Urban Releaf: Mapping Urban Trees from Space to support EU Green policies and SDGs

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Context Urban Atlas/Urban Releaf

Monitoring urban land use, green spaces and trees is increasingly important in the context of urbanisation, climate change and biodiversity loss, and to support European and global policies such as the European Green Deal and the UN Sustainable Development Goals. The **Copernicus Urban Atlas** addresses this need by providing a harmonised, pan-European land-use and land-cover dataset for 790 Functional Urban Areas.

Complementing this top-down Earth Observation approach, the **Horizon Europe Urban ReLeaf** project explores the added value of citizen science for urban climate adaptation. Focusing on trees, green spaces and heat stress, it combines low-cost sensors, mobile applications and citizen engagement in European pilot cities.

Together, these initiatives show **how EO reference data and citizen-generated information can jointly support robust, equitable and policy-relevant monitoring of urban green infrastructure.**

Land Monitoring Service

Copernicus Europe's eyes on Earth

Policy Context: SDGs and Urban Green Infrastructure and insights from EO data

SDG implementation depends on the ability of countries and cities to produce consistent, comparable and spatially explicit indicators at urban scales. Urban green spaces and trees contribute directly to several SDGs, notably **SDG 11 (Sustainable Cities and Communities)** and **SDG 15 (Life on Land).**

However, indicator production remains **challenging** due to uneven data availability, differing local definitions of green spaces, and limited capacity for regular updates. In this context, Earth Observation (EO) is a key enabler, offering repeatable, objective and scalable measurements.

Question: How can EO, and the Copernicus Urban Atlas in particular, support and strengthen SDG indicator production in urban environments?

SDG Indicator 11.7.1: Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities

$$POPS = \left[\frac{\text{Total surface of open public space+Total surface of land allocated to sreets)}}{\text{(Total surface of built up area)}}\right] \times 100$$

Methodology of calculation of SDG 11.7.1 indicator (source: UN-HABITAT)

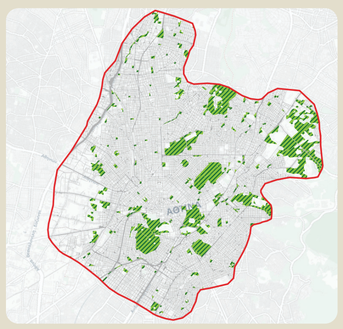
The **updated Copernicus Urban Atlas 2021** introduces a refined classification of Green Urban Areas according to public, private or unknown access. This improvement allows a more precise identification of public open spaces: including parks, facilities, streets and associated open areas, within the urban fabric, strengthening EO-based monitoring of SDG 11.7.1 in a harmonised and comparable way. This approach is complemented by the Urban ReLeaf project, which supports the assessment and validation of accessibility information using municipal data, field campaigns and citizen-generated observations.

This potential is illustrated by the use case of **Athens, Greece**, where Urban Atlas 2021 identifies approximately:

- **140 sqkm** of public open spaces
- within a total built up area of **703 sqkm**
- corresponding to **20%** of the built-up area.

When focusing on the urban centre, the share of public open spaces increases to **29.14%**, reflecting the higher concentration of public activities, facilities and accessible spaces traditionally found in central urban areas.

The figure on the right represents the public areas in core city Athens on Urban Atlas 2021:



SDG Indicator 15.1.1: Forest area as a proportion of total land area

$$\frac{Forest\ area\ (reference\ year)}{Land\ area\ (reference\ year)} \times 100$$

Methodology of calculation of SDG 15.1.1 indicator (source UNSTATS)

SDG indicator 15.1.1, which measures **forest area** as a proportion of total land area, is essential for monitoring terrestrial ecosystems and biodiversity. In urban contexts, the Urban ReLeaf project enhances support to this indicator by enabling detailed, multi-scale mapping of urban trees, from **tree canopy cover to individual trees.** This allows a shift from coarse land-cover statistics toward a more ecological and functional view of urban green infrastructure.

Urban ReLeaf also integrates **Tree Registry data** through dedicated applications and crowdsourced inventories, providing complementary information on tree location, species and management. Combined with EO-derived products, these data improve the accuracy and completeness of urban forest assessments.

Following a field campaign in **Athens, Greece,** individual tree footprints derived from VHR imagery (polygons in green) were combined with Tree Registry observations (points in red), illustrating the strong complementarity of EO and citizen-generated data for improved monitoring of SDG 15.1.1 in cities.

EO Based Methodology Aligned with SDG Practice

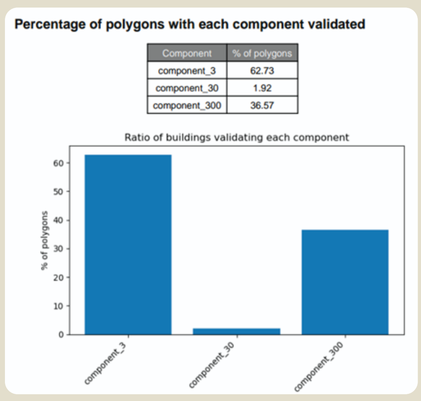
The derivation of the SDG-related indicators presented for this Athens use case is entirely based on the Copernicus Urban Atlas dataset, used as delivered and freely available through the Copernicus Land Monitoring Service (CLMS) portal. No local reclassification or city-specific adaptation of the nomenclature has been applied, in order to ensure **full reproducibility** and to enable a **comparative approach** across European cities.

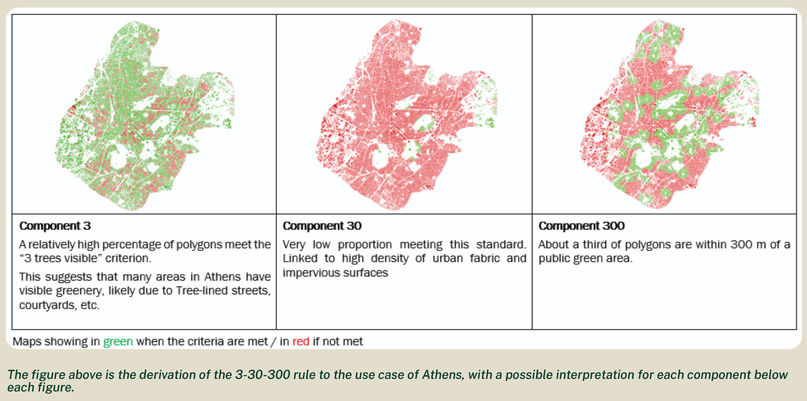
For the implementation of the indicators shown here, specific Urban Atlas 2021 land use codes have been selected to represent relevant urban and green space components. In particular, classes **12220 (Other roads and associated land)** and **14110 (Green urban areas - Public access)** are used to characterise accessible public open spaces within the urban fabric, directly supporting the monitoring of SDG 11.7.1. Nevertheless, the code **12100 (Industrial, commercial, public, military and private units)** fully aggregate public and private accessibility and should be refined to distinguished more public areas within cities.

Complementary Indicators: Linking SDGs and 3-30-300 rule

While the Sustainable Development Goals provide a global and standardized framework for monitoring urban sustainability, their implementation can benefit from operational benchmarks that translate high-level indicators into locally actionable targets.

In this context, the 3-30-300 framework does not compete with SDG indicators but rather acts as an implementation bridge, helping to operationalise SDG monitoring at neighbourhood and city scales using EO-based data.





The figure above is the derivation of the 3-30-300 rule to the use case of Athens, with a possible interpretation for each component below each figure.

Sources

- UN Environment programme – From Data to Impact : Measuring Progress through Disaggregated SDG Indicators, https://sdgs.unep.org/article/sdg-indicator-1171
- UNSTATS - SDG indicator metadata (Harmonized metadata template - format version 1.1) https://unstats.un.org/sdgs/metadata/files/Metadata-15-01-01.pdf
- Copernicus Urban Atlas, https://land.copernicus.eu/en/products/urban-atlas
- Urban Releaf, https://urbanreleaf.eu/
- European Commission, 3-30-300 rule https://www.linkedin.com/posts/european-commission_have-you-heard-of-the-3-30-300-rule-activity-7356620480973328388-sWAF?utm_source=share&utm_medium=member_desktop&rcm=ACoAABGjE4wB9KQtpyBQ38a2zXQmlB2DHRKlL2U

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