Release Statement

Gridded 2025 Population Estimates for countries in Sub-Saharan Africa, spatially constrained to GRID3 Settlement Extents

8 December 2025

Abstract

This data release provides gridded population estimates (spatial resolution of 3 arc-seconds, approximately 100-metre grid cells) for 52 countries in sub-Saharan Africa (Annex 2). The project team constrained the WorldPop Global 2025 census- and projection-based population projections of individual countries to the GRID3/CIESIN settlement extents (2024). Therefore, these model-based population estimates represent the year 2025.

This data collection was created to enable users of the GRID3 Settlement Extents v3.0 data for all countries in sub-Saharan Africa to add gridded population estimates to the extents in a fully consistent manner. Users who do not require compatibility with the GRID3 settlement extents are directed to the WorldPop Global 2015-2030 data collection [https://hub.worldpop.org/project/categories?id=3].

These data were produced by the WorldPop Research Group at the University of Southampton. This work was part of the GRID3 – Phase 2 Scaling project, with funding from the Gates Foundation (INV-044979). Project partners included GRID3 Inc, the Center for Integrated Earth System Information (CIESIN) within the Columbia Climate School at Columbia University, and WorldPop at the University of Southampton. The constrained disaggregation was done by Assane Gadiaga, KS Krishnaveni, Amy Bonnie and Attila Lazar. Project oversight and support were done by Heather Chamberlain, Maksym Bondarenko and Andy Tatem.

The authors followed rigorous procedures designed to ensure that the used data, the applied method and thus the results are appropriate and of reasonable quality. If users encounter apparent errors or misstatements, they should contact WorldPop at release@worldpop.org.

WorldPop, University of Southampton, and their sponsors offer these data on a "where is, as is" basis; do not offer an express or implied warranty of any kind; do not guarantee the quality, applicability, accuracy, reliability or completeness of any data provided; and shall not be liable for incidental, consequential, or special damages arising out of the use of any data that they offer. These data are operational population estimates and are not official government statistics.

RELEASE CONTENT

1. GRID3_SSA_population_v1.0_gridded.zip

LICENSE

SUGGESTED CITATION

Gadiaga A., Krishnaveni, KS, Bonnie, A., Chamberlain H., Bondarenko, M., Lazar A. N., Tatem A. J. 2025. Gridded 2025 population estimates for sub-Saharan Africa constrained to GRID3 settlement extents. WorldPop, University of Southampton, UK. doi: https://dx.doi.org/10.5258/SOTON/WP00851

FILE DESCRIPTIONS

The projection for all geospatial data files is the geographic coordinate system WGS84 (World Geodetic System 1984, EPSG:4326). While these data represent population counts, values contain decimals, i.e. fractions of people. For example, if four grid cells next to each other have values of 0.25 this indicates that there is estimated to be 1 person somewhere in those four grid cells.

xxx_SSApopulation_ 2025_v1_0_gridded.tif

This geotiff raster contains estimates of total population size for each approximately 100-metre grid cell (0.0008333 decimal degrees grid) across each country. The 'xxx' in the filename represents the ISO-3 country code (Appendix 2). Grid cells with values of 0 represent administrative areas where the census/estimate-based indicated no population.

Relationship to country-specific GRID3 population data sets for Democratic Republic of Congo (DRC) and Nigeria

The DRC and Nigeria estimates included as part of this collection differ from the more bespoke GRID3 estimates published for those countries. For uses limited to one or both of those countries, the more bespoke estimates are more appropriate than the estimates included in this package, because they make use of a much richer set of population input data and make use of more refined estimation methodologies. The DRC and Nigeria data included in this collection are, for the most part, only relevant for uses involving additional sub-Saharan African countries in which comparability of input data and methodologies across countries is important.

The most recent bespoke GRID3 estimates can always be found here for Nigeria (https://grid3.org/geospatial-data-nigeria) and here for DRC (https://grid3.org/geospatial-data-drc).

RELEASE HISTORY

Version 1.0 (8 December 2025)

- This is the original release of the data for dataset [doi: 10.5258/SOTON/WP00851] (as described in this release statement).

SOURCE DATA

The key datasets used to produce the gridded population estimates are:

WorldPop Global population estimates

This work utilised administrative unit level population projections and the associated boundaries and mastergrid of the WorldPop Global 2015-2030 project (Bondarenko et al., 2025).

Settlement Data

Settlement data were provided by CIESIN in the form of raster files (CIESIN, 2024). This is a composite product, harnessing information from multiple sources of gridded settlement and building footprint data (e.g. Google, Microsoft, etc). See the CIESIN documentation for more details.

We obtained two different settlement products, namely (i) settlement area, which indicates the area of all buildings whose centroid falls within a given cell, and (ii) building count, which is the number of building centroids within a given cell. For CIV, ERI, ETH, MLI, MRT, NER and NGA, the CIESIN settlement area datasets were not used in the final model.

Geospatial Covariates

The modelling utilised the WorldPop Global geospatial covariate stack (Woods et al., 2024), which are related to population density and spatial distribution. These geospatial covariates include land use and land cover data, climate variables such as temperature and rainfall, physical features and infrastructure such as roads and schools. See Appendix 1 for the list of covariates.

The CIESIN settlement data were also included in the covariate stack as model inputs. Furthermore, the model results are constrained to these settled pixels.

METHODS OVERVIEW

Projected population totals at administrative unit level were spatially-disaggregated using the Random Forest (RF)-based dasymetric mapping approach (Stevens et al., 2015), implemented in the popRF ‘R’ package (Bondarenko et al., 2021). The geospatial covariates were used in the dasymetric mapping to estimate the spatial distribution of population within each administrative unit. The gridded population outputs were spatially constrained to the CIESIN settlement extents.

As part of this process, the following additional processing steps were implemented:

- Making sure that extreme high pixel values are not estimated (>1000 people per pixel), where possible. If the population estimates were deemed too high locally

(i.e. the census projections seemed too high compared to the number of observed settled pixels), neighbouring administrative units were combined to contain more settled pixels and thus lower the localised high values.

- Detecting instances of zero people estimated per grid cell and confirming that this only occurred due to the projected population total for an administrative unit being zero. This can occur due to an area having built settlement, but no residential population recorded in the census/estimate population data (e.g. remote built structures, military zones, protected areas).

WORKS CITED

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APPENDIX 1 – list of covariates used for all model applications

(N.B. For some countries listed under the data input section, the CIESIN settlement area covariates were not used in the final model.)

Woods et al 2024:

Category	Source Dataset Name	Temporal Coverage of Covariate(s)	Covariate(s) and unit of measurement
Inland Water Mask	ESA WorldCover 10m v200	2021	Inland water coverage [%] Presence of inland water based on different thresholds of water coverage (25%, 50%, 60%, 75%, 80%, 85% and 90%) [binary] Distance to inland water [km] Distance to open-water coastline [km]
Topography	MERIT DEM	~2007	MERIT-based Elevation [m] MERIT-based Slope [°]
Climate	Terra MODIS LST	2015-2023 (time series)	Annual Mean Surface Temperature [Kelvin]
	TerraClimate	2015-2023 (time series)	Annual Mean Precipitation (scaling factor 10) [mm]
Nighttime Lights	VIIRS NTL 2.1	2015 – 2021 (time series)	Night time lights, flares/volcanoes filtered [nW/cm2/sr]
	VIIRS NTL 2.2	2022-2023 (time series)	Night time lights, not flares/volcanoes filtered [nW/cm2/sr]
Land Cover	ESA CCI Land Cover v2.0.7	2015	Distance to cultivated area edges (reclassified class 11) [km] Distance to woody-tree area edges (reclassified class 40) [km] Distance to shrub area edges (reclassified class 130) [km] Distance to herbaceous area edges (reclassified class 140) [km] Distance to sparse vegetation area edge (reclassified class 150) [km] Distance to aquatic vegetation area edges (reclassified class 160) [km] Distance to artificial surface area edges (reclassified class 190) [km] Distance to bare area edges (reclassified class 200) [km] Distance to Water, Snow and Ice (reclassified class 210) [km]
	ESA CCI Land Cover v2.1.1	2016-2022 (time series)	
Protected Areas	World Database of Protected Areas (WDPA)	2015-2022 (time series)	Distance to IUCN strict nature reserve and wilderness area edges [km] Distances to IUCN national park, national monument, habitat species management, protected landscape/seascape and managed resource protected area edges [km]
Infrastructure	OpenStreetMap (OSM)	2023	Distance to OSM major roads [km] Distance to OSM major road intersections [km] Distance to OSM waterbodies [km]
	Microsoft Roads Detection	2021	Count of Microsoft Roads Presence of Microsoft Roads [binary] Microsoft Roads Density Distance to Microsoft Roads [km] Total length of Microsoft Roads [m]
Built-up Area	Global Human Settlement Layer (GHSL) BUILT-S	2025	Distance to Built-up Surface [km]
	JRC Global Human Settlement Layer (GHSL) BUILT-V	2015, 2020, 2025, 2030	Built-up Volume [m^3]

CIESIN (2024):

Settlement extent	Building count	2024	Count of buildings [count]
	Building area	2024	Building area of buildings whose centroids are in the grid cell [m^2]

APPENDIX 2 – list of countries included in this dataset

ISO-3 code	Name
AGO	Angola
BDI	Burundi
BEN	Benin
BFA	Burkina Faso
BWA	Botswana
CAF	Central African Republic
CIV	Côte d'Ivoire
CMR	Cameroon
COD	Congo, Dem. Rep. of the
COG	Congo, Republic of the
COM	Comoros
CPV	Cabo Verde (Cape Verde)
DJI	Djibouti
ERI	Eritrea
ETH	Ethiopia
GAB	Gabon
GHA	Ghana
GIN	Guinea
GMB	Gambia
GNB	Guinea-Bissau
GNQ	Equatorial Guinea
KEN	Kenya
LBR	Liberia
LSO	Lesotho
MDG	Madagascar
MLI	Mali

ISO-3 code	Name
MOZ	Mozambique
MRT	Mauritania
MUS	Mauritius
MWI	Malawi
MYT	Mayotte
NAM	Namibia
NER	Niger
NGA	Nigeria
REU	Réunion
RWA	Rwanda
SDN	Sudan
SEN	Senegal
SHN	Saint Helena, Ascension and Tristan da Cunha
SLE	Sierra Leone
SOM	Somalia
SSD	South Sudan
STP	Sao Tome and Principe
SWZ	Eswatini (Swaziland)
SYC	Seychelles
TCD	Chad
TGO	Togo
TZA	Tanzania, United Republic of
UGA	Uganda
ZAF	South Africa
ZMB	Zambia
ZWE	Zimbabwe