

High and low density development in Puerto Rico

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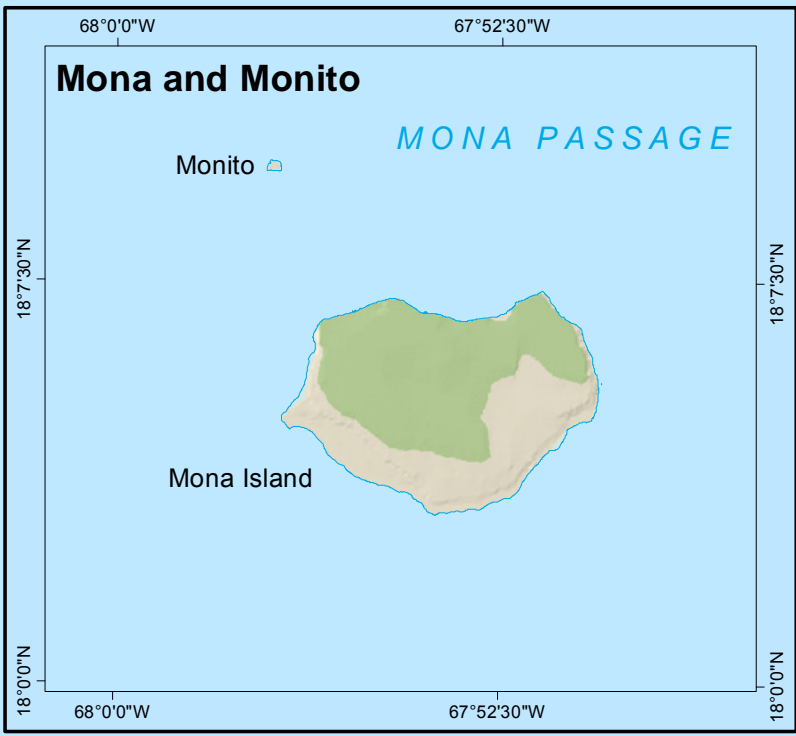
USDA Forest Service International Institute of Tropical Forestry (IITF)



PRGAP ANALYSIS PROJECT

IITF GIS and Remote Sensing Lab

A center for tropical landscape analysis



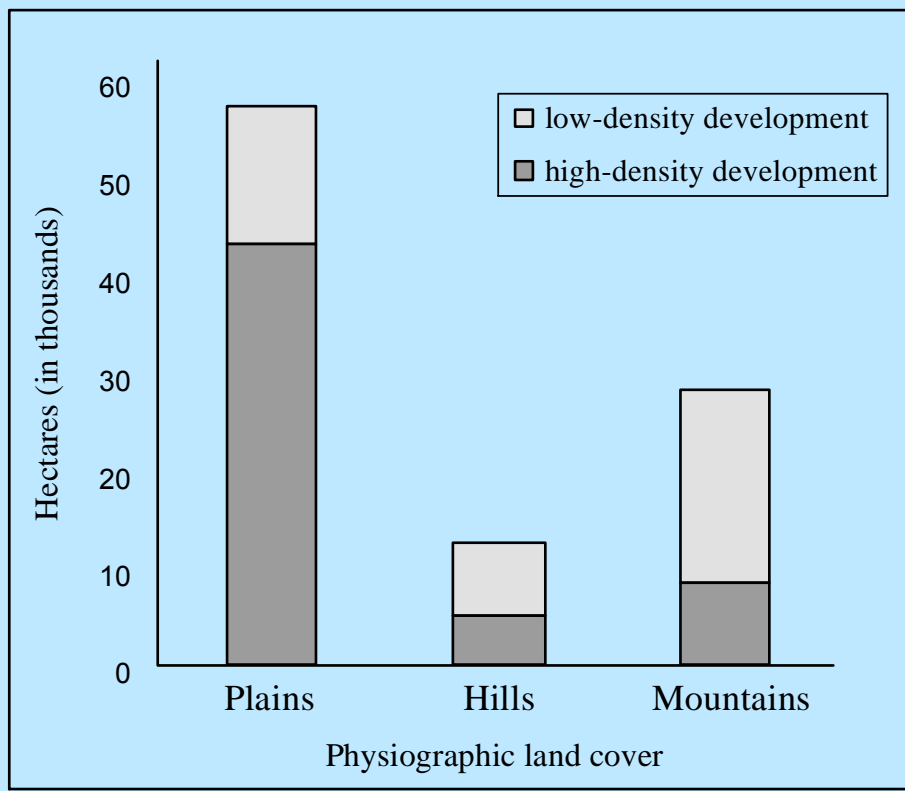
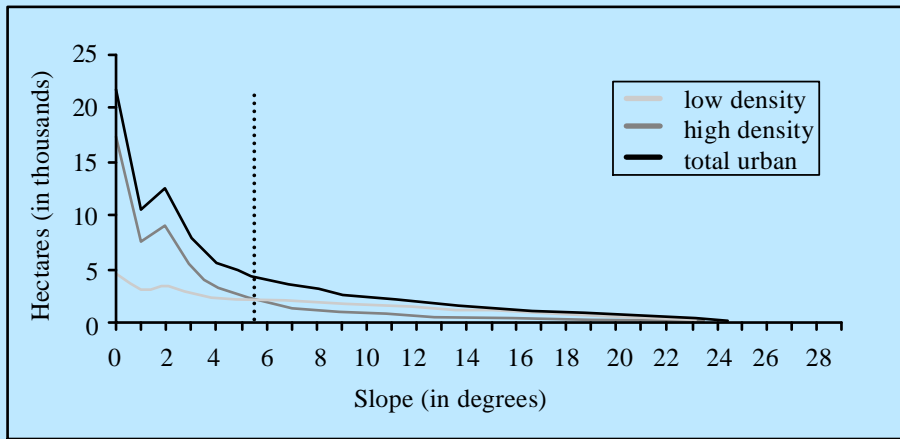
Map Description

This map shows the distribution of high and low density developed lands in Puerto Rico (Martinuzzi et al. 2007).

The map was created using a mosaic of Landsat ETM+ images that range from the years 2000 to 2003. The developed land cover was classified using the Iterative Self-Organizing Data Analysis Technique (ISODATA) unsupervised classification (ERDAS 2003). Developed land cover refers to urban, built-up and non-vegetated areas that result from human activity. These typically include built structures, concrete, asphalt, and other infrastructure. The developed cover was divided into high and low-density using a textural filter. Using a 300 m by 300 m window, the filter evaluates the proportion of surrounding developed and non-developed pixels of a given pixel. High-density refers to those urban pixels that are surrounded by more than 50% of developed pixels, while low-density refers to those pixels that are surrounded by less than 50% of developed pixels.

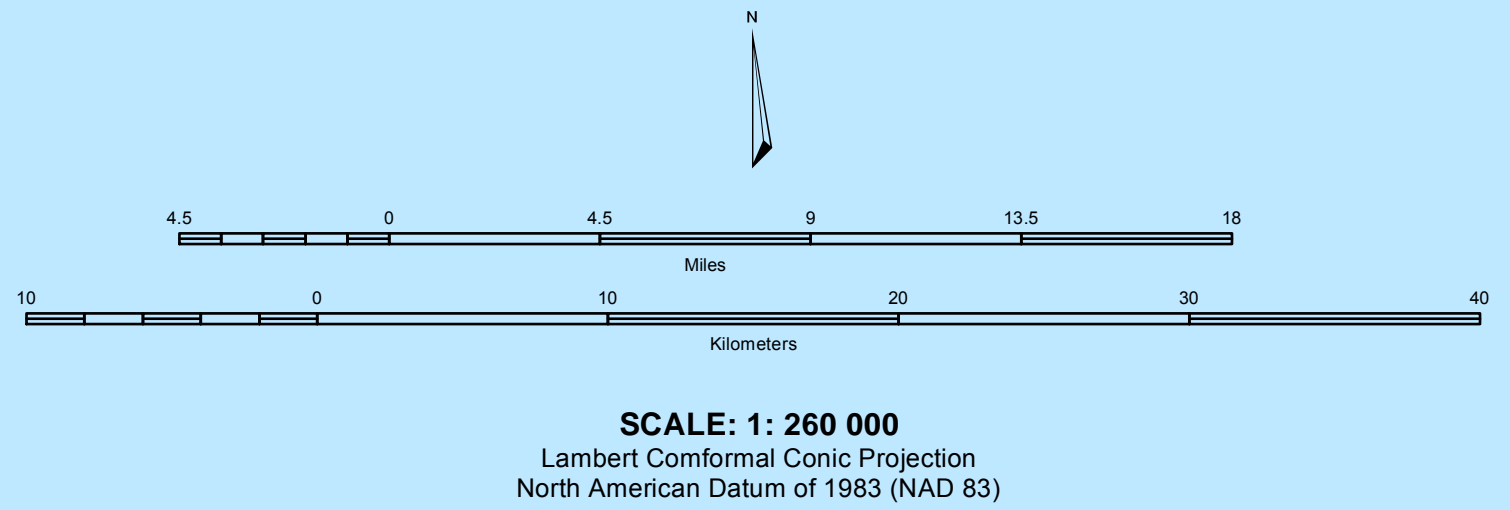
From a total of 95 342 ha of urban/built-up lands, 54 899 ha (nearly 60%) is high-density development, and 40 443 ha (nearly 40%) is low-density developments. High-density development reflects the compact pattern of construction within urban centers, including cities and towns, along important connections between major cities, and within exurban agglomerations that are non-contiguous with the urban centers; conversely, low-density reflects the noncontiguous pattern of development that expands outward from urban centers in linear features following the road network and isolated constructions. Some of the biggest highways and routes are also included within the low-density developments.

Development is closely tied to the topography of the island. Development decreases rapidly as slope increases. This tendency is observed on the total built-up areas and high-density developments, for low-density development the decrease with the slope is much slower. Between 5° and 6° slopes, the relationship between the two types of development inverts. From 0° to 5–6° the amount of high-density development is greater than the corresponding low-density development, while the contrary is found at higher slopes. The 6° slope also represents the separation point between the plains and the hills and mountains in the physiography of the island. Consequently, high-density development predominates in the plains, while low-density



Above: Distribution of high and low-density development in plains, hills, and mountains.

Left: Distribution of urban development in relation to slope. The dash line between 5° and 6° represents the break point for the proportion of low and high-density developments. The peak at 2° is an artifact from the digital elevation model (DEM), a similar peak is found in the DEM.



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Land use

- Low Density Developed Landcover (40 443 ha or 43%)
- High Density Developed Landcover (54 899 ha or 57%)

Administrative

- Urban centers

Hydrography

- Lakes/Reservoirs
- Rivers/Streams

Elevation (m)

- 0 - 50
- 50 - 150
- 150 - 400
- 400 - 700
- 700 - 1000
- Above 1000*

* Maximun elevation 1330

References

ERDAS IMAGINE 8.7. 2003. Leica Geosystem GIS and Mapping LLC.

Martinuzzi, S.; Gould, W.A.; Ramos González, O.M. 2007. Land development, land use, and urban sprawl in Puerto Rico integrating remote sensing and population census data. Landscaping and Urban Planning 79: 288-297.

Additional data sources

Elevation data: The elevation data were derived from the USGS National Elevation Dataset (NED) digital elevation model (DEM). This data set is a raster product assembled by the U.S. Geological Survey (USGS). The NED is designed to provide national elevation data in a seamless form with a consistent datum, elevation unit, and projection. Data corrections are made in the NED assembly process to minimize, but not eliminate artifacts, perform edge matching, and fill silver areas of missing data. NED has a resolution of one arc-second (approximately 30 meters) for the contiguous United States, Hawaii, and Puerto Rico and a resolution of two arc-seconds for Alaska. The hillshade was calculated using ArcGIS 9.1 and spatial analyst extension.

Hydrography data set: The hydrography dataset was derived and generalized from The National Hydrography Dataset (NHD). The NHD was originated by the U.S. Geological Survey in cooperation with U.S. Environmental Protection Agency, USDA Forest Service, and other Federal, State and local partners. 2005. Reston, Virginia. This data set is presented as vector digital data generally developed at 1:24 000/1:12 000 scale.

Urban centers: This data set was developed by the GIS and Remote Sensing Lab of the International Institute of Tropical Forestry using visual interpretation of existing maps. Each point in the data set represents the approximate urban center for each municipality.

Suggested citation

Gould W.A.; Martinuzzi, S.; Ramos González, O.M. 2008. High and low density development in Puerto Rico. Scale 1: 260 000. IITF-RMAP-11. Río Piedras, PR: US Department of Agriculture Forest Service, International Institute of Tropical Forestry.

Acknowledgements

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