

# Global Human Settlement Layer Understanding Human Presence on Planet Earth

Science based information on population and human settlements to support informed policy decisions

The European Commission's science and knowledge service Joint Research Centre

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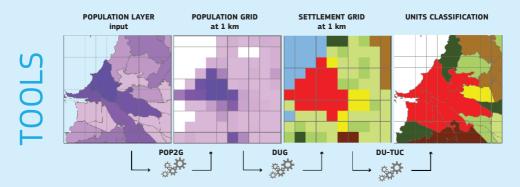
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# The Global Human Settlement Layer (GHSL) produces data and tools to map and monitor people, built-up areas and settlements for the planet Earth

Input Data **GHS Products** Satellite imagery **GHS-BUILT** References GHS-SMOD i i i i i i i Census data

Since 2011, the GHSL project has been transforming Earth observation (EO) data into accepted global statistics on global human settlements and population. Automatically processed EO data are combined with population census and other economic data. The open and free GHSL data range from global datasets (the GHSL Data Package 2019) to pan-European built-up layers (the European Settlement Map) and analytical data (the Urban Centre Database)



GHSL Tools are specifically designed to be applied in cascade to facilitate the application of the Degree of Urbanisation method to any census data or population grid. The suite currently includes tools for the application of the Degree of Urbanisation, the extraction of features from EO data, and GIS analysis

DATA

The Degree of Urbanisation is jointly developed by the European Commission, COM, OECD, The World Bank, FAO ILO, UN Habitat to delineate urban and rural areas for international comparison





The United Nations Statistical Commission has endorsed in 2020 the Degree of Urbanisation method based on GHSL data

The Degree of Urbanisation is used to generate indicators including those for the Sustainable Development Goals (SDGs)















GHSL data contribute to the Human Planet Initiative (HPI) under the Group on Earth Observation (GEO).

The HPI supports novel, evidence-based assessment of the human presence on the planet Earth

A core deliverable of GHSL and HPI is the Atlas of the Human Planet. With annually changing topics, it illustrates progress in our understanding of human presence and impact. The past Atlases show that:



The built environment has doubled during 1975–2015



Most of the world's population growth occurs in hazard prone areas



Planet Earth hosts more than 10,000 cities with more than 50,000 inhabitants



Urbanisation dynamics varies across the globe and occur at different speeds



GHSL layers are used by an increasing number of scientist and practitioners to understand societal processes at all scales



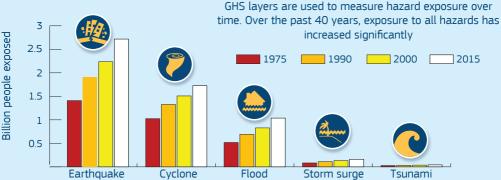
### Disaster Risk Management Applications

The different phases of the disaster cycle require detailed knowledge about the presence of population, settlements and infrastructure assets. The GHSL data were developed to meet these needs and support applications along the whole disaster risk management cycle.

Diseases affect people differently depending on the type of settlement they are living in



Post-disaster crisis
management requires precise
information on the affected
population and settlements.
GHS layers are used for
generating initial impact and
disaster assessments, and also for tasking
post-disaster satellite image acquisition used for
rehabilitation and reconstruction





UN World Conference on Disaster Risk Reduction 2015 Sendai Japan The Sendai Framework for Disaster Risk Reduction is the chief international agreement on Disaster Risk Reduction. GHSL data support crisis management and disaster response. Built-up area and population are two essential societal variables for understanding exposure of people and human settlements to natural and man-made disasters



## **Urbanisation Applications**

Urban areas host the majority of the global population, and this proportion continues to grow everywhere. Urbanisation is one of the current societal megatrends. Over the last decades, the increase of the urban population share and the physical expansion of urban areas have changed the landscape in many parts of the globe. New technologies and datasets – such as GHSL – help to improve the collective understanding of the process of urbanisation.

#### Rural area



Child mortality rate is higher in rural areas across all regions of the world

# Towns and semi-dense areas



Well-being in towns and semi-dense areas is higher than in rural areas but

lower compared to cities. On average 17% of respondents were satisfied with life

#### Cities



Access to internet is primarily determined by income classes but

in cities it is always higher than in other settlements







Africa is among the most urbanised and fast urbanising regions of the world

Urban population doubled in 2015 compared to 1990

2x
urban
population



30 countries in Africa

Less urbanised and urbanising faster than global average



Sustainable Development Goal 11 (SDG 11) is the thematic goal within the SDG framework to "Make cities and human settlements inclusive, safe, resilient and sustainable". Information on where people are and how they live is key to make progress on this goal.

The New Urban Agenda serves as a guideline for urban development for the next twenty years. The GHSL provides thematic variables for all 10,000 urban centres on Earth.





# **Development Applications**

Data and knowledge for development are a key priority for global organisations and donors. Knowing where people are, how they live, and which place-based policies are most needed would help to make the transition towards sustainable development more effective. The GHSL data provide essential information on population and the built environment. The Degree of Urbanisation helps policy-making to provide a harmonised definition of cities, and urban and rural areas. GHSL data are being utilized to measure a number of the SDG indicators apart from SDG 11.

The JRC has developed a dataset to study net migration at high spatial resolution





The income of a country shapes the relationship between spatial expansion and population growth of human settlements

Population grids help to plan electrification infrastructure in developing countries





The Sustainable Development Goals are a set of 17 interlinked global goals to achieve a better and more sustainable future for all by 2030. The Degree of Urbanisation upscaled to the globe thanks to GHSL data, is essential for harmonising data collection and for making urban / rural statistical comparison possible.



# Environmental and Sustainability Applications

Climate change and environmental degradation are existential threats to Europe and the world. The European Green Deal is Europe's new growth strategy aiming to transform the Union into a modern, resource-efficient and competitive economy with zero net greenhouse emission and the preservation of the Earth's natural capital. The implementation of the European Green Deal requires regular updates on the use of Earth's resources, including updates on the use of the land transformed by urbanization and updates on the demand of resources needed to sustain cities and settlements.

Mountain areas host 14% of the world population. Between 1990 and 2015, the world mountain population increased by nearly 300 million





One third of global anthropogenic emissions is emitted in urban centres

Urban centres in Europe and in most parts of the globe are getting greener





GHSL data coupled with the Emission Database for Global Atmospheric Research (EDGAR) helps scientists and policymakers to keep track of emission trajectories in cities.



The European Green Deal is Europe's plan to make the EU's economy sustainable, and climate neutral by 2050.

# Copernicus: Europe's eyes on Earth

Copernicus is the EU's Earth observation (EO) programme, looking at our planet and its environment for the of benefit all European citizens. It offers information services that draw from satellite EO and in-situ (non-space) data.

Vast amounts of global data from satellites and ground-based, airborne, and seaborne measurement systems provide information to help service providers, public authorities, and other international organisations to improve European citizens' quality of life. The information services that are provided are free and openly accessible to users.

### GHSL 2021: A new data suite based on Copernicus satellite data

The 2021 release of GHSL data leverages Copernicus Sentinel-2 data. The combined improvement in temporal span and higher resolution allows the mapping of small hamlets that were previously overlooked, and of new expansion areas that were not captured in datasets that are a few years old. The GHS-BUILT product (built-up area grid) is a 10 metres resolution built-up density map with residential and non-residential characterisation. The annual grids derived from the year 2018 are projected for the year 2020, and back-casted by integrating Landsat input for the epochs: 2000, 1990, and 1975. The improvements to the GHS-BUILT also benefit GHS-POP (population grid) that is improved with a new model to estimate population time-series.



The Sentinel-2 satellite imagery at 10 metres resolution improves the accuracy of built-up area maps and detects many more settlements along the urban-rural continuum.

An improved model to back-cast population counts in small census units is applied to CIESIN's Gridded Population of the World (GPW) Dataset to obtain a more accurate time series of resident population for the period 1975-2020 along with annually interpolated grids



From 2022, the new Exposure Mapping component of Copernicus Emergency Management Service (EMS) will produce annual updates of the global built-up area and population data sets of GHSL

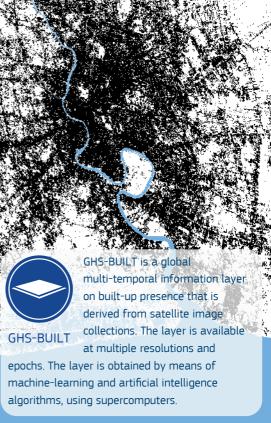


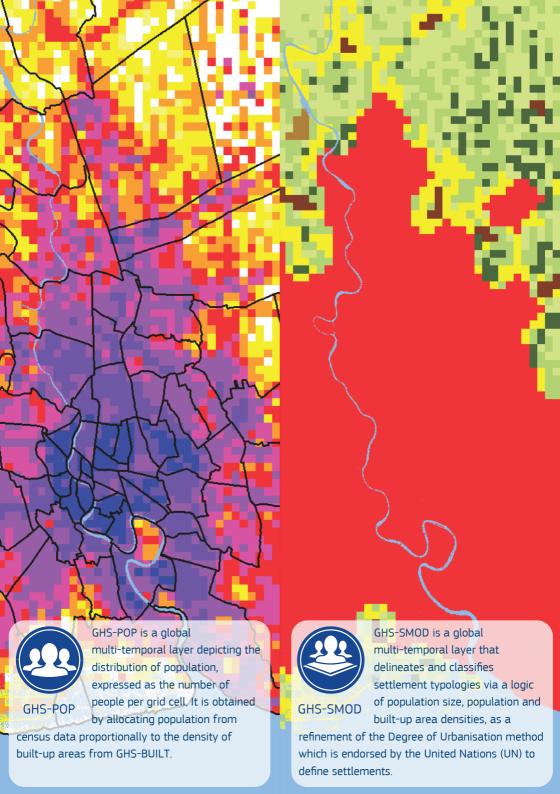
Sentinel-2

GHS
Composite-52

GHS-composite-52 is a global, cloud-free, pixel-based composite created from the Sentinel-2 data archive for the year 2017-2018, with a spatial resolution of 10 metres. This dataset was used as

the core input data for updating the GHS-BUILT Global Human Settlement Layer.







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