8.39 Land use change and green space configuration

Project Name: Connecting Nature (Grant Agreement no. 730222)

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Land use change and green space configuration (Applied and EO/RS)	**Green Space Management**
Description and justification	Identifying urban land-use patterns is important for decision-makers to ensure sustainable development. Typical metrics for this indicator comprise the use of land use and land cover maps. These are typically obtained by classifying and modelling Remotely Sensed (RS) data, for example Landsat in a GIS environment. Use of remote sensing involves the application of multi-temporal datasets to quantitatively analyse the temporal effects of the land use changes as well as green space configuration. Due to the high degree of complexity of urban issues, GIS and remote sensing (RS) technologies have long been used to facilitate scientists to assess the overall state of urban environment, to manage the urban infrastructures and improve the efficiency and rationality of its spatial management. A necessary prerequisite for the improvement of urban environment is rationality of its spatial management – the optimal division of urban spaces by their functional predestination. One of approaches suited to this is functional zonation of the city – a spatial management of basic types of activities – labour, household, recreational. Data on landuse change and greenspace configuration collected in these ways can be used to: • Track landuse change on sites in relation to ecosystem service provision; • Track trends in private garden use to monitor a substantial green infrastructure asset over which local authorities have little influence; • Set targets for landuse change, for example recognising the highest quality brownfield sites for biodiversity and ecosystem service delivery and prioritising the beneficial reuse of brownfield sites with little environmental value.
Definition	Records change in land use (e.g., from brownfield to green areas by adding vegetated brownfield to UGI resource) and

	accounting for configuration (e.g., individual gardens, groups of gardens and socio-economic factors impact on the utility of private gardens for native biodiversity conservation).
Strengths and weaknesses	**Applied methods:** Applied methods are used to support and supplement evidence generated through remote sensing metrics. As such, they should strengthen the evidence generated. **Earth observation / Remote sensing methods:** During the last decades, geographic information systems (GIS), historical maps, aerial imagery, and remotely sensed images have proven very effective in studying land change dynamics. These tools have been widely used also on the city level to assess changes over time and to predict future scenarios based on long-term sets of observations. Agarwal et al. (2002) presented a framework to compare models of land use change with respect to scale (spatial and temporal), complexity, and their ability to incorporate space, time, and human decision making. Several different approaches have been developed to predict future land use transformations.
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 can be found in: Connecting Nature Indicator Metrics Reviews Env42_Applied and Env42_RS
Scale of measurement	**Applied methods:** This indicator is generally applied at a city-scale, but neighbourhood and site level assessments can also be made. **Earth observation / Remote sensing methods:** methods suitable for a range of geographical scales.
Data source	
Required data	Required data will depend on selected methods, for further details see applied and earth observation/remote sensing metrics reviews in: Connecting Nature Indicator Metrics Reviews Env42_Applied and Env42_RS
Data input type	Data input types will depend on selected methods, for further details see applied or earth observation/remote sensing metrics reviews in: Connecting Nature Indicator Metrics Reviews Env42_Applied and Env42_RS
Data collection frequency	Data collection frequency will depend on selected methods, for further details see applied or earth observation/remote

	sensing metrics reviews in: Connecting Nature Indicator Metrics Reviews Env42_Applied and Env42_RS
Level of expertise required	**Applied methods**: As this indicator is generally associated with remote sensing, GIS expertise and a familiarity with modelling are required. Supplementing this with local ground-truthed data requires expertise in habitat assessment and, potentially, participatory processes. **Earth observation / Remote sensing methods**: It is a challenge and a critical need to understand the methods for extracting useful information from the data, as well as to interpret the time-series signals correctly. We need to be able to interpret both slow variations due to gradual ecosystem transformations, and faster variations due to disturbances or other rapid events. Methods based on remote sensing theory, process modelling, and statistical data analysis will help developing this understanding.
Synergies with other indicators	The synergy between geographic information systems (GIS) and remote sensing comes into play here. To be interpreted accurately, remotely sensed data are often supplemented with other data. Often these ancillary geospatial data can be found or included in a GIS for analysis. But to be more valuable in decision-making contexts, GIS data layers should be up-to-date as is practical. Remotely sensed data are a key technology for updating many types of GIS data. Thus when environmental planners, resource managers, and public policy decision-makers want to measure, map, monitor, or model future scenarios in order to facilitate better management decision-making, remote sensing is being employed more and more within the context of a GIS as a decision support system. Due to this link between GIS and Remote Sensing, there are strong synergies with other mapping indicators and other environmental indicators such as UHI, drainage, air quality, biodiversity as well as health and wellbeing.
Connection with SDGs	All except SDG 4: Economic opportunites (e.g., grow-your-own); Urban agriculture; Links to access to greenspace; Links to environmental education; Co-benefits for clean water; Links between greenspace and clean energy (biosolar, biofuel); Job creation; Improved green infrastructure; Social equality in relation to greenspace; Sustainable urban development; Opportunities around responsible management of greenspace; Climate change adaptation; Potential co-benefits related to more sustainable water management; Habitat creation;

	Environmental Justice; Opportunities for collaborative working.
Opportunities for participatory data collection	**Applied methods** Participatory processes are possible to supplement remote sensing data with ground-truthed data to avoid the pitfalls of the heterogeneity in land use of high-density urban areas. Citizen science and participatory GIS processes can be used for this. **Earth observation / Remote sensing methods**: A combination of remote sensing, field observations and focus group discussions is often suggested to be used to analyse the dynamics and drivers of LULC change. Supervised image classification can be applied to map LULC classes. In addition, focus group discussions and ranking can support to explain the drivers and causes linked to the land cover changes.
Additional information	
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8.40 Soil sealing

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Soil sealing (Applied and EO/RS combined)	Green Space Management
Description and justification	Impermeable ground and modified ecosystems transform natural soil and alter important environmental processes (e.g., water cycle, energy balance, etc.). Mapping impermeable surfaces provides an indicator of urban development, e.g., densification/urban sprawl, and can aid assessments of drainage, urban heat island, biodiversity and health and wellbeing. Data on soil sealing collected in these ways can be used to: • Set targets for soil unsealing; • Monitor changes in relation to loss of permeable surfaces; • Linking to other indicators such as land use change and stormwater management;