

## MONITOR URBAN AREAS AND GREEN INFRASTRUCTURES

*Satellite imagery supports cities in filling the gap of environmental information and contributing towards the production of urban planning documents.*

### The challenge

In 2050, 70 % of the world population will live in cities and policymakers are already engaged in providing a city capable of (1) hosting more inhabitants, (2) preserving and enhancing their health and quality of life, and (3) adapting to climate change. Green frames and green-infrastructures are obviously credible answers to new challenges that cities have to face. Local authorities and urban planning agencies currently consider vegetation as an important theme of urban master plans. They are looking for new decision-making tools to monitor ecological services such as biodiversity conservation, heat island and air pollution reduction.

### The space based solution

Urban vegetation is difficult to monitor and manage. Databases on urban vegetation are primarily made from field missions, are difficult to update and limited to the public domain. Faced with these constraints, satellite imagery is a suitable tool to monitor urban areas; they have the advantages of being continuous, global and objective.

On a European scale for example, the Copernicus land services took the initiative to map urban vegetation for cities of more than 50,000 residents. However the minimal mapping unit is still limited and cannot extract the individual trees or small hedges network. Specific works are ongoing to investigate contributions of very high-resolution images such as Pléiades images to extract and characterise low and high urban vegetation (Figure 1).

In addition, Sentinel-2 images are a very good complementary data source to monitor urban morphology at a coarser scale. With the 10m spatial resolution, it is possible to understand land-use, classify spatial arrangements of building and estimate their height.

This information is crucial for climate modelling and evaluating the urban heat island effect (Figure 2).

### Benefits to Citizens

The market for sustainable management of city and urban vegetation is emerging. Conversely, budgets of local authorities tend to be decreasing and consequently, it opens up new challenges for innovative solutions. Very high-resolution satellite images allow extraction of vegetation at fine scale (single tree and tree line) and provide a better understanding of vegetation in the public and private domains.

New information can be provided to local authorities to manage their city: (1) diagnoses in terms of biodiversity, and environmental health help to define new urban planning documents; (2) climate modelling to locate sensitive areas affected by urban heat islands. This phenomenon can impact the inhabitants' wellbeing; (3) land imperviousness monitoring to identify green area conversion into car parks in the private domain; (4) vegetation index to prove that urban development is not at the expense of the environment and to ensure that compensatory measures are respected.



Urban vegetation extraction and characterisation based on very high resolution Pléiades satellite image. Application in Rennes, FRANCE.

Thematic Area



TERRITORIAL  
MANAGEMENT AND  
URBAN PLANNING

Region of Application



BRITTANY  
ILLE-ET-VILAINE

Sentinel mission used



S2

Copernicus Service used



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Usage Maturity Level

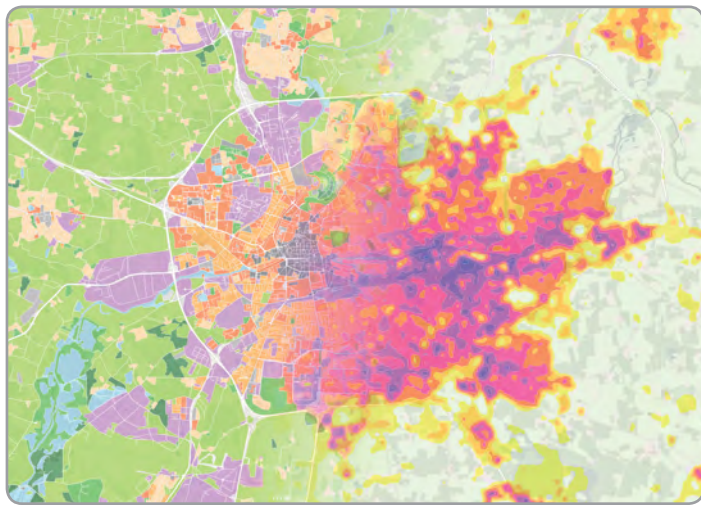


3

## Outlook to the future

A first initiative to evaluate the benefit of satellite images was conducted by the an planning agency of Rennes (AUDIAR). Rennes is an urban area about 700 km<sup>2</sup> and 440,000 inhabitants. Relevant results have been achieved and the agency is now relying more and more on satellite images to carry out their diagnosis. The encouraging results have thus interested the services of the local authority, Rennes Metropole. It has commissioned a study on the implementation of environmental indicators in order to setup decision-making tools.

Kermap, a startup in earth observation, has been selected to develop innovative solutions to provide smart monitoring of land imperviousness, biodiversity, citizen comfort, urban climate and carbon stock estimates. This information will then help Rennes Metropole to renew its urban master plan.



Local Climate Zones and Urban Heat Island modelling based urban vegetation data and Sentinel-2. Applications in Rennes, FRANCE.

*Credit: Contains modified Copernicus Sentinel data [2017]*

“Satellite images create value-added data essential for monitoring our territory and building a sustainable city.”

*Emmanuel Bouriau, Land and Environment Division, Urban planning Agency of Rennes (AUDIAR)*

Both in France and in Europe as a whole, these documents have to be updated regularly (every 3 to 5 years) and include an increasing need for sanitary and environmental information. In that context, satellite image is a suitable and affordable tool that is becoming more and more important in the decision-making process.

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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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