Geneva International Centre for Humanitarian Demining
Centre International de Déminage Humanitaire - Genève

Populations-at-risk

May 2007 **GICHD Fact Sheet for Mine Action**

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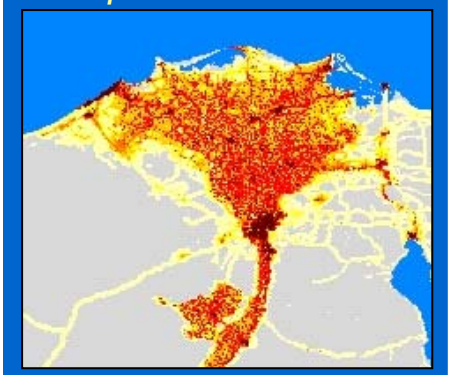
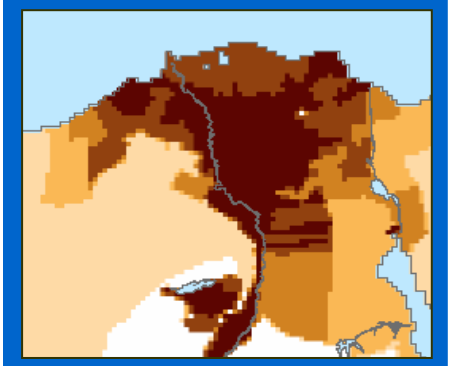
Key Tips:

Examples: Nile Delta



Landscan Global Population Data



GPW Version 3

Population Data in Mine Actions

How can population data improve mine actions? Population distribution, density, and aggregate numbers are key factors determining mine action priorities. For each minefield, it is important to know how many people live nearby and even better to know quantitatively how many people live at increasing distances of 1 km, 2 km, and so on. To obtain the greatest value per dollar in landmine removal and education programs, for instance, it is helpful to know the aggregate number of people affected by each minefield, weighted by distance.

How can population data be combined with other geographic data to improve mine actions? Population distribution can be combined in a GIS with land cover data, infrastructure data, aerial photographs, satellite images, and/or technical survey data to determine how minefields block or impede access to crucial resources: fields, water sources, or transportation networks. Priorities can then be determined based on the number of people impeded and the magnitude and importance of resources from which they are impeded.

Global Population Data

The Landscan Global Population Database is the *de facto* world standard database for estimating populations-at-risk.

- Landscan is available free of charge from Oak Ridge National Laboratory.
- Landscan is updated annually and distributed by GICHD as a standard IMSMA database.
- Landscan is based on census counts provided by the International Programs Center of the U. S. Census Bureau.
- Landscan is derived through dasymetric interpolation of best available census data using region-specific models that consider land cover, distance to roads, slope, and other geographic factors.

The Gridded Population of the World (GPW) is an alternative database available worldwide for certain needs.

- GPW is available from the Center for International Earth Science Information Network (CIESIN) at Columbia University.
- GPW is based on census counts provided by the United Nations.
- GPW is derived through cartographic smoothing of census data.

Population FAQs

What data resolution is needed? Ideally, population counts would be available for each building in the vicinity of each minefield, but such precise data are not available worldwide. Landscan is more precise than GPW.

References:

Dobson, J. E. 2007. "In Harm's Way: Estimating Populations at Risk. Technical paper in NRC [National Research Council]. *Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises*. Washington, D.C.: National Academy Press.

Dobson, J. E., E. A. Bright, P. R. Coleman, R.C. Durfee, B. A. Worley. 2000. "LandScan: A Global Population Database for Estimating Populations at Risk," *Photogrammetric Engineering & Remote Sensing* (inc. front cover of journal) 66(7):849-857.

Contact Us

This fact sheet was prepared by the University of Kansas for the Geneva International Centre for Humanitarian Demining (GICHD).

To contact GICHD:

Alan Arnold

a.Arnold@gichd.ch

GICHD Web Site

www.gichd.ch

How precise are global population data? Landscan data resolution is 30 by 30 arc seconds, which is approximately 1 sq km in area at the Equator and gets finer toward the Poles. GPW data resolution is 2.5 by 2.5 arc minutes, which is approximately 25 sq km in area at the Equator.

How accurate are Landscan Global data? The Landscan procedure is designed to add precision without degrading accuracy. At the level of individual cells, Landscan data are estimates based on dasymetric interpolation of best available census counts. Hence, there is no reference database against which to conduct accuracy assessments. Instead, cells are summed closely to the input census geometry and aggregate populations are forced to match control totals of the original census count data.

Which data structure works best? Census data typically are published in vector form with aggregate census counts shown for polygons. However, raster data structures are easier to use in most mine action applications. Fortunately, the developers of both Landscan and GPW have converted vector census counts to raster format. Landscan is available in ESRI GRID format and ESRI raster binary format.

What are the best data sources? The Landscan Global Population Database already is provided as one of the IMSMA databases distributed by GICHD. If additional areas are required, Landscan data can be downloaded from Oak Ridge National Laboratory. Applicants must file a simple registration form, but there is no charge. The URL is: www.ornl.gov/sci/landscan/landscanCommon/landscan_data-avail.html.

For what time of day are populations estimated? Census data typically reflect where people sleep at night, not where they work, shop, or play in the daytime. Landscan, however, represents a 24-hour ambient population indicating where people likely spend time day and night.

What is dasymetric interpolation? Various cartographic and statistical techniques are available for smoothing, interpolating, and disaggregating census counts. A great distinction lies in whether they are performed on population variables only or, conversely, involve one or more ancillary variables. Landscan uses dasymetric interpolation, which is a standard cartographic technique for involving many ancillary variables. First, areas of zero population, oceans for instance, are removed from the total land area, then other areas are adjusted iteratively to reflect areas of increasing population density. This technique was developed in 1936 by John K. Wright of the American Geographical Society specifically for use with population data. Conversely, GPW is based on cartographic smoothing of a single variable, population itself.

Calculating Population Density

Landscan data are numerical population estimates per cell, and cell size changes with latitude. The formula for calculating the area (in sq km) of each Landscan cell is:

$$\textbf{Area} = R^2 (\sin(\text{lat2}) - \sin(\text{lat1})) * \text{deltaLon}$$

where:

R = Radius of the earth in Kilometers (3956.66)
lat2 = Upper Latitude in radians (radians = decimal degrees * π/180)
lat1 = Lower Latitude in radians
deltaLon = Longitudinal width of cell in radians

To calculate density, simply divide each cell value by the resulting cell area.