
Erin Doxsey-Whitfield and Linda Pistolesi
Center for International Earth Science Information Network (CIESIN), Columbia University, Palisades, New York

Introduction
The gridded population of the world (GPW) data set displays the global distribution of the human population on a continuous surface. The GPW series, which began in 1995 and runs to its fourth version (GPWv4), is a valued asset for the research community. The third version of GPW has been used extensively in integrated human-environment research, including vulnerability mapping, disaster impacts, and health dimensions of environmental change, often with satellite remote sensing or other biophysical data. GPWv4 will be publicly available at http://sedac.ciesin.columbia.edu/. This paper describes the GPW methodology and the key highlights of GPWv4.

Methods
The development of GPWv4 builds upon previous versions of the data set (Figure 2). The two basic inputs of GPW are non-official population data (i.e., tabular counts of population listed by administrative area) and spatially-explicit administrative boundary data. Gridded data has been updated using census data and cartography from the 2010 round of censuses. Data are gridded at 30 arc-seconds ("1.1 km").

Census information modeled with this approach may be freely and easily incorporated into global analyses that make use of auxiliary data sets that might be endogenous to more highly modeled surfaces. However, the precision and accuracy of a given pixel is a direct function of the size of the input areal unit, which is why a large effort was made to increase the spatial resolution of input units in GPWv4.

Increased Spatial Resolution of Input Units
In the last decade, there have been considerable advances in the availability of online and open source census data. Improvements in technology have allowed census functionality to more easily distribute their results to the public using electronic and online formats. The increase in timely and spatially-explicit boundary data has allowed us to greatly improve the accuracy of GPWv4, resulting in a higher spatial resolution than was previously possible.

Overall improvements between GPWv3 and GPWv4:
- Substantial increase in total input units
- 15 more countries gridded at level 3 or Higher (Figures 3 and 4)
- 29 countries saw an increase of 100–999 units
- 35 countries increased by more than 1,000 units
- Average resolution of all countries improved from 46 km to 37 km

Addition of New Census Variables
In order to broaden the applicability of GPW versions, it is expanding to include three census variables, circa 2010:
- Urban/rural status
- Age, as single five-year age groups
- Administrative level

Where possible, the variables will be cross-tabulated, resulting in a consistent global gridded population data set with detailed estimates of age, sex, and urban/rural distribution within each country. These detailed grids will be a vital tool for investigating a range of issues, including understanding the relationship between land cover and human health, disaster vulnerability, disaster preparedness, and health. Examples of these grids are given for Bhutan and Costa Rica (Figures 5 and 6).

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