A short walk to the park?
Describing the updated methodology

An SDG-compatible method to assess people's access to nearby green urban areas in Europe's cities

Hugo Poelman, European Commission, DG Regional and Urban Policy

One of the targets of the UN sustainable development goal 11 aims to "provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities". To measure progress towards this target, indicator 11.7.1 is formulated as the "average share of the built-up area of cities that is open space for public use for all, by sex, age persons with disabilities". The initial metadata for this indicator discussed issues of definition of the spaces at stake and their relationship with the extent of cities, but did not consider the spatial relationship between open spaces and the place of living of the urban population[1].

Green urban areas are clearly amongst the categories of areas aimed at by the SDG 11.7 target. Using EU-wide harmonised data on land use, land cover and population in cities, an earlier DG Regional and Urban Policy working paper[2] developed a methodology to assess the access of urban population to green urban areas, as defined in the Copernicus Urban Atlas datasets. This paper has highlighted the benefit of taking into account the spatial relationship between people's place of residence and the location of the green urban areas when assessing the availability of those areas in cities.

Since the publication of the initial SDG metadata and of the working paper, the UN metadata have been refined, new and updated European data sources became available, and the degree of urbanisation was endorsed globally for international comparisons. These three developments offered a good opportunity to revise and update our methodology and to align it to the revised UN-Habitat metadata.

A major innovation in the revised UN metadata is the introduction of an additional indicator: "estimation of share of population with access to open public spaces and disaggregation by population group"[3]. To operationalise such indicator, UN-Habitat proposed a definition of "access":

"To help define an "acceptable walking distance" to open public spaces", UN-Habitat organized a series of consultations with national statistical officers, civil society and community groups, experts in diverse fields, representatives from academia, think tanks, other UN-agencies, and regional commissions among other partners. These consultations, which were held between 2016 and 2018 concluded that a walking distance of 400 meters - equivalent to 5 minutes' walk was a practical and

[1] UN-Habitat, 2018

[2] Poelman, H., 2018

[3] UN-Habitat, 2021

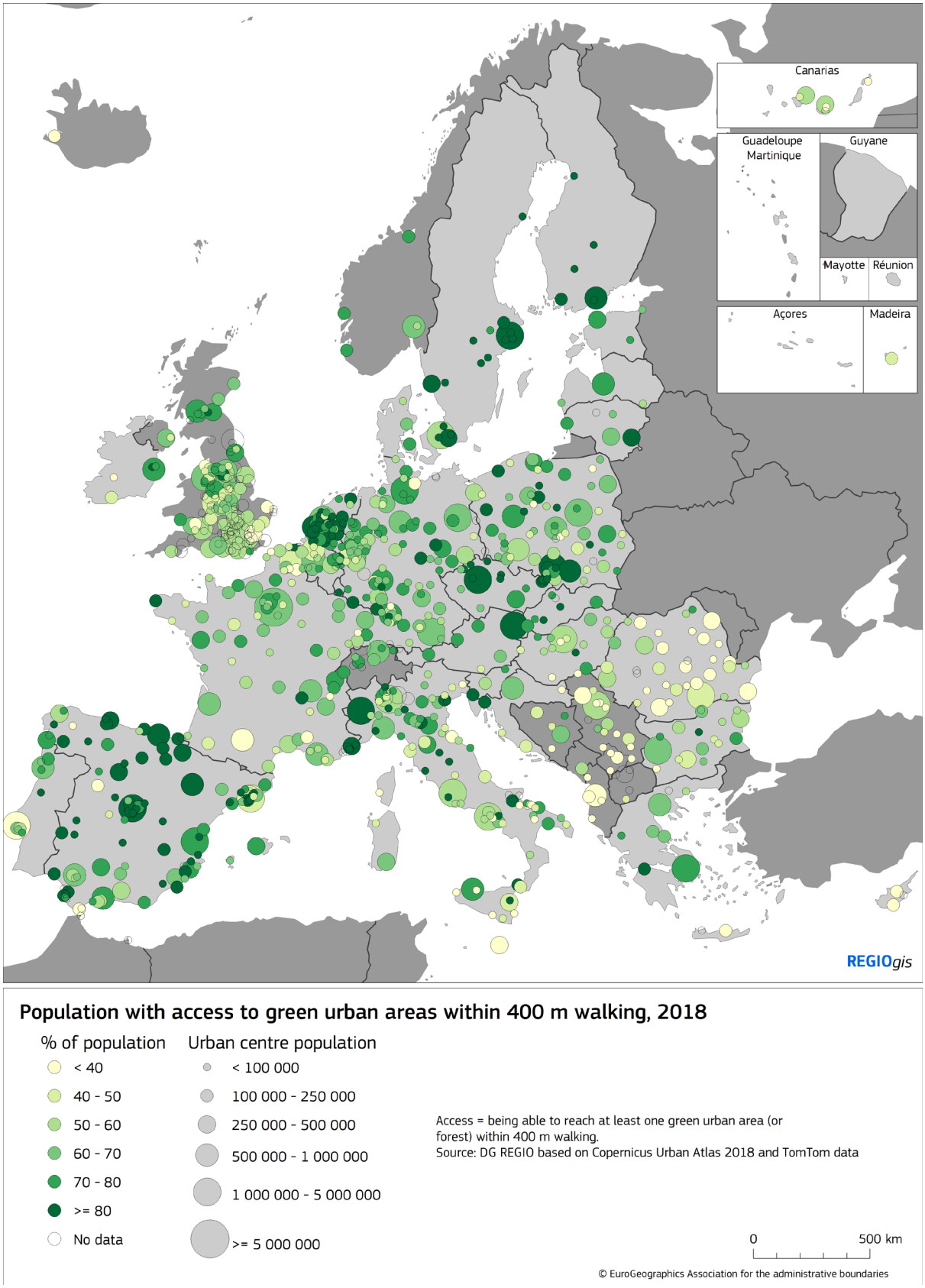
realistic threshold. Based on this, a street network-based service area is drawn around each public open space, using the 400 meters access threshold.[4]"

In the context of the SDG target, the concept of open public space not only encompasses green urban areas but also other open pieces of land that provide recreational areas for residents and help to enhance the beauty and environmental quality of neighbourhoods[5]. Typical examples of non-green areas that can be defined as open public spaces are plazas, squares, pedestrian streets, (pedestrianised) waterfronts, etc. While some experimental analysis has taken place aiming to identify such areas from Europe-wide sources, such analysis still encounters major obstacles of lack of comparability and fuzzy definitions, making it very hard to analyse actual availability and access to open public spaces in a harmonised and comparable way. For that reason our analysis exclusively focuses on green areas, for which a harmonised definition and delineation is available from the Copernicus Urban Atlas data.

Whereas in our previous working paper we used a 10-minutes walking time to determine which green urban areas were accessible, in this update we align the threshold to a walking distance of **400** meters. We evaluate this walking distance using a street network that aims to represent all walkable streets. Without precise in-situ information about the actual walkability of individual streets, all elements of a comprehensive street network are considered as walkable, except motorways and equivalent highways. The 400 meters walking distance is evaluated from each green urban area or forest that is represented in the Copernicus Urban atlas datasets. Using population estimates for each Urban Atlas building block (i.e. an area surrounded by streets) we compute which part of the urban centre's population has access to green areas within walking distance. Map 1 shows the result for all urban centres where sufficient Urban Atlas data are available. On average, 64.6% of the inhabitants of these urban centres have access to at least some green areas within 400 meters walking, but the share of population having access varies from below 20% to over 90% of the urban centre's population. In urban centres with more than 1 million inhabitants this share varies from around 40% in Lisbon and Bucharest to more than 90% in Prague and Stockholm.

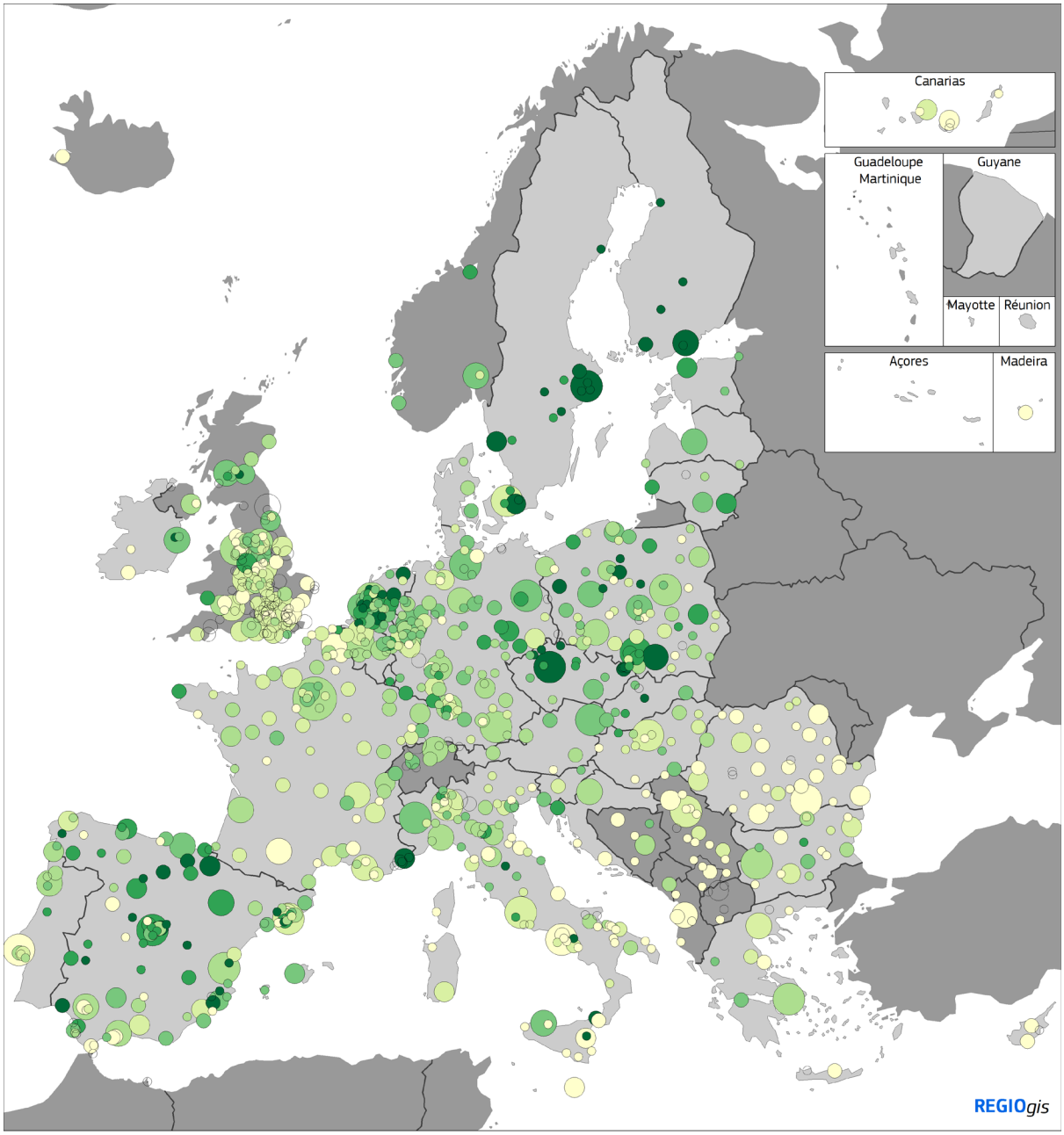
[4] UN-Habitat, 2021, page 7.

[5] UN-Habitat, 2021, page 2.



Map 1 – Population with access to green urban areas within 400 m walking.

For each of the inhabited areas in the urban centres, we can also determine the actual surface of the green urban areas that can be reached within a short walk. Consequently, we can calculate the share of population that has easy access to green urban centres of at least 1 hectare. Using this indicator assumes that accessible green areas should exceed a minimum size in order to be able to better provide opportunities for active recreation and leisure. Map 2 depicts the share of population having access to green areas of at least 1 hectare. Amongst all urban centres this share varies from around 10% to more than 90%, with an average of 54.5%. Amongst urban centres of more than 1 million inhabitants, the lowest shares are again found in Lisbon and Bucharest (34 and 35%) and the highest ones in Stockholm and Prague (92.4 and 90.7 %). In some major cities the share of people having access to some neighbouring green areas is high but drops by more than 15 percentage points when considering only green areas of more than 1 hectare. For instance, small patches of green are widespread in cities like Turin, Athens and Valencia, but in those cities it is less common to find somewhat larger green areas in one's close neighbourhood.



Population with access to green urban areas of at least 1 ha within 400 m walking, 2018

% of population
- < 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- >= 80
- No data

Urban centre population
- < 100 000
- 100 000 - 250 000
- 250 000 - 500 000
- 500 000 - 1 000 000
- 1 000 000 - 5 000 000
- >= 5 000 000

Access = being able to reach green urban areas (or forests) of at least 1 ha within 400 m walking.
Source: DG REGIO based on Copernicus Urban Atlas 2018 and TomTom data

0 500 km

Map 2 – Population with access to green urban areas of at least 1 ha within 400 m walking.

Methodology

Input data

The calculation of the indicators requires data on green urban areas, the street network and the location of population. In addition, the spatial extent of the areas under review, i.e. the urban centres, is needed.

For the purpose of this analysis, green urban areas are defined as the Copernicus Urban Atlas land cover/land use classes "green urban areas" and "forests".

The Copernicus Urban Atlas 2018 geodata provide harmonised information about land use and land cover in Europe's urban areas and their surroundings. Urban Atlas contains a class of "green urban areas" (Urban Atlas class code 1.4.1), described as: "Public green areas for predominantly recreational use such as gardens, playgrounds, zoos, parks, castle parks and cemeteries. Suburban natural areas that have become and are managed as urban parks. Forests or green areas extending from the surroundings into urban areas are mapped as green urban areas when at least two sides are bordered by urban areas and structures, and traces of recreational use are visible.[6]" In the close neighbourhood of urban centres, forest areas may also fulfil similar functions. For that reason we also included Urban Atlas class 3.1 ("forests").

To assess access to green urban areas by means of walking we use a street network dataset that is designed to cover all relevant streets in the urban areas. From the TomTom MultiNet network (2018) we selected the street segments that can be considered as walkable, i.e. mainly excluding motorways[7].

The spatial distribution of population within an urban centre is represented by estimates of residential population in 2018 by Urban Atlas polygon. These estimates were produced by JRC, compatible with the JRC-GEOSTAT 2018 population grid[8].

The indicators are produced at the level of the urban centres, i.e. high-density clusters of 1 km² grid cells that have been created on the basis of the Eurostat-GEOSTAT 2011 population grid[9].

Assessing access to green urban areas

For each of the green areas a service area of 400 m walking distance needs to be created. Technically, service areas are created starting from a point, but representing a green urban area that

[6] European Commission, 2020, p. 32 and 34.

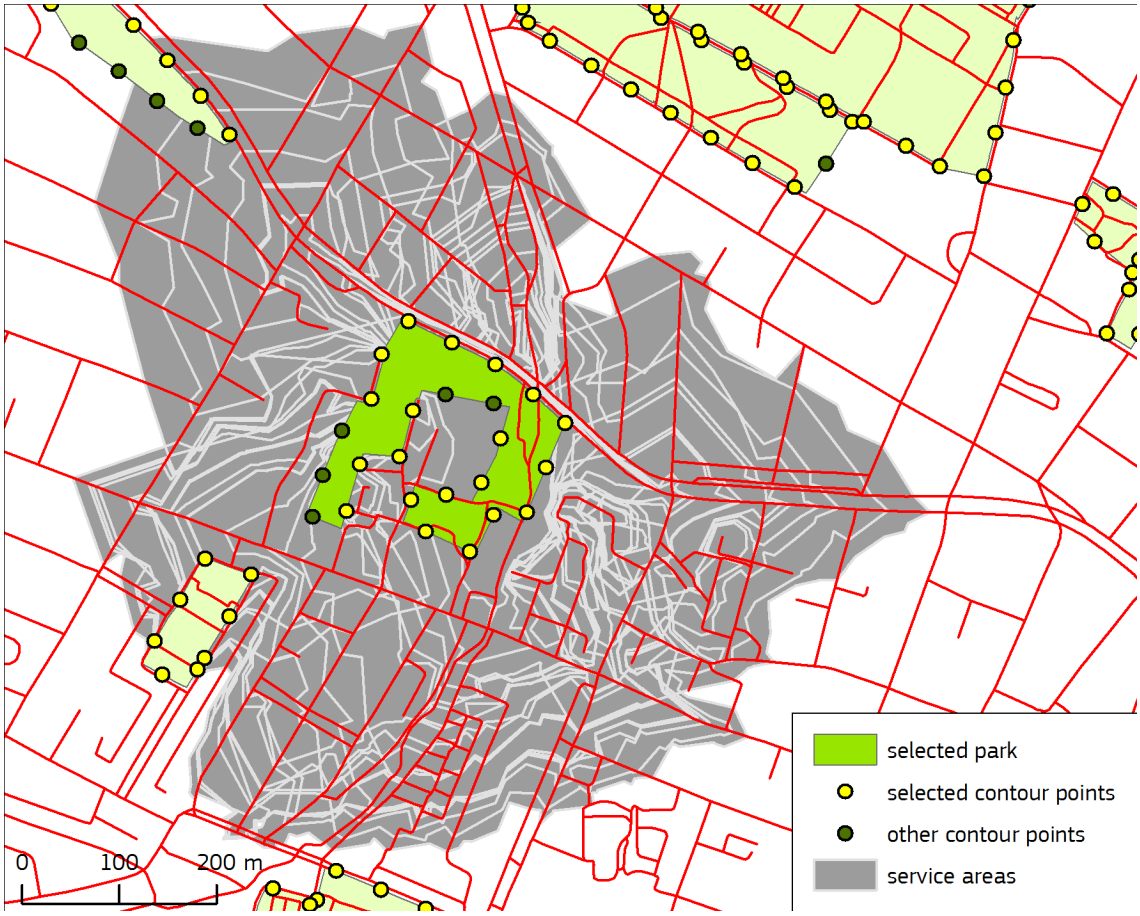
[7] The street network is created by applying the following selections on the MultiNet road network features: NEW_SELECTION: ("FOW" <> 1 AND "FRC" not in (0, 1, 2) AND "FEATTYP" <> 4165) AND ("F_ELEV" <>-1 AND "T_ELEV" <>-1); ADD_TO_SELECTION: "FOW" = 3; ADD_TO_SELECTION: "SPEEDCAT" >= 6

[8] The population estimates have been integrated in the Copernicus Urban Atlas 2018 datasets: https://land.copernicus.eu/local/urban-atlas/urban-atlas-2018?tab=download
The JRC-GEOSTAT 2018 population grid is published at: https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/population-distribution-demography/geostat

[9] Layer HDENS_CLST_2011 at: https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/population-distribution-demography/clusters

can be of a considerable size or can have an irregular shape by a single point would lead to unusable results. To get meaningful service areas we need to represent the green urban areas by means of a collection of points that can be linked to the network. The amount of points should be big enough to represent the shape of the green features, but not excessively large, in order to keep computation time and the amount of service areas manageable.

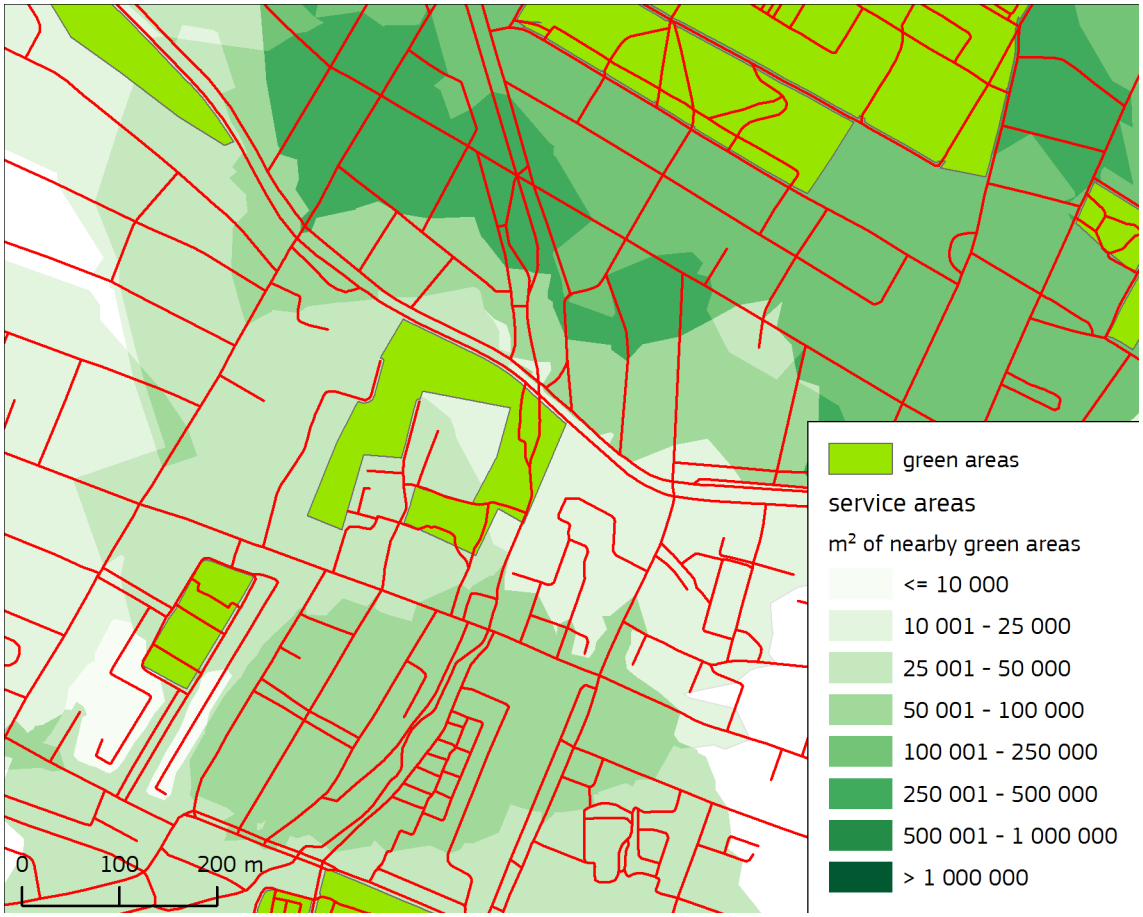
For each green areas' polygon we create points along lines, using a fixed distance of 50 m between the points, using the option to include the endpoints of the polygon contours. This method obviously produces a large number of contour points. This number can be reduced by selecting those close to the street network. Contour points that are far from the streets are in principle useless, because they are supposed to be located in places where one cannot access the green area (for instance along rivers, railways, motorways, etcetera). Hence, we select the contour points that are within 25 meters from a street. In exceptional cases some small green areas will not be represented by any selected contour point. For these areas their centroid point is added.



Map 3 – Contour points representing green areas and service areas of 400 m walking

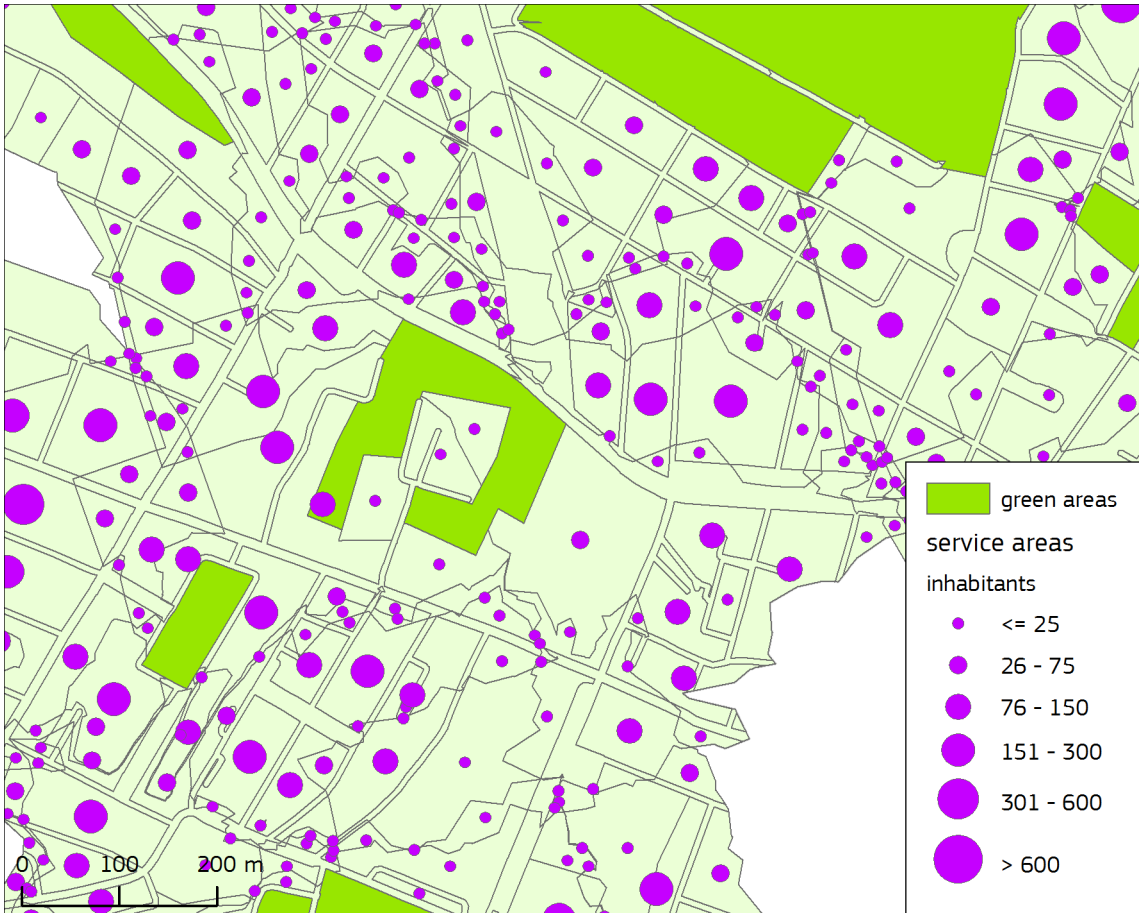
Around all points service areas of 400 m walking via the street network are created. Map 3 illustrates the contour points delimiting the green areas and the initial service areas created around each of the selected points. To obtain a single service area for each green area, we dissolve the service areas by the unique identifier that represents each Urban Atlas polygon (and thus each green area). To each dissolved service area the surface area figure of the green urban area is added.

The next step is the intersection of all dissolved service areas. This process results in many overlapping pieces of service areas. For each overlapping area we calculate the sum of the green areas' surface. This means that, for each part of territory covered by one or more service areas, we know what the total surface of green urban area that can be reached within 400 m walking (map 4).



Map 4 – Total surface of green urban areas that can be reached within 400 m walking

Finally we intersect the combined service areas with the inhabited Urban Atlas polygons, computing (by means of simple area weighting) the population living in each of the service area polygons. Each of the Urban Atlas polygons that falls within the boundaries of the urban centre (i.e. that has its centroid within those boundaries) is taken into account. Map 5 illustrates the result of this operation: a population estimate is shown for each part of an inhabited Urban Atlas polygon that is covered by one of more service areas.



Map 5 – Population of Urban Atlas polygons within service areas

We sum the total population of polygons having their centroid within the urban centre boundaries to obtain the polygon approximation of the total population of the urban centre. We also sum the population of the parts of polygons falling within the service areas. This gives us the population living within 400 m from any green urban area.

Using the intersection of service areas and inhabited polygons, we can now also compute the population that has access to green areas of at least 1 ha (or any other surface threshold). For that purpose, we select only those polygons that are within the urban centre and that represent a total green area of at least 1 ha, and sum their population.

References

European Commission, 2020, Mapping guide v6.2 for a European Urban Atlas. https://land.copernicus.eu/user-corner/technical-library/urban_atlas_2012_2018_mapping_guide

Eurostat, 2021, Applying the Degree of Urbanisation — A methodological manual to define cities, towns and rural areas for international comparisons. Luxembourg, Publications Office of the European Union, https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-02-20-499, DOI: 10.2785/706535

Poelman, H., 2018, A walk to the park? Assessing access to green areas in Europe's cities. DG Regional and Urban Policy Working Paper 01/2018. http://ec.europa.eu/regional_policy/en/information/publications/working-papers/2018/a-walk-to-the-park-assessing-access-to-green-areas-in-europe-s-cities

UN-Habitat, 2018, Metadata on SDGs indicator 11.7.1 - Indicator category: Tier II, https://unhabitat.org/sites/default/files/2020/07/metadata_on_sdg_indicator_11.7.1.pdf

UN-Habitat, 2021, Metadata on SDG Indicator 11.7.1, https://data.unhabitat.org/documents/GUO-UN-Habitat::metadata-on-sdg-indicator-11-7-1/explore