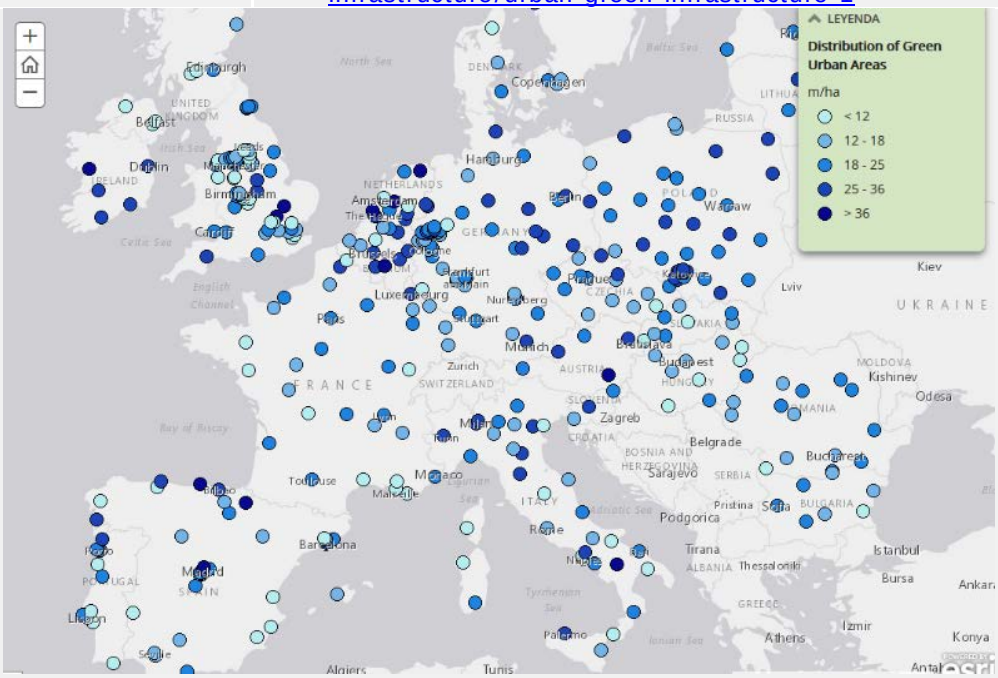
	https://www.eea.europa.eu/themes/sustainability-transitions/urban-environment/urban-green-infrastructure/urban-green-infrastructure-1



8.3.1 Public green space distribution (applied and EO/RS)

Project Name: Connecting Nature

Author/s and affiliations: Connop, S.[1], Dushkova, D.[2], Haase, D.[2] and Nash, C[1].

[1] *Sustainability Research Institute, University of East London, UK*

[2] *Geography Department, Humboldt University of Berlin, Berlin, Germany*

Public greenspace distribution (Applied and EO/RS combined)	**Green Space Management**
Description and justification	Public greenspace in cities contributes to quality of life in terms of environmental services and social and psychological services. Public greenspace distribution can therefore be an important factor for making a city sustainable. Decisions on where to create greenspace/NBS should be based on criteria related to maximising the equitability of distribution, focusing on areas lacking greenspace and in areas where ES valuation identifies greatest benefit/need.

	Data on public greenspace distribution generated in these ways can be used to: • Quantify the benefits of a nature-based solution project in terms of improving the distribution of public greenspace; • Support the planning of new nature-based solution greenspace initiatives; • Underpin other indicators that require an understanding of greenspace distribution as a foundation (e.g., green space provision and availability).
Definition	Measure of the distribution of public greenspace (total surface or per capita) and categories (i.e., street trees, residential gardens, school green areas, parks) using more applied and participatory approaches as an index to increase quality/quantity of green/blue existing, restored and new NBS with a high degree of multifunctionality (informed by ES Valuation e.g., includes cultural ES value, needs of residents, socio-economics etc) and adapted to the type of urban area (e.g., size of urban area/landscape structure).
Strengths and weaknesses	**Applied methods:** Accuracy will be influenced by the resolution of satellite imagery and the complexity of metrics used to quantify distribution. Mapping combined with census data provides the most basic level data on distribution of greenspace in relation to population patterns. Using a more comprehensive range of metrics can provide greater evidence for supporting equality in urban greenspace distribution. **EO/RS methods:** data such as Lidar and high-resolution images are not easily accessible for many regions or users, due to the high costs of data acquisition and it is usually impractical to provide full coverage of extensive metropolitan areas, with limited data available over long periods. With the advantages of global availability, repetitive data acquisition, and long-term consistency, Landsat series satellites have become the best compromise to overcome these limitations
Measurement procedure and tool	A variety of methods exist from applied/public participation techniques through to earth observation/remote sensing approaches. For further details on measurement tools and metrics, including those adopted by past and current EU research and innovation projects, refer to Connecting Nature Indicator Metrics Reviews Env23_Applied and Env23_RS.
Scale of measurement	**Applied methods:** Typically carried out over a city-scale but can be assessed at a local level also.

	EO/RS methods: Possible at various geographical scales
Data source	
Required data	Required data will depend on selected methods, for further details on applied and earth observation/remote sensing metrics refer to Connecting Nature Indicator Metrics Reviews Env23_Applied and Env23_RS.
Data input type	Data input types will be depend on selected methods, for further details on applied or earth observation/remote sensing metrics refer to Connecting Nature Indicator Metrics Reviews Env23_Applied and Env23_RS.
Data collection frequency	Data collection frequency will be depend on selected methods, for further details on applied or earth observation/remote sensing metrics refer to Connecting Nature Indicator Metrics Reviews Env23_Applied and Env23_RS.
Level of expertise required	**Applied methods:** Expertise in relation to mapping and modelling will be necessary. Also expertise in leading participatory processes would be of value to maximise the quality of outputs. **EO/RS methods:** Selecting an applicable data source and the method to process data is a complicated process which needs expert knowledge. The assessment should be made by experts engaged in the NBS project who have expertise not only in RS, but also in urban planning, forestry, landscape ecology, regional planning. Each of them will then assess all built and land cover type combinations.
Synergies with other indicators	Synergies with other greenspace mapping indicators, and the data can be used as an index for other environmental and health/wellbeing indicators.
Connection with SDGs	SDG3, SDG4, SDG8, SDG9, SDG10, SDG11, SDG13, SDG14, SDG15, SDG16, SDG17: Access to greenspace; Environmental education; Job creation; Improved green infrastructure; Social equality in relation to flood risk; Sustainable urban development; Climate change adaptation; More sustainable water management; Habitat creation; Environmental Justice; Opportunities for collaborative working
Opportunities for participatory data collection	It may be possible to validate greenspace type and distribution using a PPGIS type citizen science exercise and/or workshops with stakeholder groups holding tacit knowledge.
Additional information	
References	**Applied methods:**

de la Barrera, F., Reyes-Paecke, S. and Banzhaf, E. (2016) Indicators for green spaces in contrasting urban settings. Ecological Indicators 62, 212-219.

Mears, M and Brindley, P (2019) Measuring Urban Greenspace Distribution Equity: The Importance of Appropriate Methodological Approaches. ISPRS International Journal of Geo-Informatics 8, 286.

Rall, E, Hansen, R and Pauleit, S (2019) The added value of public participation GIS (PPGIS) for urban green infrastructure planning. Urban Forestry & Urban Greening 40, 264-274.

EO/RS methods:

Atiqul Haq SM. (2011) Urban green spaces and an integrative approach to sustainable environment. Journal of Environmental Protection.;2:601–608. 10.4236/jep.2011.25069

Badiu, D.L., Iojă, C.I., Pătroescu, M., Breuste, J., Artmann, M., Niță, M.R., Grădinaru, S.R., Hossu, C.A. and Onose, D.A. (2016) Is urban green space per capita a valuable target to achieve cities' sustainability goals? Romania as a case study. *Ecological indicators*, 70: 53-66.

Comber, A., Brunsdon, C., & Green, E. (2008) Using a GIS-based network analysis to determine urban green space accessibility for different ethnic and religious groups. Landscape and Urban Planning, 86(1): 103–114.

Daniels B, Zaunbrecher BS, Paas B et al. (29018) Assessment of urban green space structures and their quality from a multidimensional perspective. Science of the Total Environment 615 (2018) 1364–1378. https://doi.org/10.1016/j.scitotenv.2017.09.167

Davies, Z.G., Edmondson, J.L., Heinemeyer, A., Leake, J.R. and Gaston, K.J. (2011) Mapping an urban ecosystem service: quantifying above-ground carbon storage at a city-wide scale. *Journal of applied ecology*, 48(5): 1125-1134.

de la Barrera, F., Reyes-Paecke, S. and Banzhaf, E. (2016) Indicators for green spaces in contrasting urban settings. *Ecological Indicators*, 62: 212-219

Foster A, Dunham IM. (2015) Volunteered geographic information, urban forests, and environmental justice. Computers, Environment and Urban Systems.; 53:65–75. 10.1016/j.compenvurbsys.2014.08.001

Joseph, M., Wang, L. & Wang, F.H. (2012) Using Landsat Imagery and Census Data for Urban Population Density Modeling in Port-au-Prince, Haiti. GI Science & Remote Sensing, 49:2, 228-250.

Le Texier M, Schiel K, Caruso J (2018) The provision of urban green space and its accessibility: Spatial data effects in Brussels. PLoS One 13(10): e0204684. doi: 10.1371/journal.pone.0204684

Mitchell R, Astell-Burt T, Richardson EA. (2011) A comparison of green space indicators for epidemiological research. Journal of Epidemiology and Community Health.;54(10):853–858 10.1136/jech.2010.119172

Nicholls S. Measuring the accessibility and equity of public parks: a case study using GIS. Managing Leisure. 2001;6(4):201–219. 10.1080/13606710110084651

Oh, K. and Jeong, S., 2007. Assessing the spatial distribution of urban parks using GIS. *Landscape and urban planning*, *82*(1-2): 25-32.

Ren Z., He X., Zheng H., Zhang D., Yu X., Shen G., Guo R. Estimation of the Relationship between Urban Park Characteristics and Park Cool Island Intensity by Remote Sensing Data and Field Measurement. Forests. 2013;4:868–886. doi: 10.3390/f4040868.

Santos T, Tenedório JA, Gonçalves JA (2016) Quantifying the City's Green Area Potential Gain Using Remote Sensing Data. Sustainability 2016, 8, 1247; doi:10.3390/su8121247

Seiferling I, Naik N, Ratti C, Proulx R. (2017) Quantifying and mapping urban trees with street-level imagery and computer vision. Landscape and Urban Planning.;165:93–101

Taylor BT, Fernando P, Bauman AE, Williamson A, Craig JC, Redman S. (2011) Measuring the quality of public open space using Google Earth. American Journal of Preventive Medicine.;40(2):105–112. 10.1016/j.amepre.2010.10.024

Sister C, Wolch J, Wilson J. Got green? Addressing environmental justice in park provision. GeoJournal. 2010;75:229–248. 10.1007/s10708-009-9303-8

Van De Voorde T. (2016) Spatially explicit urban green indicators for characterizing vegetation cover and public green space proximity: a case study on Brussels, Belgium. International Journal of Digital Earth.;10(8):798–813. 10.1080/17538947.2016.1252434

Van Herzele A, Wiedemann T. A monitoring tool for the provision of accessible and attractive urban green spaces. Landscape and Urban Planning. 2003;63:109–126. 10.1016/S0169-2046(02)00192-5