

Digimap for Schools

Population Density Overlay

User Guide

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Introduction

Population density as used here, is defined to be the midyear population value divided by the country's land area (displayed as km²)¹. Population statistics considers residents regardless of their personal legal status nor citizenship(s), and people considered as 'overseas travellers, migrants and refugees' are counted based on their home locations¹. In total land area calculations, underwater land bodies, exclusive economic zones and territorial claims and waters are all excluded¹.

Population statistics are recorded worldwide in country-specific censuses and distributed publicly from national statistical offices. Organisations (e.g. The World Bank) have publicly published compiled worldwide population datasets². Whilst these are beneficial on the user-end for a range of data manipulation methods, the data themselves should be used with caution. For instance, census data are not always available in every country nor is collection temporally continuous. Political turmoil may also have led to the publishing of inaccurate information in fear that confidentiality may be transgressed.

This user guide presents an overview of the data, the methods behind the creation of the overlays, and their various potential uses.

¹ <https://ourworldindata.org/grapher/population-density?country=~BGD> ²

² <https://data.worldbank.org/indicator/SP.POP.TOTL>

Data

Global Population Density

The global population density data are sourced as .csv files from Our World in Data and The World Bank^{1,2}, where the former provides data on population density and the latter on total population per country. Both datasets were filtered to only include figures from 1961-2018 over 10-year intervals. Whilst the datasets only present discrete country population density, aggregated values were additionally calculated for USSR, Yugoslavia, and Czechoslovakia for the 1961-1991 layers.

Gridded Population Data

The gridded population data are 1km spatial resolution raster (GeoTIFF) files sourced from WorldPop³. The dataset displays the global population density for 2020 adjusted to UN population estimates and provided in the Mercator projection. The raster file acts as a population and density grid where each cell is expressed as the total population of that particular area.

The dataset was built such that the count of people in a pixel (per square kilometre) was divided by the pixel surface area, and further adjusted to match the country total from the UN population estimates.

Using the above data sources two data product families were derived:

- Global population data products - Low spatial resolution global population density layers from 1961-2018 over 10-year intervals
- A Gridded Population dataset at 1km spatial resolution showing global population density for 2020 (UN adjusted population estimates)

³ <https://www.worldpop.org/project/categories?id=18>

Creation

Global population

The population density values were mapped onto the appropriate boundary depending on the epoch of interest on the basis of a common join field (the country code (ISO Alpha-3)). For the 1961-1991 population densities, these were mapped onto historical boundaries sourced from CShapes⁴. The remaining years were mapped onto Natural Earth boundaries⁵. The data were then styled by applying a graduated symbology to each geometry and divided using 8 interval subdivisions (including a 'No Data' entry noted as - 9999 in the dataset). The final data were projected to the Mercator system (EPSG: 4326).

The population density intervals were designed to stay fixed for each epoch for ease of naïve use. These intervals were chosen to ensure that a fine balance between the spatial contrast and the raw density values were displayed as best as possible on the web mapping service. Whilst largely a trial-and-error judgement, additional methods including computing histograms (showing the frequency distributions of density for each epoch) and basic statistical information allowed for a more reliable and supported decision.

The data are best viewed at approximately 1:16,000,000 [Fig.1]. There is scope to zoom in for a finer view at the country-level.

⁴ <http://nils.weidmann.ws/projects/cshapes.html>

⁵ <https://www.naturalearthdata.com/downloads/>

Figures

Figure 1

Exemplar map showing population densities across Europe and parts of Africa in 1971. This layer was created using QGIS for visualisation purposes prior to implementation in Digimap for Schools.

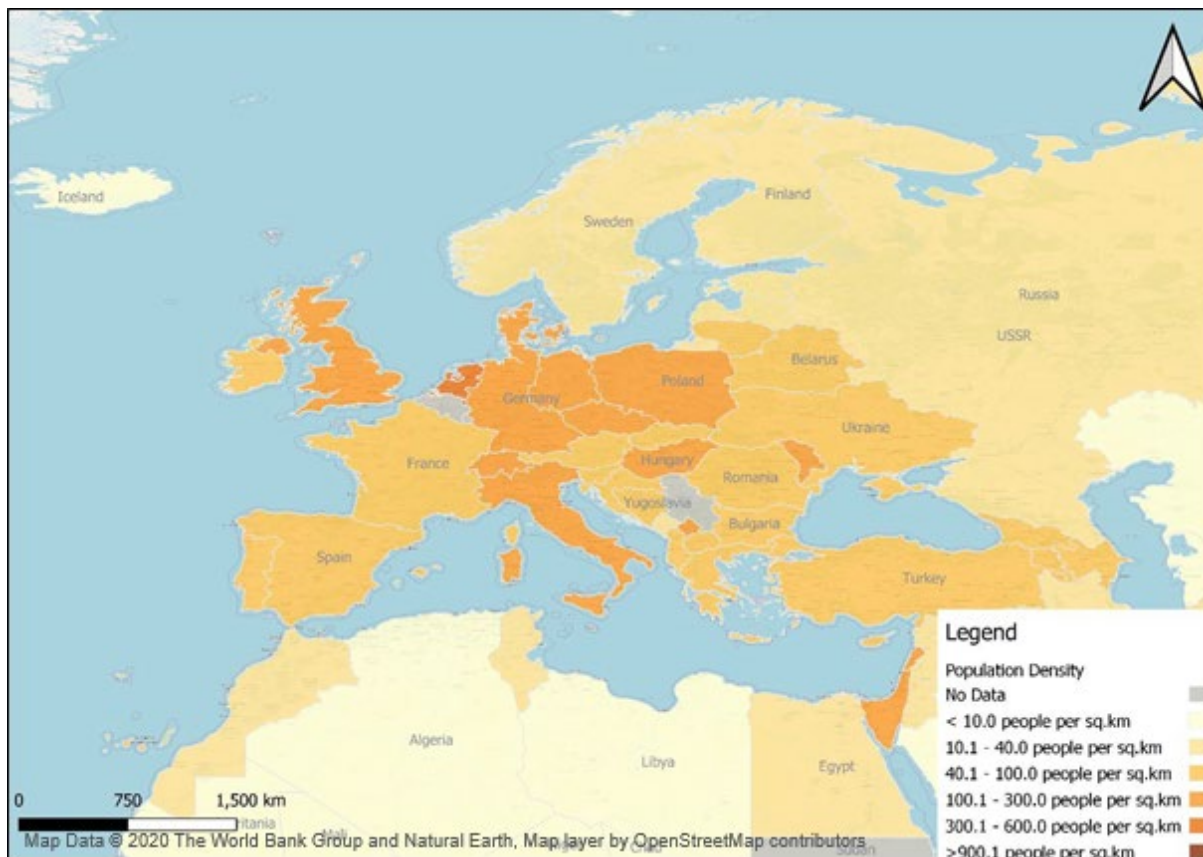
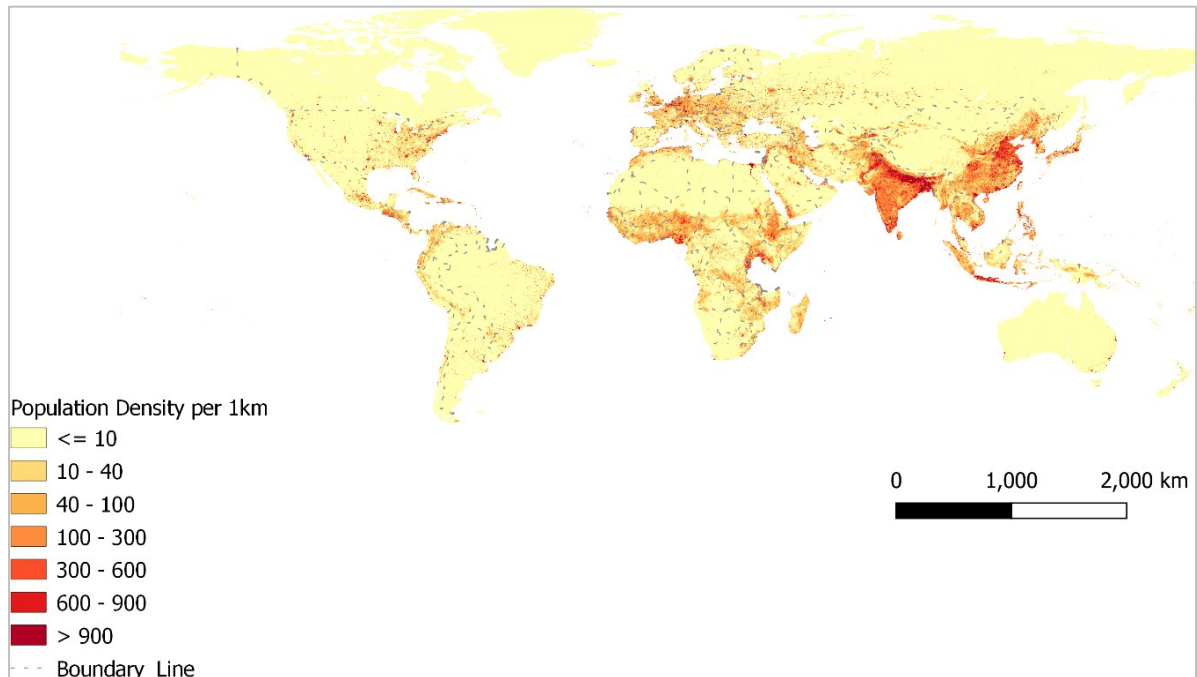


Figure 2

Exemplar map showing gridded population density for 2020 at 1km resolution:



Gridded Population

Given the nature of the raster files used (such that they had been pre- processed prior to download), there was no need for further additional modification.

All of the individual countries were downloaded from Worldpop and mosaiced into 5 continents for ease of designing and implementation on the server. The layer was processed using a singleband pseudo-colour and divided into 7 intervals [Fig.2].

Usage

The derived data products are available for a range of uses including academic research, teaching and reuse for non-profit activities. Both products enable cross-boundary comparisons, and over various epochs depending on the scope of the mentioned products. For the gridded population product, this could be used alongside the population density layer available in vector format on EDINA's Society Digimap and DataNation services. The added support of the gridded population data enables a detailed and more accurate representation of the spatial distribution of population.

Conclusion

This guide provides an explanatory overview of both the global and gridded population density datasets available in Digimap for Schools, the map creation processes and their various potential uses. The scope of the datasets allowed for the creation of a set of global population density layers from 1961-2018 at low spatial resolution, as well as a 2020 gridded population layer at 1km spatial resolution. The nature of all layers allows for a degree of cross-boundary comparison. Users are warned to use common sense in interpreting the end results – they are indicative rather than definitive.

Licences

All data were sourced under the following licenses:

Contains data licensed under the Creative Commons BY License, the Creative Commons Attribution 4.0 International Public License, and the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License.

References

- 1 Our World in Data (2017). Population Density 2017. Retrieved from: <https://ourworldindata.org/grapher/population-density?country=~BGD>
- 2 The World Bank (n.d.). Population, total. Retrieved from: <https://data.worldbank.org/indicator/SP.POP.TOTL>
- 3 WorldPop (2020). Population Density Datasets. Retrieved from: <https://www.worldpop.org/project/categories?id=18>
- 4 Weidmann, Nils B., Doreen Kuse, and Kristian Skrede Gleditsch. 2010. The Geography of the International System: The CShapes Dataset. International Interactions 36 (1). Retrieved from: <http://nils.weidmann.ws/projects/cshapes.html>
- 5 Natural Earth Data (n.d.). Natural Earth Data Downloads. Retrieved from: <https://www.naturalearthdata.com/downloads/>