



Dasymetric Allocation of Population

This EnviroAtlas map illustrates where people are most likely to reside within an area based on land cover. This population distribution technique recognizes that people are unlikely to live in uninhabitable areas, e.g. open water. By removing these areas and estimating the density of the habitable land, this map provides a more accurate representation of the population of an area.

Why is dasymetric mapping important?

The U.S. Census Bureau collects population information through the decennial census. Though collected from individual residents, the US Census Bureau aggregates this data into various units, such as census blocks. Census blocks are statistical areas bounded by both visible features such as roads and streams, as well as invisible boundaries such as county or state limits. Because of this aggregation, many analyses may assume that population is distributed uniformly across the census block.

While this assumption is practical for the purposes of the census, it makes it very difficult to determine how many individuals within a census block live near roads, in floodplains, or other potential risk exposures. Traditionally, maps from census data that calculate distance use the centroid of the block as the starting point. In some areas with large census blocks, this may introduce error when determining walking or driving distances for individuals.

Dasymetric mapping is a geospatial technique to more accurately distribute data that has been assigned to arbitrary boundaries, such as census blocks, using additional information such as land cover. Using the National Land

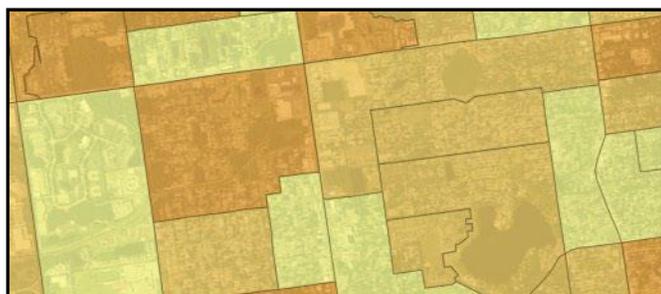


A dasymetric population map for several census blocks in Tampa Bay, FL. A single census block may have pixels that are non-habitable, as indicated in blue, as well as a range of low, medium, and high-density land cover types indicated in shades of red—the darker the pixel, the greater the population density.

Cover Dataset ([NLCD 2011](#)) the EnviroAtlas dasymetric population map, as seen above, assumes that individuals will not live in areas that are classified as open water, ice/snow, or emergent wetlands. Additionally, areas with slopes greater than 25% were also considered uninhabitable. Vegetated and developed areas were considered habitable and were assigned an estimated population density based on their respective land cover class. EnviroAtlas uses this technique to create a more informed delineation of population estimates. These data provide the foundation for estimating walking distances, viewsheds, and exposure potential in many maps contained in EnviroAtlas.

How can I use this information?

For some research, planning, or policy questions it is important to know how far people may be from places of interest such as parks, roads, or bus stops. It can also be helpful to estimate how many people are within a certain distance from these or other places of interest. These data can be used to replicate many of the maps in the EnviroAtlas community component for other cities and communities. They can also be used in conjunction with other local and national datasets to calculate distances to other important features, amenities, or exposures.



The 2010 US Census population map for several census blocks in Tampa, FL. The population is portrayed as being evenly distributed across the block.

How were the data for this map created?

This map uses dasymetric mapping to distribute the 2010 US Census population data using land cover classes from the 2011 National Land Cover Dataset ([NLCD](#)). The NLCD classes were divided into five categories based on habitability, as shown in the table below. A majority filter was used to reclassify roads in the developed open space category (NLCD 21) to either natural land cover types or agriculture where appropriate. Majority filters replace the value of a cell or pixel based on the values of the majority of their contiguous cells.

Dasymetric category	NLCD class (code)
Non-habitable	Open water (11), perennial ice/snow (12), emergent herbaceous wetlands (95)
Habitable 1	Deciduous forest (41), evergreen forest (42), mixed forest (43), shrub/ scrub (52), grassland/herbaceous (71), pasture/hay (81), cultivated crops (82) woody wetlands (90),
Habitable 2	Developed, open space (21)
Habitable 3	Developed, low intensity (22)
Habitable 4	Developed, medium intensity (23)
Habitable 5	Developed, high intensity (24)

Using the tools in the [Dasymetric Toolbox](#) for ArcGIS v10, population densities were calibrated for each habitable class by state using census block data. Because Rhode Island and Washington, D.C were not large enough to accurately calculate separately, they were combined with Massachusetts and Maryland, respectively. To force population allocation to developed areas, density for the habitable 1 category was set to 0.001.

What are the limitations of these data?

The accuracy of dasymetric maps is highly dependent on the data being used as inputs. This map carries the limitations of both the NLCD data, as well as the census population estimates. The NLCD classifies land cover based on satellite imagery, a process that is not 100 percent accurate.

Selected Publications

Mennis, J. 2003. [Generating surface models of population using dasymetric mapping](#). *The Professional Geographer* 55(1):31–42.

Mennis, J. and T Hultgren. 2006. [Intelligent dasymetric mapping and its application to areal interpolation](#). *Cartography and Geographic Information Science* 33(3):179–194.

Langford, M. and D.J. Unwin. 1994. [Generating and mapping population density surfaces within a geographical information system](#). *The Cartographic Journal* 31(1):21–26.

Furthermore, the NLCD does not specifically identify land uses, so there is no distinction between shopping malls or industrial areas and high-density residential areas. For this same reason, it may appear that people actually live on highways or other roads.

While dasymetric mapping is a significant improvement over the even distribution approach, it is only an estimation of population distribution. Mapped data are not perfect and should be used to inform further investigation. Accuracy information for the source datasets can be found on their respective websites.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Web services allow users to access the data without downloading them, and can be used with other geospatial applications. For more information on how to use EnviroAtlas web services, see the [web services](#) webpage. The Dasymetric Toolbox for ArcGIS v10 and above is also available for download on the [dasymetric](#) mapping webpage.

Where can I get more information?

A selection of resources on dasymetric mapping is listed below. For additional information on data creation, access the metadata found in the drop-down menu for each map layer listed in the EnviroAtlas table of contents and click again on metadata at the bottom of the metadata summary page for more details. For questions about the NLCD data or census data, please visit their respective websites. To ask specific questions about this map please contact the [EnviroAtlas Team](#).

Acknowledgments

These data were generated by Timothy Wade, EPA and Charles Rudder, EPA Student Services Contractor. The analysis was performed using the Dasymetric Toolbox developed by Torrin Hultgren, Innovate!, Inc. This fact sheet was created by Tim Wade, EPA, and Jessica Jahre, EPA Student Services Contractor.