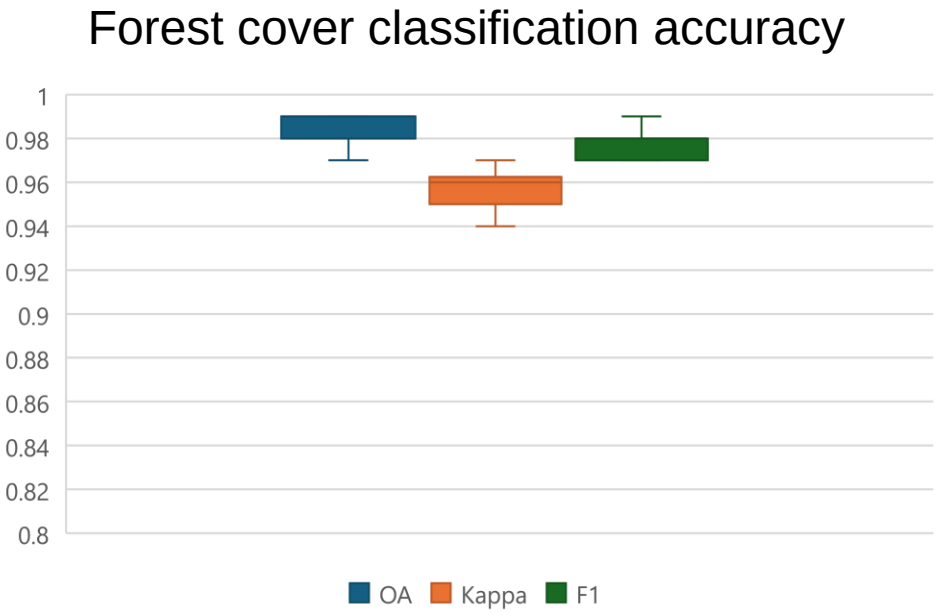
Lviv region

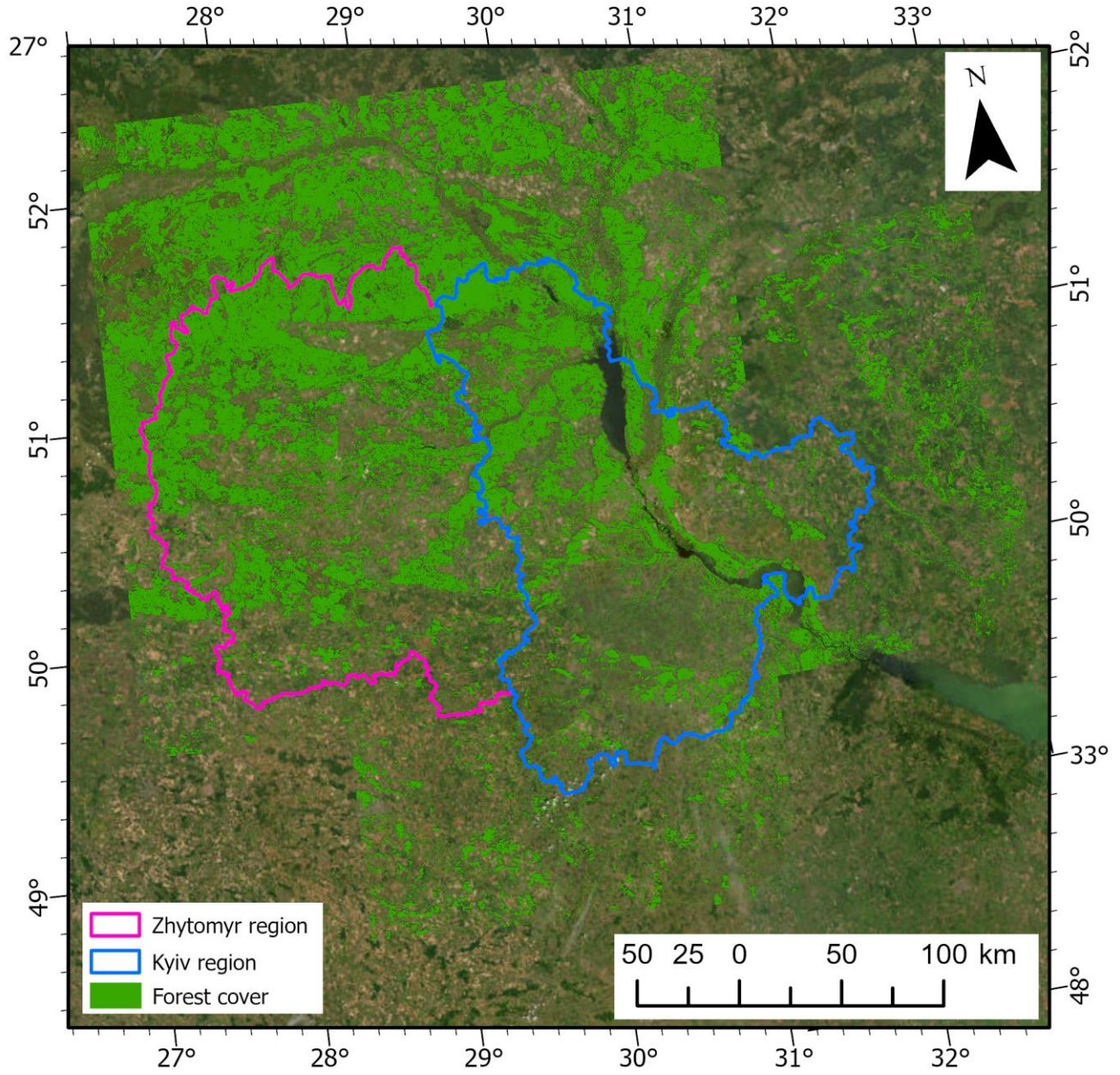




Forest cover classification

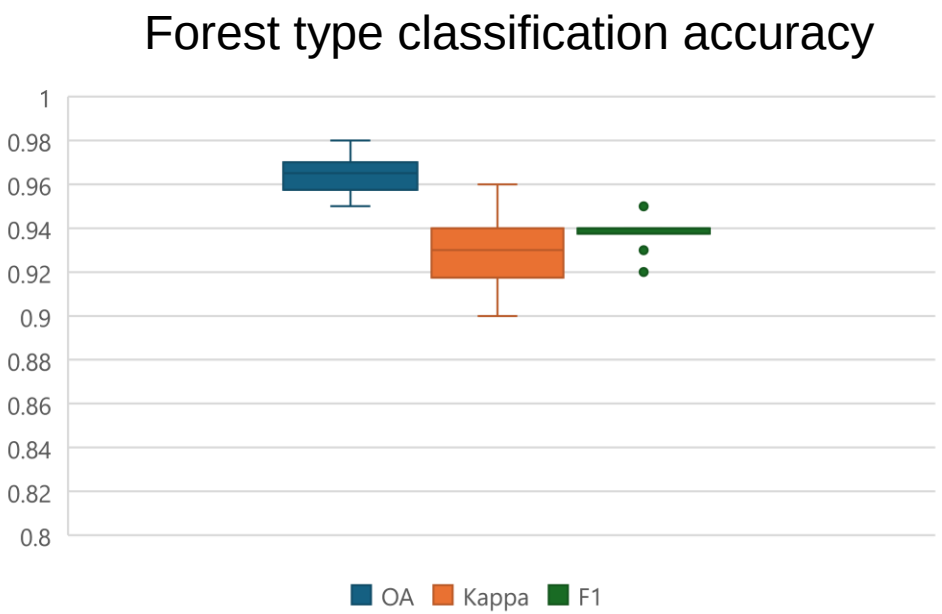
Kyiv region
Zhytomyr region

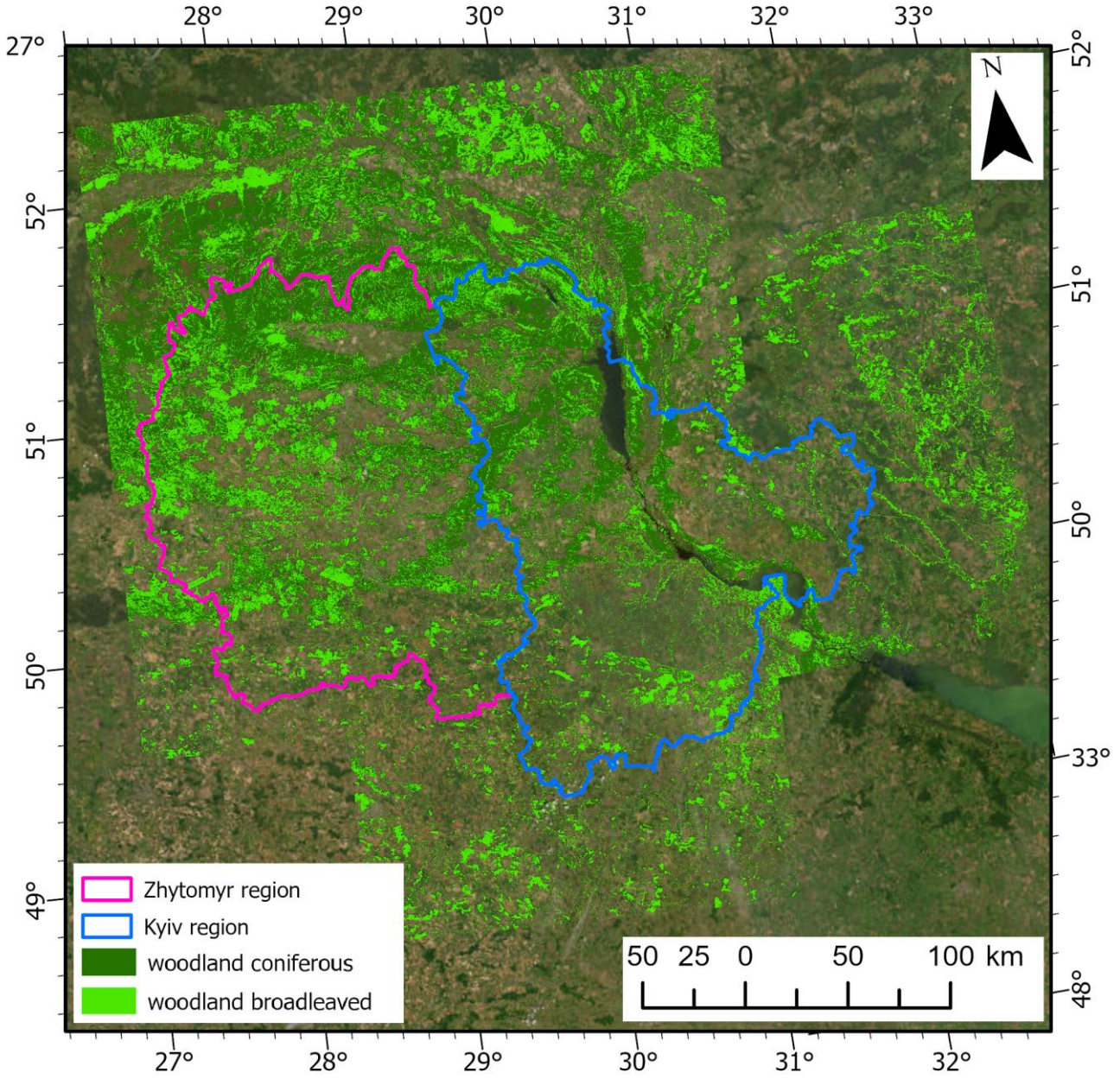




Forest type classification

Kyiv region
Zhytomyr region





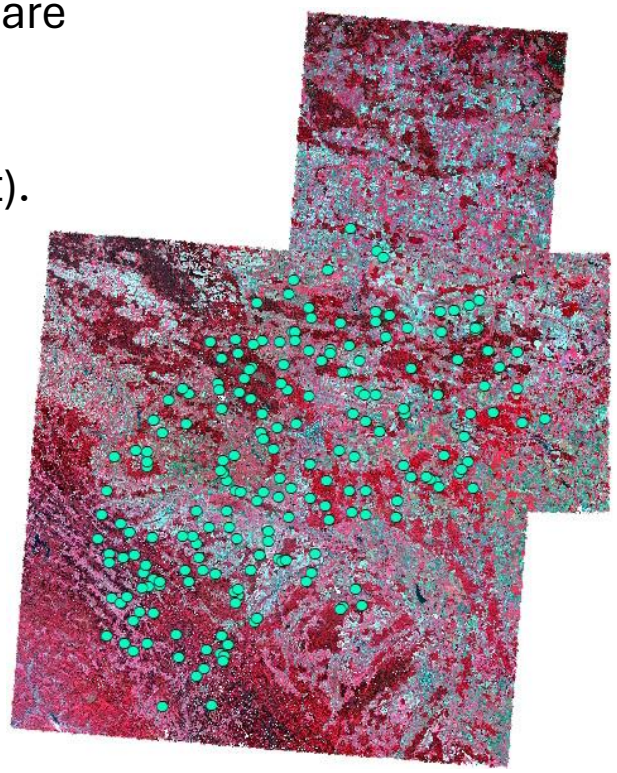
Independent verification

Rules for Forest/Nonforest verification:
- Forest;
- Forest above 30% (at least 30% of the square occupied by forest);
- Forest less than 30% (less than 30% of the square occupied by forest);
- Non-forest;
- Tree not forest (a tree that is not part of a forest).

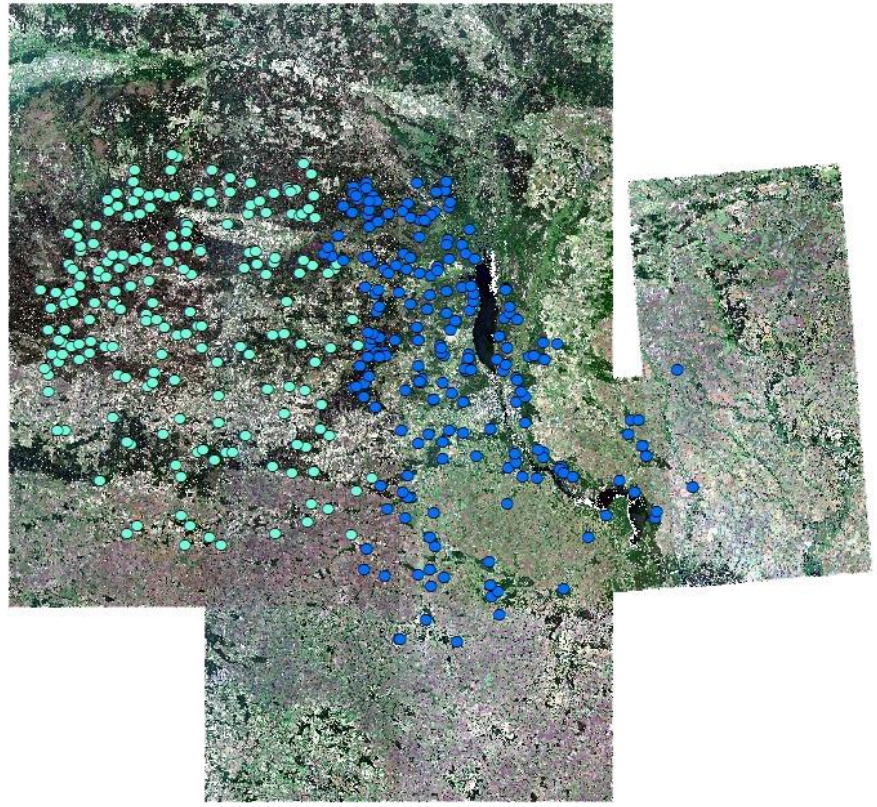
Rules for Broadleaved/Coniferous verification:
- Broadleaved;
- Coniferous;
- Mixed – by the prevailing occupation?

CIR mosaic + Google Earth with time series images!

Random polygons for the independent verification



CIR mosaic



RGB mosaic

Independent verification

Disadvantages of the Independent verification:

Mosaic creation:

Independent verification

Disadvantages of the Independent verification:

Mixed forest:

Independent verification

Disadvantages of the Independent verification:

Time series data

Independent verification

Disadvantages of the Independent verification:

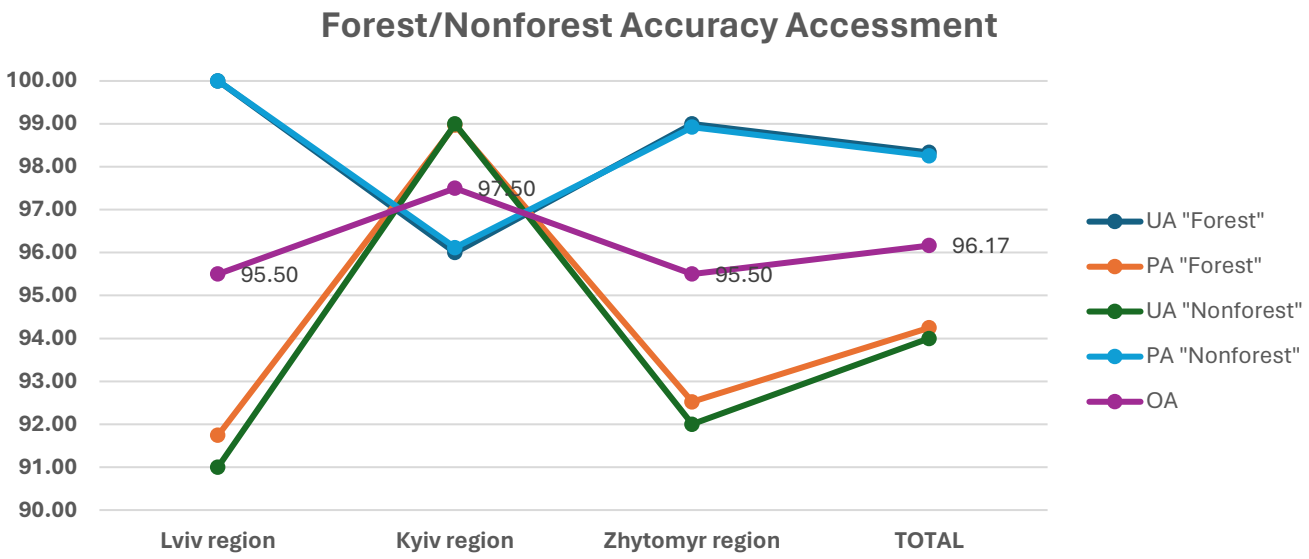
Abandoned areas

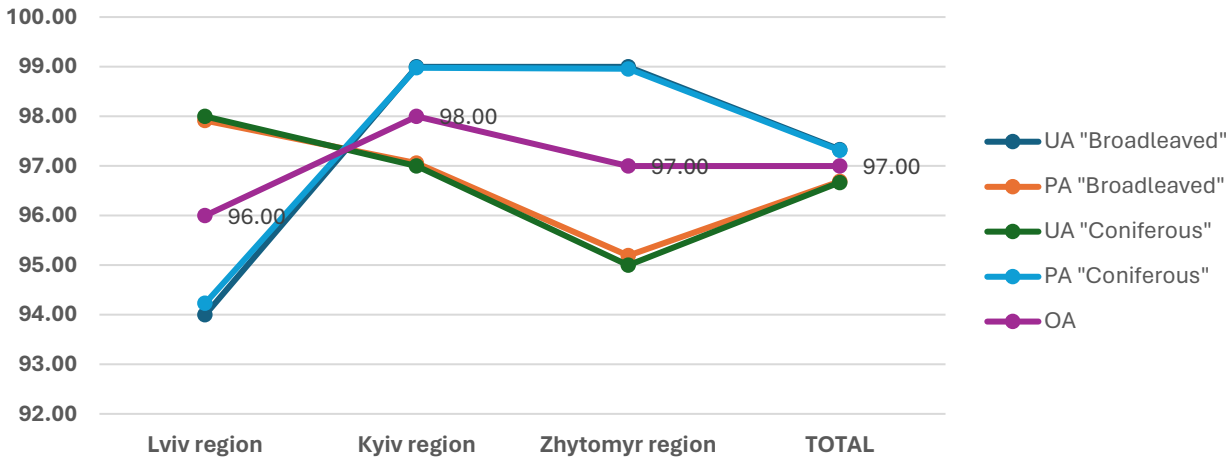
Independent verification

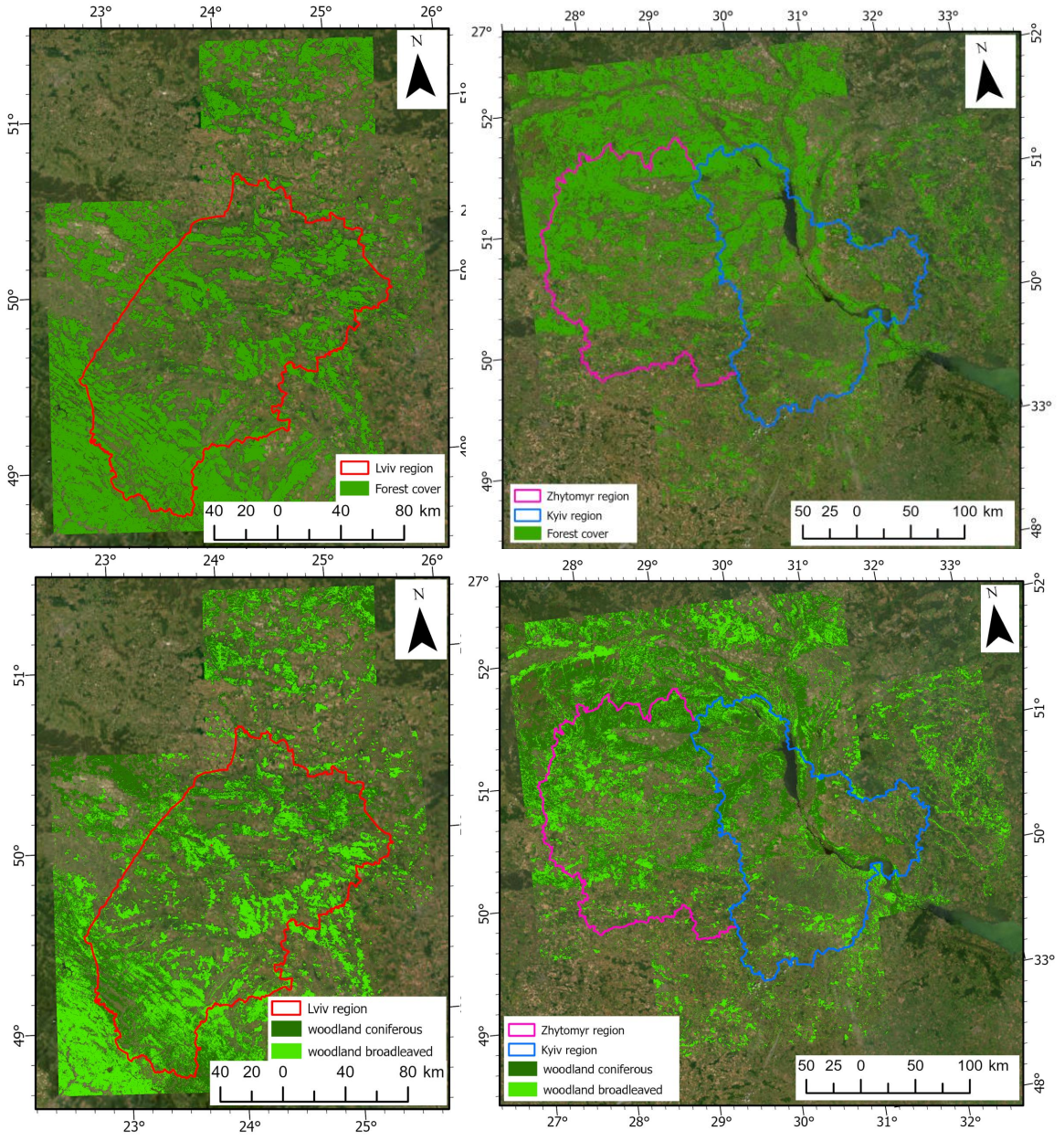
Disadvantages of the Independent verification:

Accuracy of the geometric correction

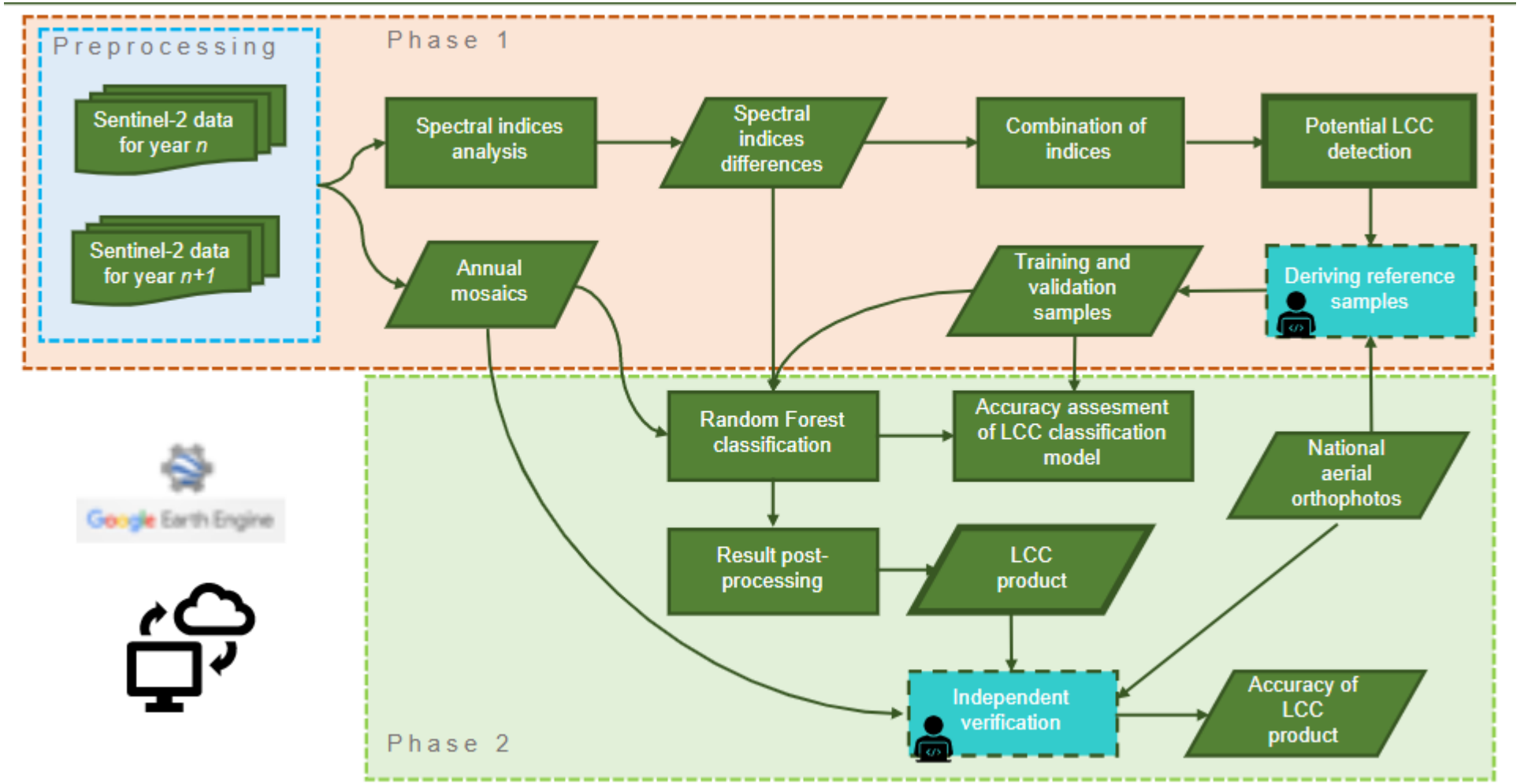
Independent verification







Land cover change analysis



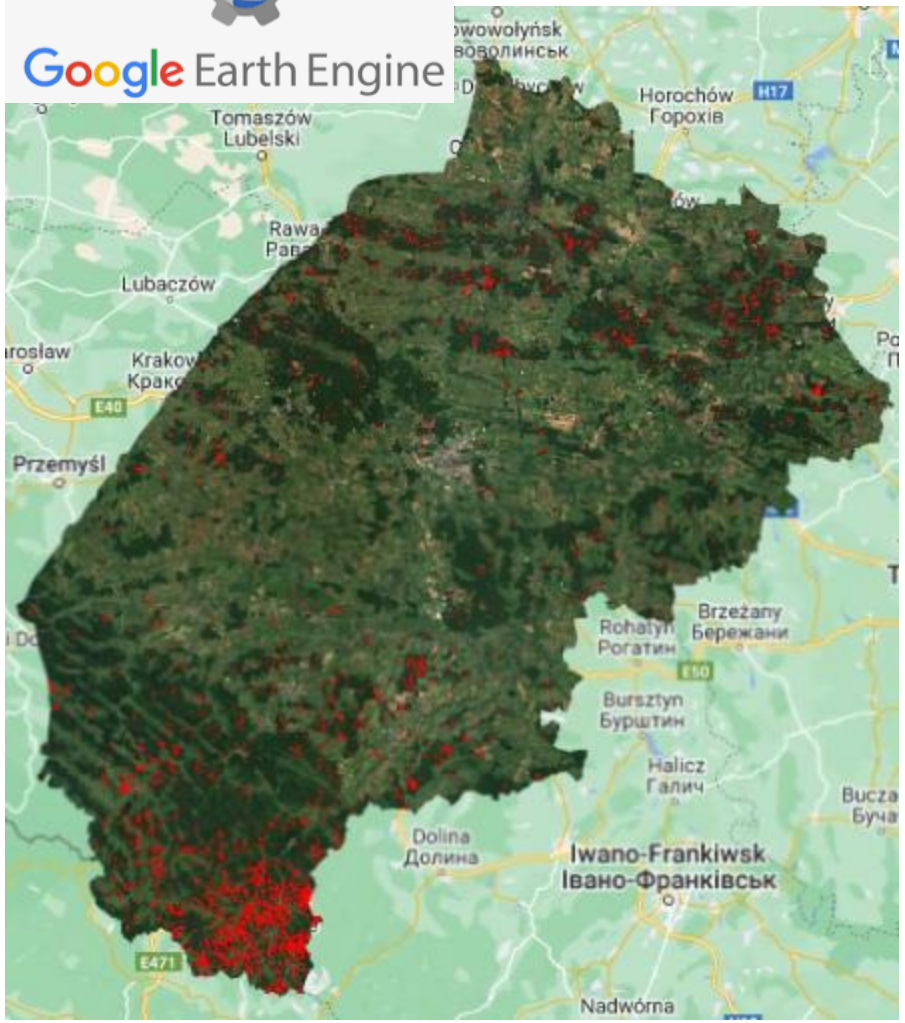
Forest change detection

Based on the tuning land cover change detection algorithm developed within InCoNaDa project:

- Data: a time series of Sentinel-2 images acquired in the growing season from June to August over the period 2020-2022.
- Method: the analysis of a combination of spectral indices and the application of Random Forest algorithm to classify the changes within the forest into three change type classes:

  1 – forest (no-change), 2 – change-clearcutting, 3 – change-burnt area.

- Model developed for Kyiv region for period 2020-2021 (OA=0.98, Kappa=0.97) and then transfer for other regions (Zhytomyr, Lviv) and the period 2021-2022.

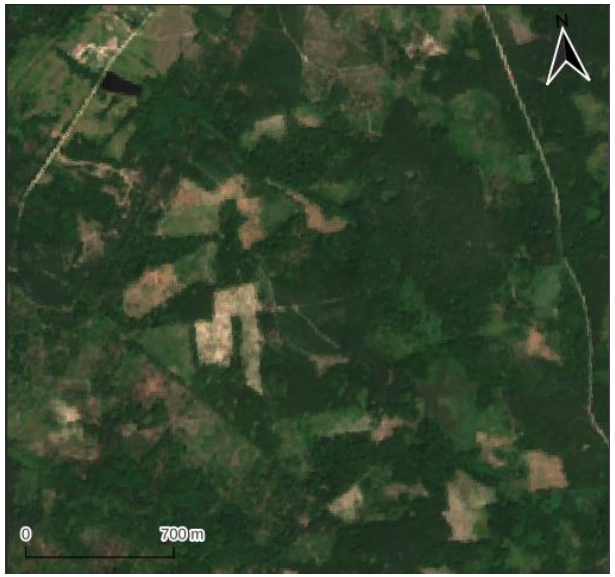


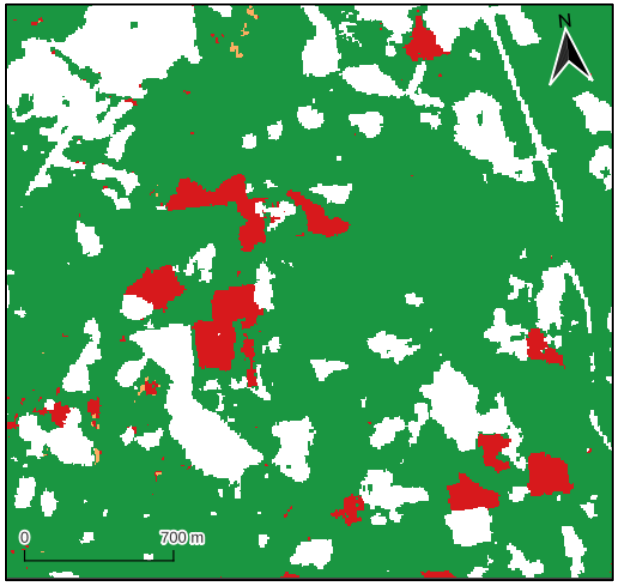
Forest changes 2020-2022 based on Sentinel-2 data

Forest change analysis

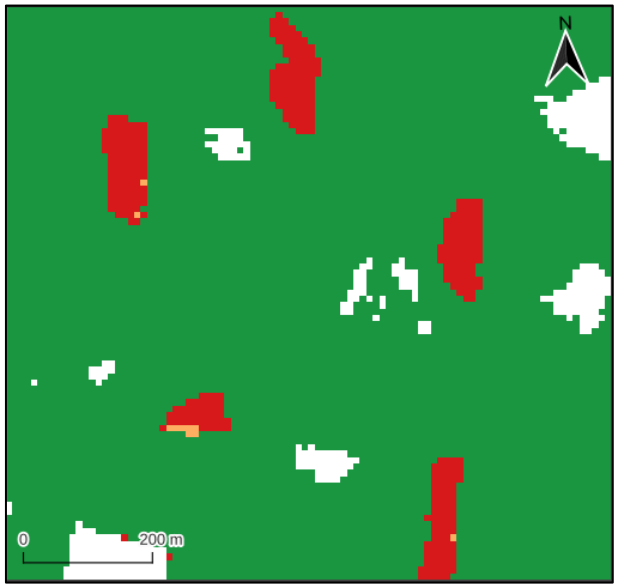
Forest changes 2020-2021
based on Sentinel-2 data

Example of forest changes



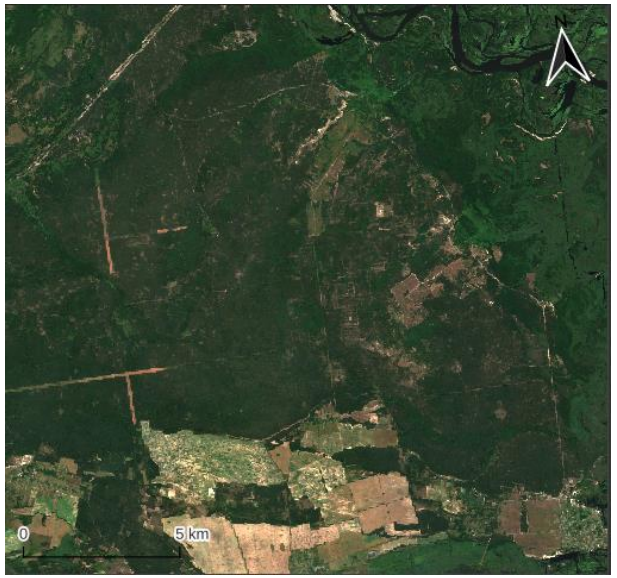


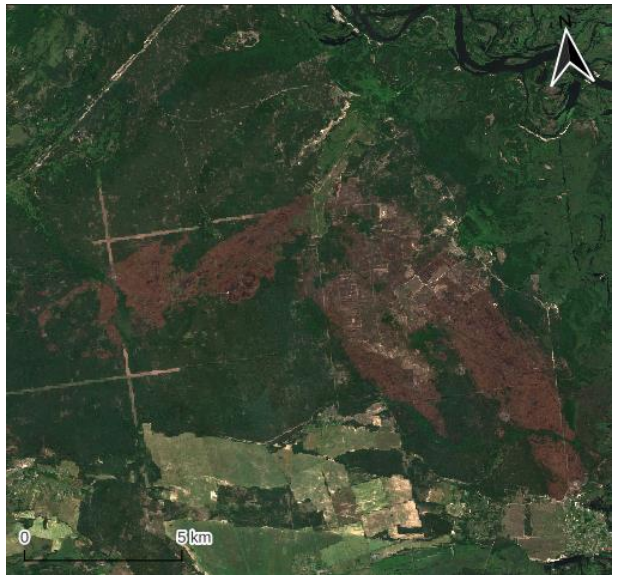
Zhytomyr region 2021-2022

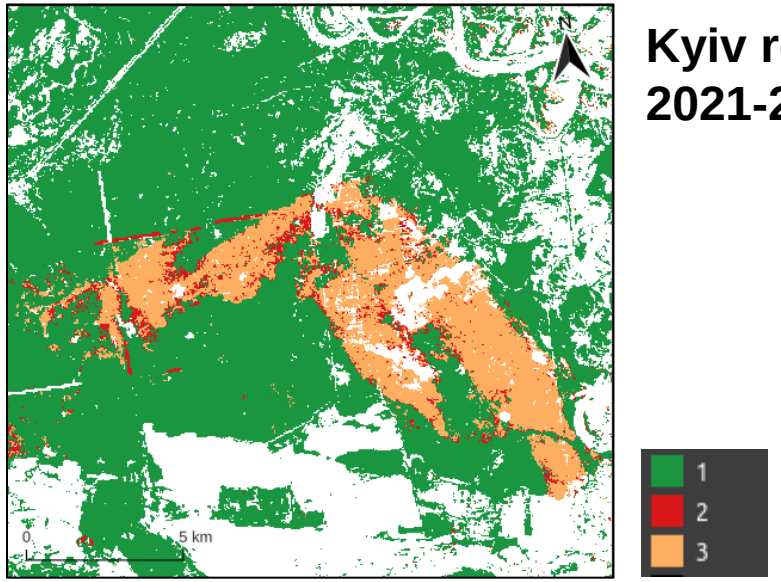


Lviv region 2020-2021

Example of forest changes







Kyiv region
2021-2022

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Thank you

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