EO FOR SUSTAINABLE URBAN PLANNING

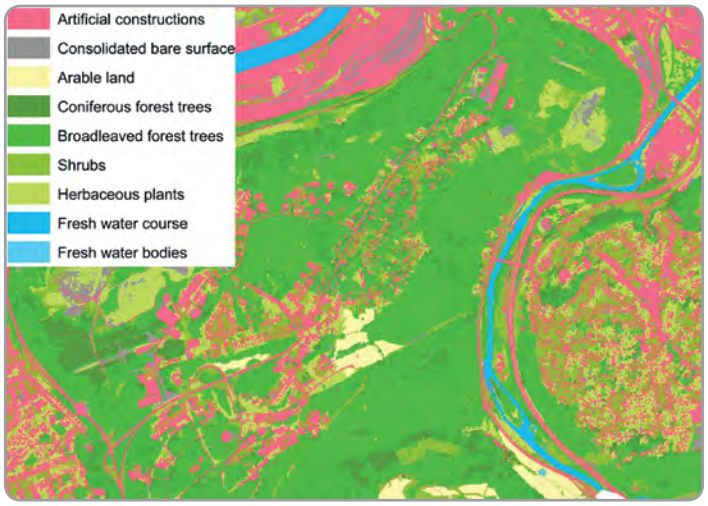
Using Earth Observation (EO) and modelling tools to spatially plan population growth. Population maps are needed to support risk management and to shape the Smart Cities of tomorrow.

The challenge

Urbanisation induces health and environmental risk-related challenges. In the context of steady urban population growth, cities and regions need to develop smart and sustainable management strategies to understand, measure, map and mitigate the increasing urban risks such as air pollution or urban heat, which are increasing in the context of climate change. In Wallonia, the current and official Land Cover (LC) and Land Use (LU) spatial database is not up to date. The LCLU map (COSW2007) does not distinguish LC from LU. Moreover, population figures are provided at the level of the statistical sectors, which have various sizes and shapes causing distortions in the spatial analysis. SmartPop develops smart spatial modelling methods combining various EO and geographical data. Derived gridded population density and risk-related maps support risk analysis, either in the assessment of hazards or in the exposure of the population, now and in the future. These tools are compliant with the EU INSPIRE directive requirements.

The space based solution

SmartPop develops two distinct LC and LU datasets integrated in a unique database. Firstly, a detailed regional urban LC mapping processing chain combines Very High Resolution (VHR) multispectral satellite imagery with aerial one as well as 3D digital height models, driven by LiDAR or photogrammetric methods. This semi-automated object-oriented chain is provided in open access. Secondly, the functional information needed in the LU map is deducted from existing thematic data and the LC map. Using this LCLU database with the High Resolution "imperviousness" Layer (HRL) from the Copernicus land monitoring service or the Global Human Settlement Layer (GHSL), SmartPop proposes population dasymetric methods disaggregating demographic figures to fine-scale raster grid (100m). With the goal of improving the regional risk modelling, the two databases are then integrated in (i) an activity-based cellular automata model that simulates LCLU changes and population distribution until 2060 and (ii) in an urban climate model, "UrbClim", that produces outputs such as urban heat island maps and the number of heat wave days per period.



RE compliant "Pure Component Land Cover" map on Sart Tilman, Seraing (2013).

Benefits to Citizens

Local and regional authorities need comprehensive, user-driven and holistic visions of the fast changing urban territory to address the population growth challenge. With SmartPop, these authorities benefit from fine-scale, up-to-date and dynamic geoinformation that allow smart and sustainable planning of the urban territory.

Thematic Area: TERRITORIAL MANAGEMENT AND URBAN PLANNING

Region of Application: WALLONIA

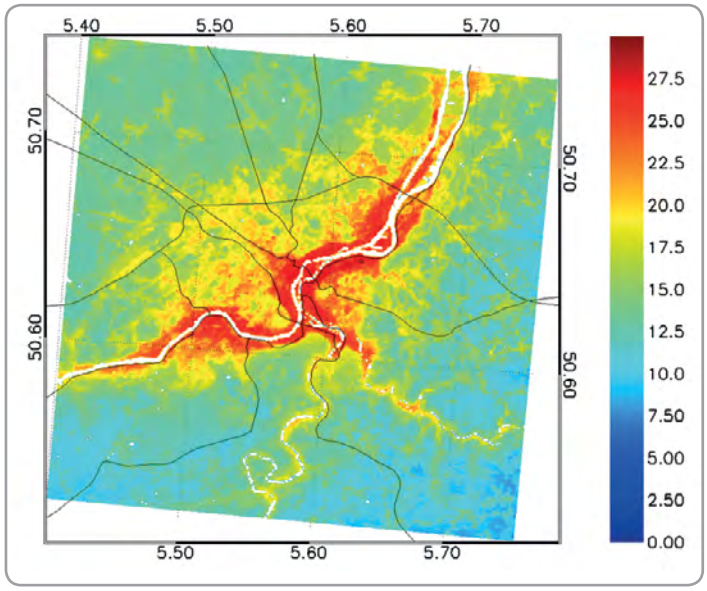
Sentinel mission used: SENTINEL-1, SENTINEL-2

Copernicus Service used: CLMS

Usage Maturity Level: 3

Outlook to the future

Thanks to the ad-hoc solution developed in Liege, a project called "Walous" and funded by public authorities has started in 2018. At regional scale, spectral indices from Sentinel-1 and 2 time series will be integrated into the current LC mapping scheme. In addition to the VHR data, these will provide useful object statistics that will help refine the level of thematic detail and increase the mapping accuracies. Sentinel data will also be primarily used for carrying out change detection analysis. By delineating the main areas of change within the LCLU database, Sentinel will help to prioritise the VHR EO data processing and hence improve the efficiency of the upgrading process.



Prediction of the number of heat wave days per summer for the 2081-2100 time period according to UrbClim (RCP8.5).

> "The Walloon Operational Plan of Geomatic and the General Direction of Agriculture, Natural Resources and Environment rely on SmartPop to answer INSPIRE and create new LC and LU maps for Wallonia. We are convinced that this application covers specific Walloon needs."
>
> ***Christel Baltus & Céline Delhage, Public Service of Wallonia (DGO3)***

The new Copernicus land monitoring services, such as Corine Land Cover +, HRL and GHSL, will be assessed with regards to the needs of Wallonia. Using the activity-based cellular automata model, different scenarios of population and LU change can be simulated. The outputs of this model will serve as inputs in risk analysis models such as "UrbClim" to analyse future risks. Using this modelling chain, robustness of environment policies can be tested under different outlooks for the future.

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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.

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