MODELLING AND FORECASTING URBAN POPULATION PATTERNS

The MAUPP project aims at improving existing models of urban growth and population distribution for vulnerability and health assessment for a set of 48 African cities.

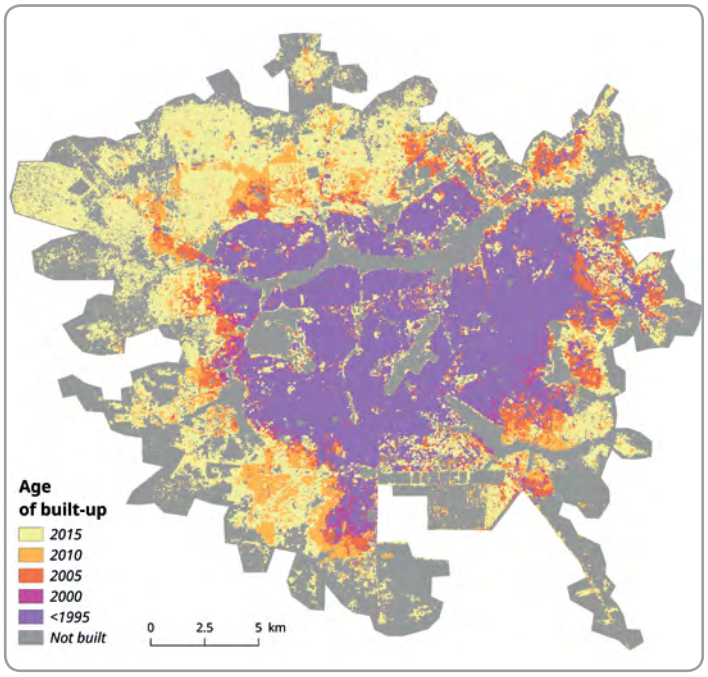
The challenge

Spatial modelling and forecasting of the human population is of primary importance for epidemiology and risk assessment, especially in Africa where the population is predicted to double over the next 40 years. At the same time, the information coming from the census is out-dated and/or only available in coarse administrative units; it therefore limits the confidence of the expansion models. The MAUPP project (maupp.ulb.ac.be) aims at taking advantage of remote sensing data to map and predict the extension of cities through time and to understand and predict intra-urban variations of population density.

The space based solution

Remote sensing offers an effective solution to map and monitor urbanisation at different spatial and temporal scales. On a local scale, they provide information on the morphology of different residential patterns that can be linked to different population densities.

On a large set of 48 cities selected to be representative of the variations in climates and urban patterns in sub-Saharan Africa, historical and recent optical and radar high resolution (~30m) remote sensing data, i.e. Landsat, Sentinel, Envisat and ERS, are fused in a highly-automated image analysis process, using open source solutions, in order to delineate their current extent and map their growth from 1995 to nowadays. This knowledge of the past is then used to build urban expansion models to forecast the urban extension until 2030. Our products achieved more than 85% of overall accuracy on independent test sets. The corresponding dataset of more than 4 Terabytes is processed on a high performing PC. Without considering the pre-processing, the processing took an average of 1 hour per city. At the same time, another part of the project focuses on the use of very-high resolution remote sensing data (~0.5m) to better capture the diversity of intra-urban patterns, and to improve the estimations of population density. For 3 African cities of different structure and size, open-source semi-automated processing chains mapped land cover and land use, at city scale, with an overall accuracy above 85%. All processes are achieved on a high performance PC.



Automated classification of the built-up area for 1995 to 2015. Ouagadougou, Burkina Faso.

Thematic Area: TERRITORIAL MANAGEMENT AND URBAN PLANNING

Region of Application: DAKAR OUAGADOUGOU

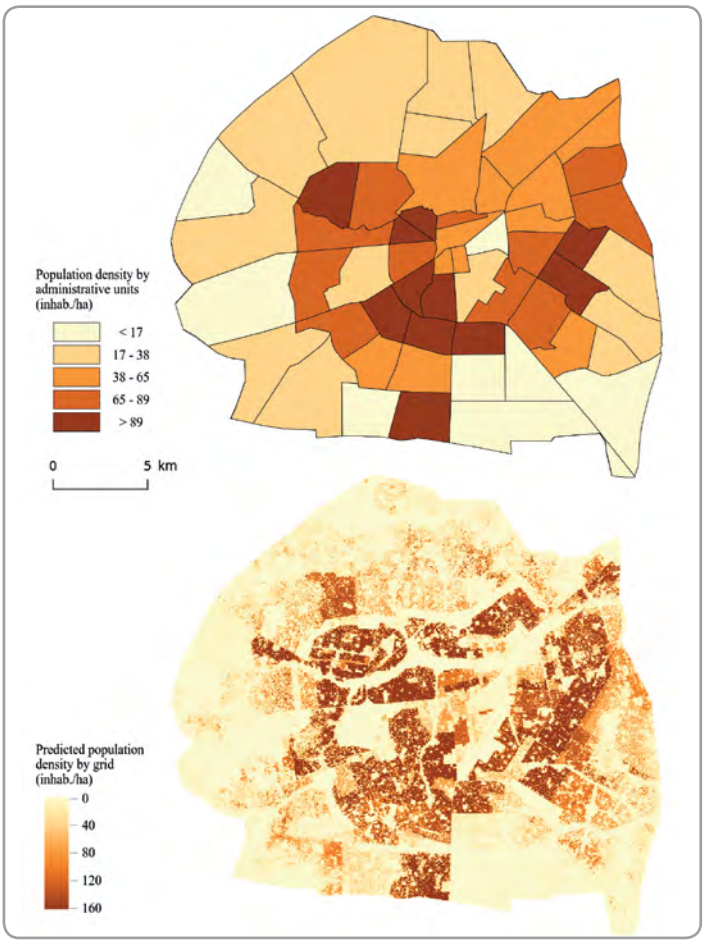
Sentinel mission used: S1 S2

Copernicus Service used: –

Usage Maturity Level: 2

Benefits to Citizens

Urbanisation has profound social, environmental and epidemiological implications and makes spatial and quantitative estimations of urban change and population density a valuable information source for epidemiology and vulnerability assessment. Such information is also very valuable for land management and planning, especially in developing countries facing rapid urban growth.



Example of population count reallocation from administrative units to a regular grid using land-cover information (Ouagadougou, Burkina Faso).

> "This kind of population data would be extremely useful for improving our urban health services."
>
> ***Olga Waigel, German Development Cooperation Agency (GIZ)***

The methods developed, and the geographic information produced will be made available on an open and free-of-charge basis. All new maps will be available to public authorities and other users through the existing WorldPop web data portal (www.worldpop.org).

Outlook to the future

In the future, the methods could be used to monitor the urban expansion of a larger number of cities. Sentinel-1 and Sentinel-2 have already proved their capability for such a purpose. Over the next few years, they will definitely become cornerstones for the automated production of geographic information, on a regular basis and at reduced costs, especially for regions such as sub-Saharan Africa where this information is still lacking.

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ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication "**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**", 2018, Edited by NEREUS, the European Space Agency and the European Commission.
The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains.
The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.
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