Exploring Earth Observations to monitor SDG indicators

Geostatistics Directorate

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www.dane.gov.co

Methodology for calculating SDG indicator 9.1.1

Proportion of rural population who live within 2 km of an all-season road

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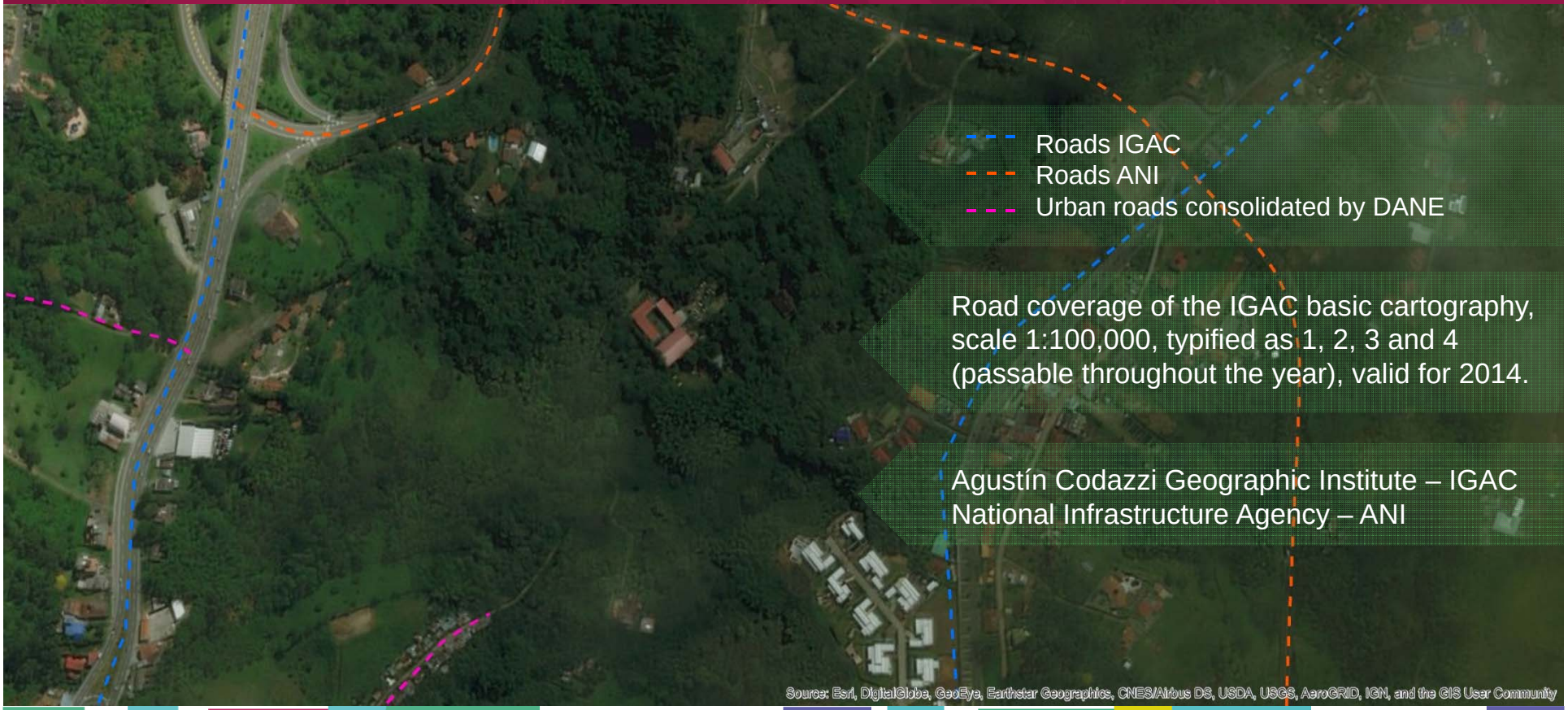
Sustainable Development Goals - SDGs

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

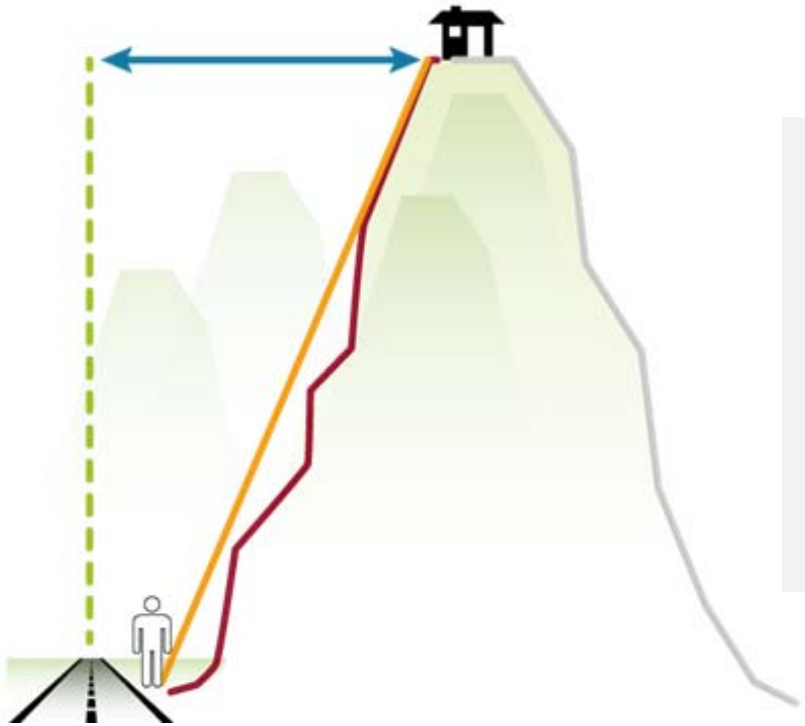
Target 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

Indicator 9.1.1 Proportion of the rural population who live within 2 km of an all-season road

Roads data from IGAC, ANI and DANE integrated to build all seasons roads layer

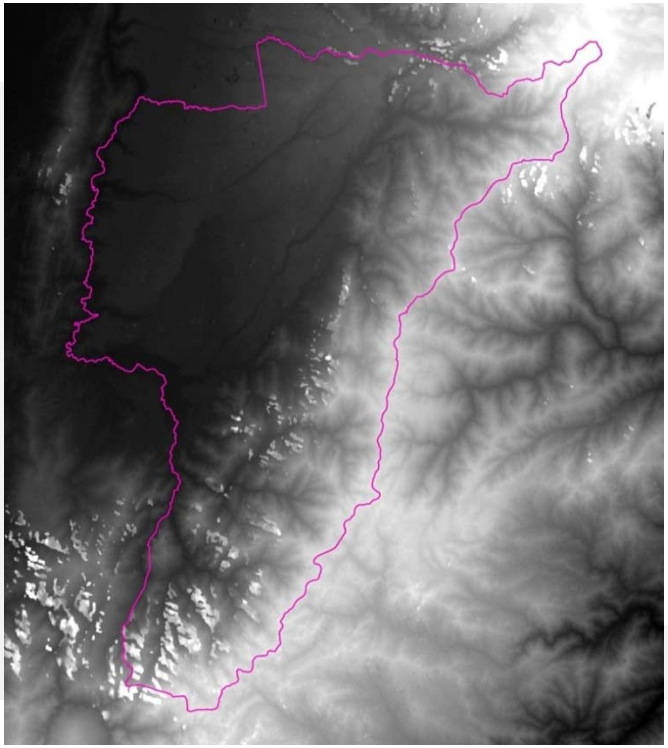


Using slope distance to calculate a more accurate influence area



- Actual distance on the ground (natural)
- Horizontal distance
- Vertical distance (difference in height)
- Slope distance

To determine slope distance, a DEM with no null data was selected



Quindio Region

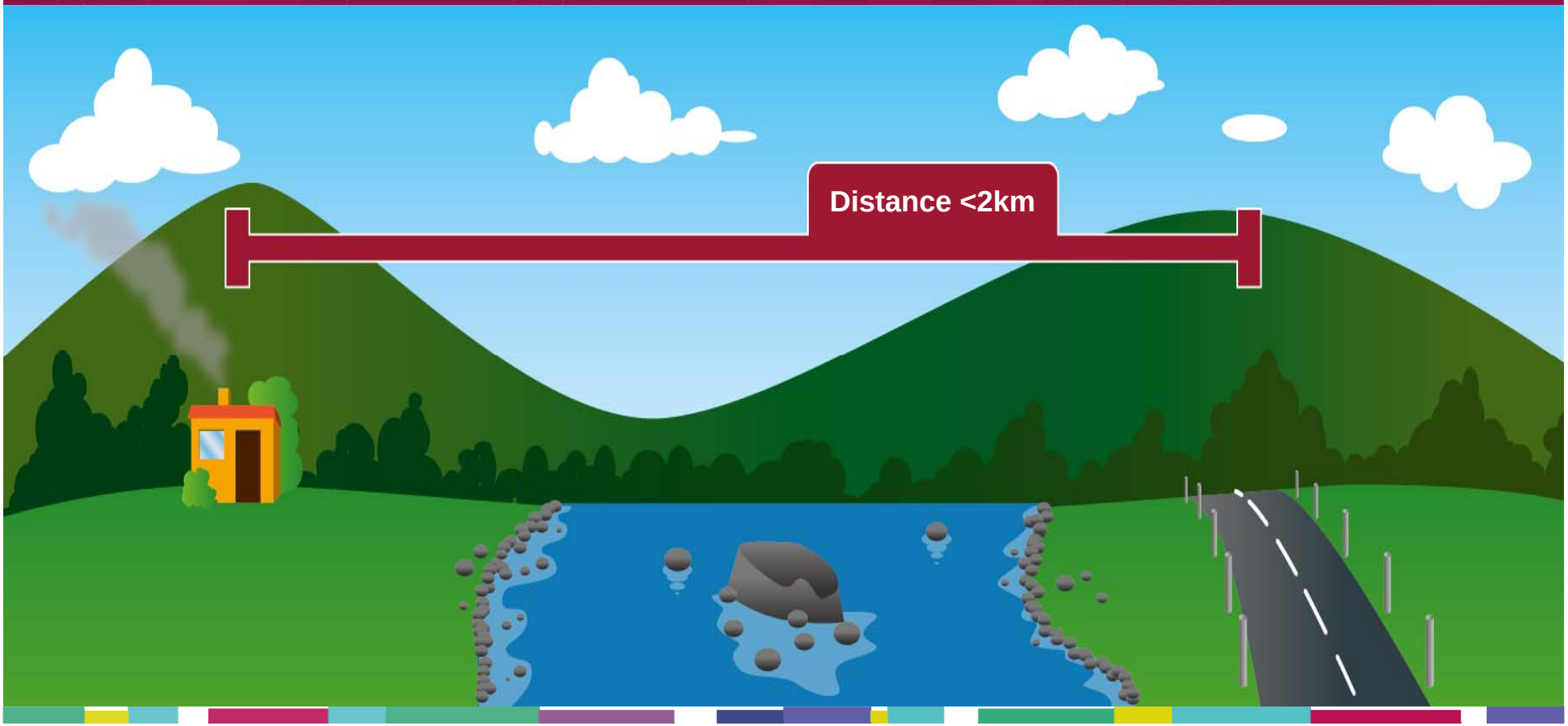
Digital elevation models with coverage in Colombia, available from the United States Geological Survey – USGS portal:

- *Shuttle Radar Topography Mission – STRM* (has null data)
- ***Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation Model - ASTER GDEM*** **(there is no null data)**

Digital Elevation Model - DEM

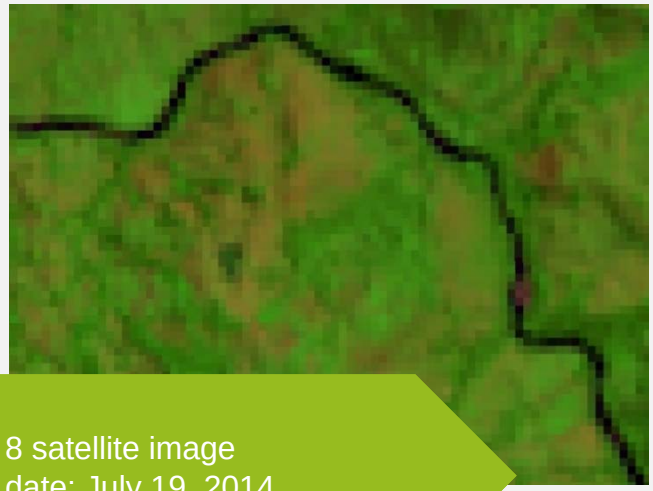
Source: ASTER GDEM
Spatial resolution: 30 meters

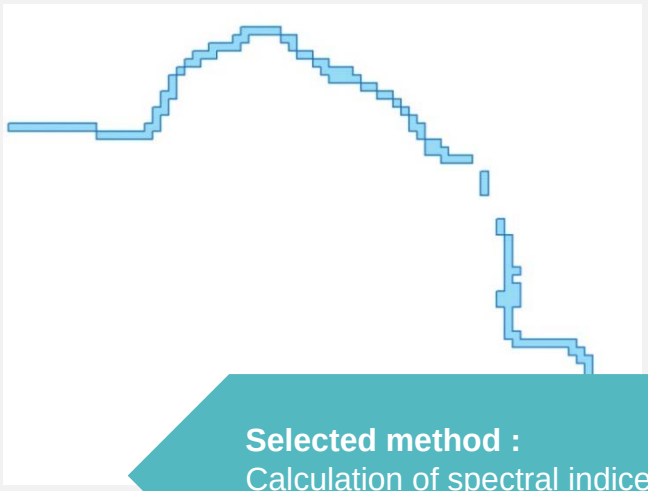
Dwellings less than 2 km from roads may not have access to roads due to the presence of surface water and the lack of bridges



Besides relief, there are other elements to consider when calculating the influence area as surface water, for which satellite images are useful

Surface water coverage





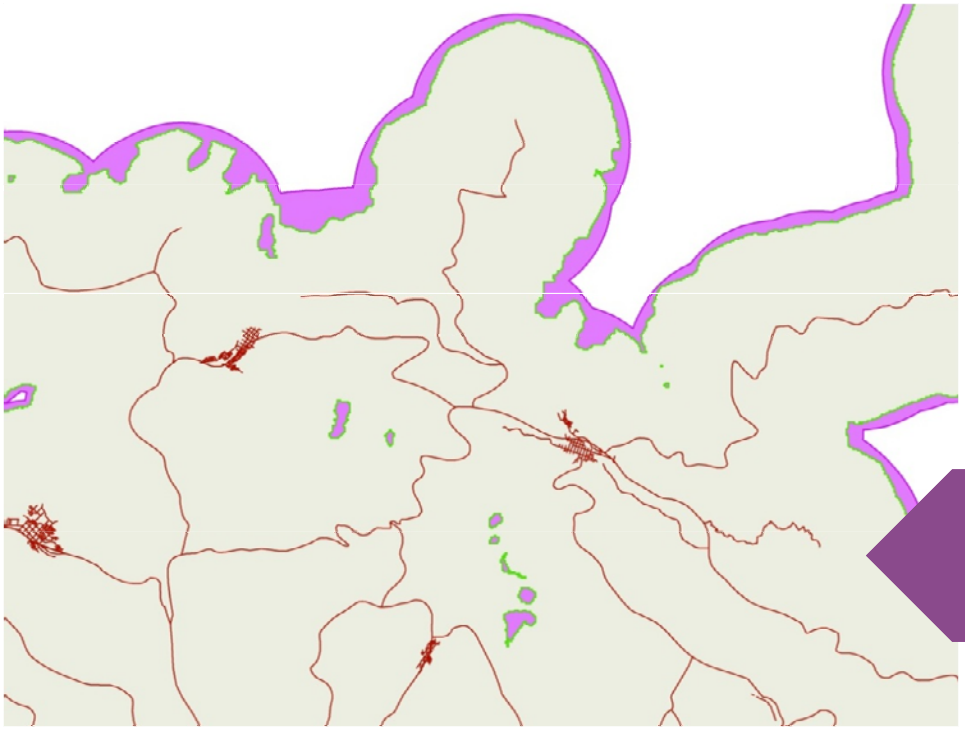
Source:
Landsat 8 satellite image
Capture date: July 19, 2014
Spatial resolution: 30 m

Tested methods :
- Supervised classification
- Unsupervised classification
- Calculation of spectral indexes

Selected method :
Calculation of spectral indices, specifically Standardized Water Differential Index

Spatial difference between influence areas

Calculate the influence area of 2km on each side of the road



All-season roads

Buffer taking into account the DEM (Digital Elevation Model) and surface water coverage

Buffer without taking into account the DEM and surface water coverage

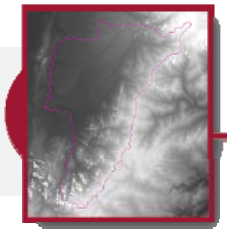
Software:
Path Distance - ArcGis

Overview methodology* Pilot test of the methodology and preliminary results for the Quindío Region

All-season roads

Surface water coverage

Digital Elevation Model - DEM



Path Distance

The number of persons residing in the rural area was taken from the National Agriculture and Livestock Census (2014)

The population is geo-referenced at the property level

Calculate the influence area of 2km on each side of the road

Intersect

The proportion of the rural population who live within 2 km of an all-season road, in the department of Quindío, corresponds to 96.7% of the people

The population of the properties that intersect in an area greater than 50% was counted, with the area of influence

Future work – Pilot learnings

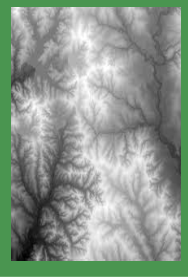
For more detailed scales, the following is required:

Information of the population updated and geo-referenced to dwellings

More detailed water coverage: Satellite images with higher spatial resolution

Updated and complete road coverage (geometry and attributes)

Digital Elevation Model with higher spatial resolution



SDG indicator 11.3.1 results for colombian urban areas

Ratio of land consumption rate to population growth rate

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Indicator 11.3.1 Ratio of land consumption rate to population growth rate, is a measure of land-use efficiency

Indicator 11.3.1 benchmarks and monitors the relationship between land consumption and population growth.

$$Indicator\ 11.3.1 = \frac{Land\ consumption\ rate}{Population\ growth\ rate}$$

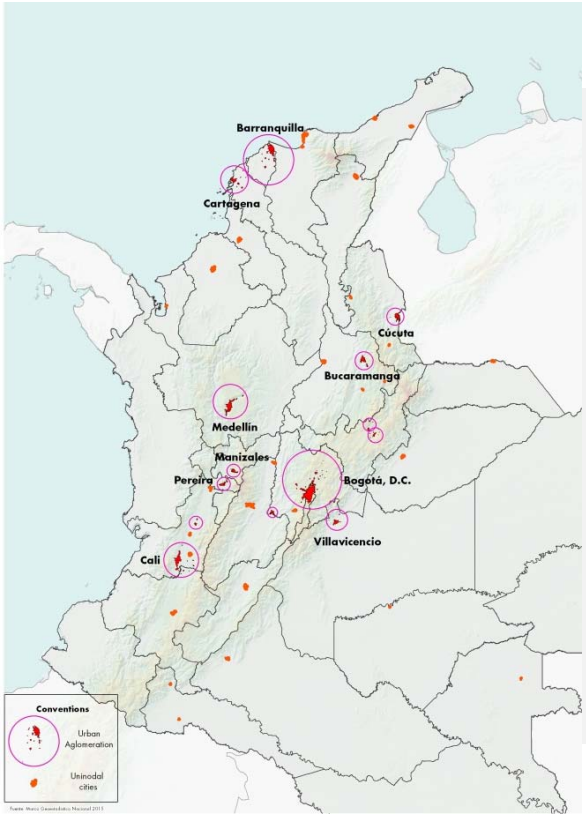
Indicator Above 1:

- Land consumption rate greater than Population growth rate.
- Inefficient land use

Indicator Below 1:

- Population growth rate greater than Land consumption rate.
- Efficient land use

The indicator 11.3.1 was calculated for 138 Colombian cities that account for 62,7% urban population)



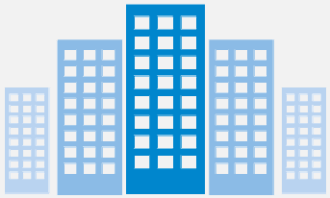
- Functional cities or urban agglomerations: Set of contiguous cities and urban centers between which there are functional relations in terms of labor commutation.
- Cities with an urban population equal to or greater than 100,000 inhabitants in 2010.
- Departmental capitals with less than 100,000 inhabitants.
- Cities with lesser than 100,000 inhabitants with a strategic hierarchy at the national level.

General statistics of indicator 11.3.1 in the 138 Colombian cities during 2003-2015

80 Colombian cities have an indicator greater than 1. It means that its land consumption rate is higher than population growth rate.

Percentage of cities with an indicator greater than 1

Percentage of cities with an indicator lesser than 1

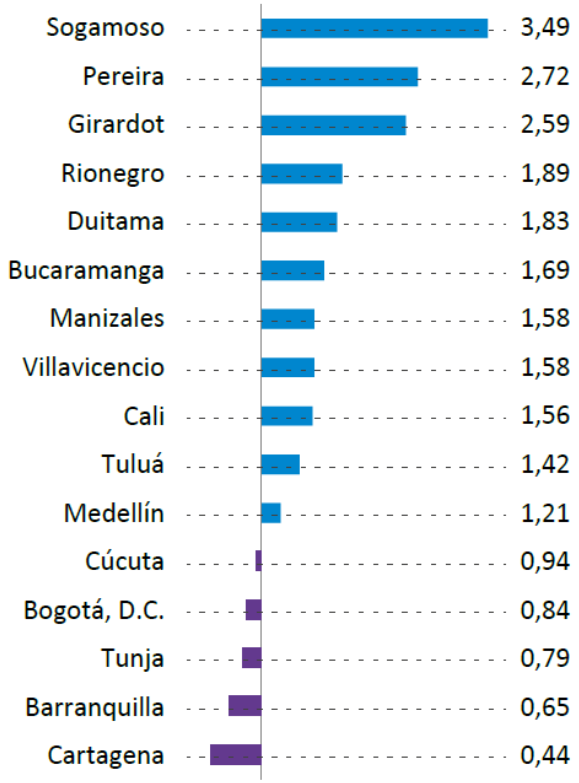


Average of land consumption rate **2,5 %**

Average of population growth rate **1.8 %**

Of the 16 urban agglomerations studied, 11 have higher land consumption in relation to the population growth rate

SDG indicator



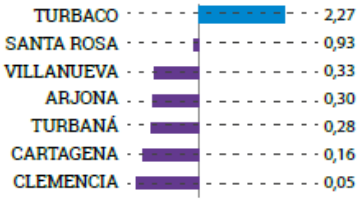
The urban agglomeration of Cartagena has the lowest indicator.

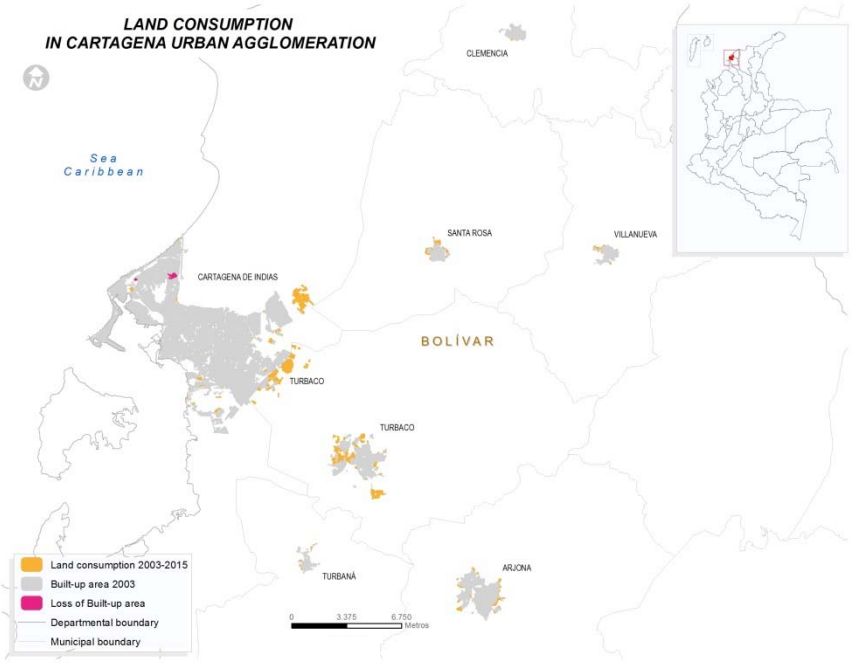
Land consumption rate **Lower** than population growth rate

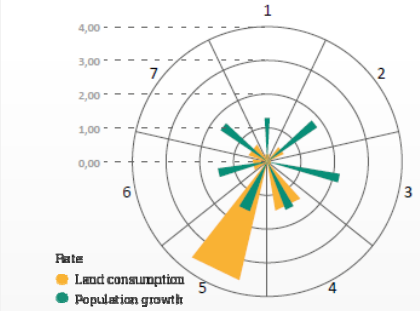
Land consumption rate **greater** than population growth rate

With the exception of Turbaco the cities from the urban agglomeration of Cartagena have a rate of land consumption lower than the population growth rate

SDG indicator





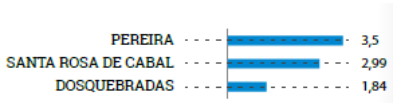


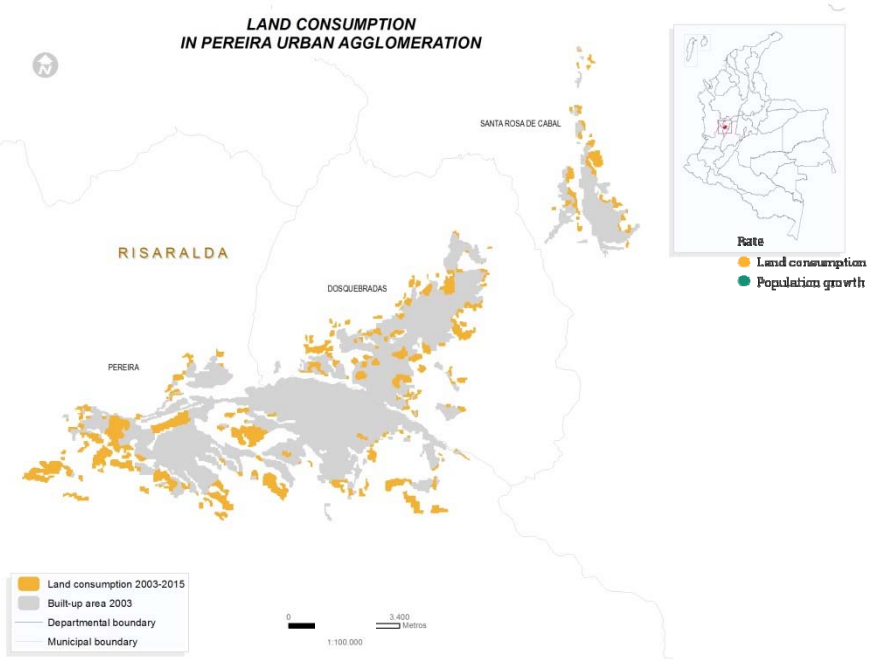
1	Cartagena	0,21	1,29	6	Turbaná	0,41	1,47
2	Arjona	0,53	1,79	7	Villanueva	0,55	1,66
3	Clemencia	0,11	2,06				
4	Santa Rosa	1,41	1,52				
5	Turbaco	3,52	1,55				

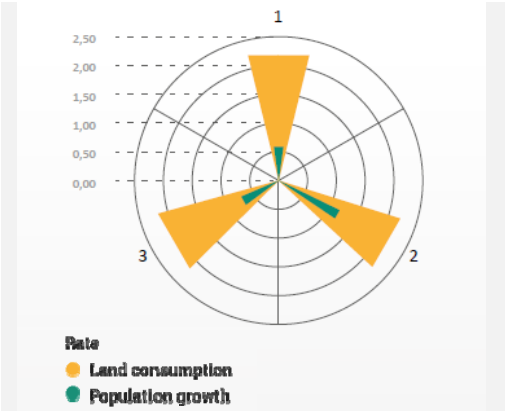
Land consumption rates versus population growth rates

The urban agglomeration of Pereira include the cities of Pereira, Santa Rosa de Cabal and Dosquebradas, which have a land consumption rate higher than the population growth rate.

SDG indicator







1 Pereira 2,17 0,62
2 Dosquebradas 2,15 1,17
3 Sta. Rosa De Cabal 2,09 0,70

Land consumption rates versus population growth rates

The next step is to work on the strategy for disseminating the results

Dissemination Strategy – Geo-portal:

- Results document
- Geographical files
- Methodology document
- Scripts
- Statistics in different formats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