



Imperviousness Density 2021 (raster 10 m), Europe, 3-yearly, Jun. 2025

The Imperviousness Density (IMD) 2021 layer is part of the High Resolution Layer (HRL) Imperviousness and contains the approximate density of artificial sealing per pixel (range: 0-100%) for the reference year 2021 as derived from Sentinel-2 image time series. The production of the HRL Imperviousness is coordinated by EEA in the frame of Copernicus, the Earth observation component of the European Union's Space programme.

The product is a raster dataset with 10-meter grid spacing (spatial resolution) that covers the 38 Eionet member and cooperating countries as well as the United Kingdom (i.e. EEA38+UK). It is distributed as 100 x 100 km tiles that are fully conformant with the EEA reference grid.

Simple

Identification info

Date (Creation)	2025-05-01
Date (Publication)	2025-08-01
Edition	01.00
Citation identifier	copernicus_r_3035_10_m_imd-2021_p_v01_r00
Citation identifier	DAT-14-en

Identifier

Code	10.2909/34ef6334-d432-4041-a3da-67e156d6501d
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Point of contact	Organisation	Individual	Electronic mail address	Website	Role
	European Commission				https://commission.europa.eu
Copernicus Land Monitoring Service			JRC-Copernicus-Land@ec.europa.eu	https://land.copernicus.eu	Custodian
European Environment Agency			sdi@eea.europa.eu	http://www.eea.europa.eu	Publisher
Copernicus Land Monitoring Service helpdesk			JRC-Copernicus-Land@ec.europa.eu	https://land.copernicus.eu/en/contact-service-helpdesk	Point of contact

Spatial representation type	Grid
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Spatial resolution

Spatial resolution	10 m
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Topic category	<ul style="list-style-type: none"> Environment Imagery base maps earth cover
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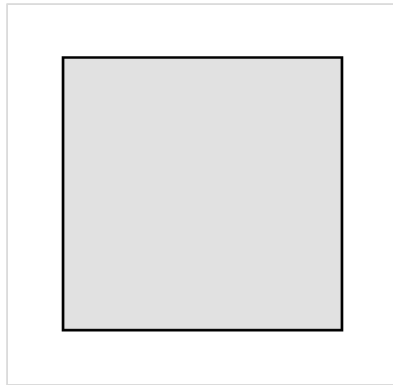
Extent

Temporal extent

Time period

2021-01-01 2021-12-31

Extent



Maintenance and update frequency	Continual
GEMET - INSPIRE themes, version 1.0	<ul style="list-style-type: none"> • Land cover • Land use
Continents, countries, sea regions of the world.	<ul style="list-style-type: none"> • EEA38 (from 2020) • United Kingdom
GEMET	<ul style="list-style-type: none"> • urban area • soil surface sealing • landscape alteration • built environment • sealing • built-up area • land use • land cover
Spatial scope	<ul style="list-style-type: none"> • European
EEA topics	<ul style="list-style-type: none"> • Land use • Buildings and construction • Soil

Resource constraints

Access constraints	Other restrictions
Other constraints	no limitations to public access

Resource constraints

Use constraints	Other restrictions
Other constraints	<p>The Copernicus component is governed by Regulation (EU) No 2021/696 of the European Parliament and of the Council of 28 April 2021 establishing the Union Space Programme and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013 and (EU) No 377/2014 and Decision No 541/2014/EU. Within the Copernicus component, a portfolio of land monitoring activities has been delegated by the European Union to the European Environment Agency (EEA) and the DG Joint Research Centre of the European Commission.</p> <p>The Copernicus land monitoring products and services are made available on a principle of full, open and free access, as established by the Commission Delegated Regulation (EU) No 1159/2013 of 12 July 2013.</p> <p>Free, full and open access to the products and services of the Copernicus Land Monitoring Service is made on the conditions that:</p> <ol style="list-style-type: none"> 1. When distributing or communicating Copernicus Land Monitoring Service products and services (data, software scripts, web services, user and methodological documentation and similar) to the public, users shall inform the public of the source of these products and services.

2. Where the Copernicus Land Monitoring Service products and services have been adapted or modified by the user, the user shall clearly state this.

3. Users shall make sure not to convey the impression to the public that the user's activities are officially endorsed by the European Union.

Language	English
Character encoding	UTF8
Additional Information	Pixel codes: 0: All non-impervious areas 1-100: 1-100% Imperviousness Density 255: Outside area

Distribution Information

Distribution format	<ul style="list-style-type: none">GeoTIFF
OnLine resource	WEKEO Portal Download (requires authentication)
OnLine resource	HRL_NVLCC_IMD_10m CLMS_NVLCC_IMD_S2021_R10m
OnLine resource	Product Information & Technical Documentation
OnLine resource	

Data quality info

Hierarchy level	Dataset
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Report

Result

Title	Commission Regulation (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services
Date (Publication)	2010-12-08
Explanation	See the referenced specification

Resource lineage

Statement	Input data: Copernicus Sentinel-2 imagery (L2A) acquired from January to December for the reference year 2021. Pre-processing: A data reduction algorithm was applied on of the Sentinel-2 time-series to obtain a set of band quantiles. Additionally, a combination of polynomial and harmonic functions were fitted to the time-series of Normalized Difference Vegetation Index (NDVI) to derive harmonic coefficients. Training data: Sentinel-2 quantiles 2018, Imperviousness Density 2018 and CLCplus Backbone 2018 were used for model training.
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Classification and prediction:

A modified deep convolutional neural network (CNN) called U-Net was trained. The trained model was applied to the Sentinel-2 harmonics and quantiles input to predict raw Imperviousness Densities for the reference year 2021. From these predictions, areas with Imperviousness Density values greater than 90 were extracted and combined with the sealed areas (class 1) of the CLCplus Backbone 2021 layer to create a binary mask of the impervious outline for reference year 2021. The usage of this sealing mask significantly enhanced the level of detail in the impervious surface outline.

Post-processing:

Steps applied comprise: 1) Calibration using data for the reference years 2018 (Imperviousness Density, CLCplus Backbone and NDVI harmonics) and 2021 (NDVI harmonics) and 2) re-calculation of the final Imperviousness Density values on the impervious pixels (class 1) of the sealing mask for 2021.

Changes to previous release (2018):

- Introduction of a new production system and algorithm (U-Net CNN).
- Reduction of in-situ data dependency for dataset production.
- First Impervious Built-up Change (IBUC) layer (2018-2021).

Hierarchy level

Dataset

Reference System Information

Reference System Information

Code

[EPSG:3035](#)

Reference System Information

Reference System Information

Code

[EPSG:32740](#)

Reference System Information

Reference System Information

Code

[EPSG:32738](#)

Reference System Information

Reference System Information

Code

[EPSG:32620](#)

Reference System Information

Reference System Information

Code

[EPSG:32622](#)

Maintenance and update frequency

Metadata

Metadata identifier

34ef6334-d432-4041-a3da-67e156d6501d

Language

English

Character encoding

UTF8

Contact

Organisation

Individual

Electronic
mail address
Website Role

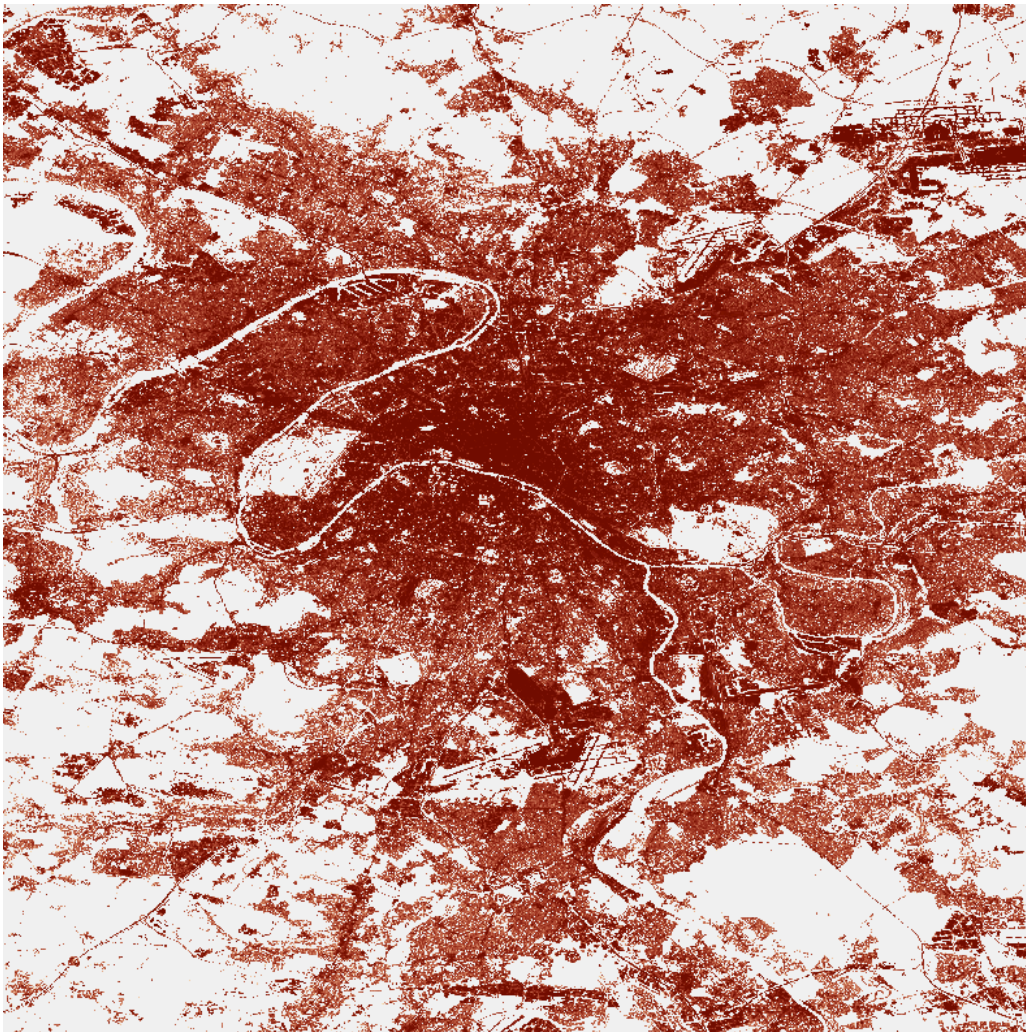
Type of resource

Resource type	Dataset
Metadata linkage	https://doi.org/10.2909/34ef6334-d432-4041-a3da-67e156d6501d
Date info (Creation)	2025-02-07T15:25:28.516994Z
Date info (Revision)	2026-06-09T08:08:54.654765Z

Metadata standard

Title	ISO 19115/19139
Edition	1.0

Overviews



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