Oct 01, 2019

Compare estimates of people living 1, 5 and 10km from the coast in Pacific Island Countries and Territories

PLOS One

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1 Works for me dx.doi.org/10.17504/protocols.io.59yg97w

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ABSTRACT

Compare estimates of the numbers of people living within 1, 5, and 10 km from the coast in Pacific Island Countries and Territories (PICTs). These distances are somewhat arbitrary, but in the absence of generally agreed definitions of the 'coastal zone' and of more integrated analyses that include elevation above sea level, livelihood portfolios and other measure of exposure to the ocean, they provide a logical basis for the analyses. Three coastal zones at 1, 5, and 10 km were mapped onto every populated island for each PICT. People residing within 1 km were considered to live on the coast, those within 5 km included those who could still easily walk to the coast and 10 km, those who interact with coastal communities (e.g. in terms of access to markets or other activities) and who would be able to easily get to the coast with some form of transport.

The two global datasets used to spatially distribute populations were the SEDAC-CIESIN Gridded Population of the World v4 and the Oak Ridge National Laboratory LandScan™. GPWv4 is a minimally modelled population dataset that uniformly distributes census data from their native enumeration areas. LandScan™ allocates population census data using dasymetric cartographic techniques relying on ancillary data such as land cover, roads, terrain slope, urban extent, and accessibility to model population density at 30 arc-second grid resolution within administrative boundaries. Both global datasets distributed populations within enumeration areas to 30 arc second cells (approximate 1 km^2 at the Equator).

The following protocol explains the workflow used to calculate the Coastal Population Estimates for PICTs.

The protocol involves three main steps:

1. Generation of 1, 5 and 10 km coastal buffers
2. Spatial disaggregation of the census population datasets using one of the three methods based on data availability. This step is not applicable for the global population grids.
3. Overlay the coastal buffer mask on the disaggregated population datasets and sum the population contained within the coastal buffers to calculate the percentage of the country's population within each of the three coastal zones.

EXTERNAL LINK

https://doi.org/10.1371/journal.pone.0223249

1 CREATE 1, 5 AND 10 KM COASTAL BUFFERS.

Two main types of population datasets were used for the spatial analysis(in step 2):

1. Census Population Data - analysed using three different methods depending on the data availability.
2. Global population grids: SEDAC-CIESIN Gridded Population of the World v4 and the Oak Ridge National Laboratory LandScan™

In order to align the Coastal Buffer Masks with the two types of datasets, two sets of buffers were created to clip both types of datasets.

1. To mask Census Population Datasets, the coastal buffers were generated using country administrative boundaries (except for Fiji which admin boundaries did not match accurately with the coastline, for this case GADM (https://biogeo.ucdavis.edu/data/gadm3.6/shp/gadm36_FJI_shp.zip) was utilised as it was the most accurate input available)
2. To extract coastal population from Landscan and GPW4 the coastal buffers were generated from GAUL http://www.fao.org/geonetwork/srv/en/metadata.show%3Fid%3D12691 in order to make all layers comparable.

Attached below is a table that compiles all the information related to the Coastal Buffer generation

Buffers for Census Data.xlsx

2 SPATIAL DISAGGREGATION OF THE CENSUS POPULATION DATASETS

Four methods were used to allocate census data across countries' areas. The selection of the method utilized in each case depends on the availability and the spatial precision of the census data.

2.1 **Method 0.**

In five of the smallest PICTs the land area of all populated islands fell within the 1 km zone. No analyses or assumptions were required.

This method was used in the following PICTs: Kiribati, Marshall Islands, Pitcairn Islands, Tokelau, and Tuvalu.

2.2 **Method 1**.

Households were GPS-located and each household had specific population data. In this scenario, no spatial processing was necessary.

This method was applied to Tonga and French Polynesia (for the case of French Polynesia step 2 and 3 was undertaken by F. Polynesia's National Statistics Office due to data sharing restrictions)

2.3 **Method 2**.

Households were GPS-located, but population data was only available at enumeration area level. The population data and the number of household locations within each Enumeration Area were utilized to calculate a mean household size for each enumeration area that was then allocated to each GPS-located house.

PICTs:· : Federated States of Micronesia (FSM), Fiji, Commonwealth of the Northern Mariana Islands (CNMI), Palau, Samoa, Solomon Islands, Vanuatu, and Wallis and Futuna.

Count GPS points in each Enumeration Area (EA) polygon using a Spatial Join. (New layer = SJ1)
- Check if there are any EA's with population > 0 and no GPS points contained within them (SJ1). - If this is the case, edit the GPS layer and generate an auxillary (temporary) centroid within the EA polygon in order to retain a population count during the spatial join. - Repeat Spatial join (New Layer = SJ2). - If an EA was totally covered by the coastal buffer (1, 5 or 10 km) then the location of the auxillary centroid was not important. if the coastal buffer only partially covered the EA, then if the auxillary centoid fell within the buffer the EA population was counted, otherwise the EA was excluded.
In the SJ2 layer, created AHS (Average Household Size) field and calculated totpop / # GPS Household points with field calculator
Assign AHS to each GPS household location. Spatial Join from GPS household layer to EA layer
Select by location from GPS household layer using the 1, 5, and 10 km buffers and export a new layer for each buffer selection.
Calculate total population within the 1, 5 and 10km GPS point layers.

2.4 **Method 3**.

Population data were available for each enumeration area with no GPS household location data available. The population was averaged by unit area across a given enumeration area. Vector analysis allowed us to precisely determine the proportion of each enumeration area, and hence each enumeration area's population, within each zone. Data were georectified using the ESRI World Cylindrical Equal Area (WKID: 54034) projection to preserve area. This method assumed the population was uniformly distributed within the enumeration area.

PICTs: American Samoa, Cook Islands, Guam, New Caledonia, Niue, Nauru, and PNG. Nauru was unique as only three enumeration areas fell outside the 1 km zone, and these were manually allocated to the 5 km Coastal zone.

NOTE: Calculate Area in World Cylindrical Equal Area (54034) projection (on-the-fly)

Set project projection to World Cylindrical Equal Area (EPSG:53034)
For EA/Admin polygons containing population numbers, add column [AREA_KM2] to calculate the total area for each EA/Admin
Intersect the EA/Admin polygons with buffer zone 1,5 and 10 km
The resulted intersect polygons: - add column [AREA_B1KM] and calculate the area for the EAs within buffer - add column [POP_B1KM] and calculate field 1kmbuffpop = [totpop]*([AREA_B1KM]/[AREA_KM2])
Repeat same process for 5 and 10 km buffers