

Documentation for the  
GHS population grid, derived from GPW4, multitemporal  
(1975, 1990, 2000, 2015) (GHS-POP)

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**Abstract**

This document outlines the basic methodology and data sets used to construct the Global Human Settlement Layer (GHSL) Population Grid (GHS-POP), referred to as the GHS\_POP\_GPW4\_GLOBE\_R2015A data collection, along with use cases, limitations, and use constraints.

**Data set citation:**

European Commission, Joint Research Centre (JRC); Columbia University, Center for International Earth Science Information Network - CIESIN (2015): GHS population grid, derived from GPW4, multitemporal (1975, 1990, 2000, 2015). European Commission, Joint Research Centre (JRC) [Dataset] PID: [http://data.europa.eu/89h/jrc-ghsl-ghs\\_pop\\_gpw4\\_globe\\_r2015a](http://data.europa.eu/89h/jrc-ghsl-ghs_pop_gpw4_globe_r2015a)

The data are available from the GHSL - Global Human Settlement Layer web page:  
<http://ghslsys.jrc.ec.europa.eu/data.php>  
[http://ghslsys.jrc.ec.europa.eu/ghs\\_pop.php](http://ghslsys.jrc.ec.europa.eu/ghs_pop.php)

and from the JRC Data Catalogue:  
[http://data.jrc.ec.europa.eu/dataset/jrc-ghsl-ghs\\_pop\\_gpw4\\_globe\\_r2015a](http://data.jrc.ec.europa.eu/dataset/jrc-ghsl-ghs_pop_gpw4_globe_r2015a)

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We appreciate feedback regarding this data set, such as suggestions, discovery of errors, difficulties in using the data, and format preferences. Please contact:

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## **I. Introduction**

The GHS-POP data packages belong to the family of GHSL products. The Global Human Settlement Layer (GHSL) project is supported by European Commission, Joint Research Centre and Directorate-General for Regional and Urban Policy. The GHSL produces new global spatial information, evidence-based analytics, and knowledge describing the human presence in the planet.

The GHS population grids depict the worldwide distribution and density of residence-based population, expressed as the number of people per 250-m cell. Multitemporal population grids for 1975, 1990, 2000 and 2015 were produced by combining best-available population estimates for 1975, 1990, 2000 and 2015, with best-available assessment of the spatial extents of human settlements as inferred from Landsat satellite data for same periods. Using a dasymetric mapping approach, UN-adjusted population counts for those epochs were disaggregated to mapped built-up areas from GHSL.

## **II. Data and Methodology**

The production of GHS-POP population grids are based on methods developed at JRC-EC, within the framework of the Global Human Settlement Layer (GHSL) project.

A detailed description of the methods for GHS\_POP\_GPW4\_GLOBE\_R2015A can be found in Freire et al. (2016).

### **Input data**

#### *Census Data*

Residential population estimates (number of inhabitants) for target years 1975, 1990, 2000 and 2015 were provided by CIESIN GPWv4 based on census counts and reporting units. National-level population estimates for 1975, 1990, 2000, and 2015 were adjusted to the estimates of the United Nation's World Population Prospects: The 2015 Revision (United Nations, 2015). The medium-variant projections were used for these calculations. For more details, refer to the GPWv4 documentation and metadata and to Doxsey-Whitfield et al., 2015.

#### *Built-up areas*

Distribution and density of built-up was mapped in the Global Human Settlement Layer (GHSL) global layer per corresponding epoch (GHS\_BUILT\_LDSMT\_GLOBE\_R2015B).

These GHSL layers are available at:

[http://ghslsys.jrc.ec.europa.eu/ghs\\_bu.php](http://ghslsys.jrc.ec.europa.eu/ghs_bu.php)

[http://data.jrc.ec.europa.eu/dataset/jrc-ghsl-ghs\\_built\\_ldsmt\\_globe\\_r2015b](http://data.jrc.ec.europa.eu/dataset/jrc-ghsl-ghs_built_ldsmt_globe_r2015b)

## **Methods**

The GHS-POP data sets are produced with methods developed by the GHSL team. Residential population estimates for target years 1975, 1990, 2000 and 2015 provided by CIESIN GPWv4 were disaggregated from census or administrative units to grid cells, informed by the distribution and density of built-up as mapped in the Global Human Settlement Layer (GHSL) global layer per corresponding epoch.

The population disaggregation approach is based on raster-based dasymetric mapping relying on built-up density (BU) from GHS-BUILT as proxy to restrict and refine the distribution of people and inform on the respective density (Freire et al., 2016). For each period, population grids were produced following a clear volume-preserving dasymetric mapping approach: given a census layer and a GHS-BUILT raster layer, for a populated polygon (source zone),

- a) if the polygon generates 250 m cells and contains BU, disaggregate the population in proportion to density of BU;
- b) if the polygon generates 250 m cells and does not contain BU, disaggregate population using areal weighting;
- c) if the polygon does not generate its own 250 m cell, convert polygon to point (centroid within), sum all points within a cell, and sum to mosaic of a) and b)

Quality control was conducted to ensure that all input population was gridded and totals were preserved. 2015 GHS-POP grid was benchmarked using official GEOSTAT 2011 data set which reports resident population counts from 2011 censuses for 18 European countries. After aggregating the 2015 GHS-POP to the same vector 1-km populated cells ( $n = 1,111,646$ ), correlation analysis was performed, yielding  $r = 0.83$ .

## **III. Data Set Description**

The Population Count at 250 m, R2015A (1975, 1990, 2000, 2015) data sets are available at [http://ghslsys.jrc.ec.europa.eu/ghs\\_pop.php](http://ghslsys.jrc.ec.europa.eu/ghs_pop.php)

### **Data set description:**

The population count grids consist of estimates of the number of persons per 250-m grid cell for each of the four target years: 1975, 1990, 2000, 2015, adjusted to match the 2015 revision of the UN World Population Prospects national population estimates, for each of the four target years: 1975, 1990, 2000, 2015. Coordinate System is World Mollweide (EPSG:54009)

### **Data set web page:**

[http://ghslsys.jrc.ec.europa.eu/ghs\\_pop.php](http://ghslsys.jrc.ec.europa.eu/ghs_pop.php)

**Data set format:**

The files for this data set are available as global grids in GeoTiff format. Each downloadable is a compressed zip file, which contains: 1) the global GeoTiff for the year of estimate, 2) PDF documentation.

**Data set downloads:**

GHS\_POP\_GPW41975\_GLOBE\_R2015A\_54009\_250 (280 MB)  
GHS\_POP\_GPW41990\_GLOBE\_R2015A\_54009\_250 (787 MB)  
GHS\_POP\_GPW42000\_GLOBE\_R2015A\_54009\_250 (824MB)  
GHS\_POP\_GPW42015\_GLOBE\_R2015A\_54009\_250 (1.1 GB)

## **IV. Limitations**

Inconsistencies in input census data were identified in Egypt and Poland.

The population grid for 1975 is less reliable at the pixel level due to the combination of uncertainties in hindcasting population estimates for small census units and limitations in detection and mapping of built-up areas for that epoch.

Due to limitations and uncertainties in source data, scale, and methods, multitemporal analyses for individual grid cells is strongly discouraged.

## **V. Acknowledgments**

GHS-POP R2015A grids were produced in the frame of the Global Human Settlement Layer (GHSL) project by the European Commission, Joint Research Centre, during 2015, in Ispra, Italy.

Census-based population estimates for the target years were provided by the Center for International Earth Science Information Network (CIESIN) of Columbia University, from Gridded Population of the World, Version 4 (GPWv4).

Funding for development and dissemination of this data set was provided by the European Commission.

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## **VIII. Recommended Citation(s)**

### **Data set:**

European Commission, Joint Research Centre (JRC); Columbia University, Center for International Earth Science Information Network - CIESIN (2015): GHS population grid, derived from GPW4, multitemporal (1975, 1990, 2000, 2015). European Commission, Joint Research Centre (JRC) [Dataset] PID: [http://data.europa.eu/89h/jrc-ghsl-ghs\\_pop\\_gpw4\\_globe\\_r2015a](http://data.europa.eu/89h/jrc-ghsl-ghs_pop_gpw4_globe_r2015a)  
Accessed DAY MONTH YEAR.

### **Scientific publication:**

Freire S, MacManus K., Pesaresi M, Doxsey-Whitfield E., Mills J., 2016. Development of new open and free multi-temporal global population grids at 250 m resolution. Proceedings of the 19th AGILE Conference on Geographic Information Science. Helsinki, Finland, June 14-17, 2016.  
[https://agile-online.org/conference\\_paper/cds/agile\\_2016/shortpapers/152\\_Paper\\_in\\_PDF.pdf](https://agile-online.org/conference_paper/cds/agile_2016/shortpapers/152_Paper_in_PDF.pdf)

## **IX. Source Code**

Please contact GHSL team at [ghsl-data@jrc.ec.europa.eu](mailto:ghsl-data@jrc.ec.europa.eu) for information about the code used to develop the data sets.

## **X. References**

Center for International Earth Science Information Network - CIESIN - Columbia University. 2015. Gridded Population of the World, Version 4 (GPWv4): Population Count Adjusted to Match 2015 Revision of UN WPP Country Totals. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).

Doxsey-Whitfield, E., K. MacManus, S.B. Adamo, L. Pistoiesi, J. Squires, O. Borkovska and S.R. Baptista. 2015. Taking Advantage of the Improved Availability of Census Data: A First Look at the Gridded Population of the World, Version 4. *Papers in Applied Geography* 1(3): 1-9. <http://dx.doi.org/10.1080/23754931.2015.1014272>.

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