	Index on Cities' Biodiversity (also known as the City Biodiversity Index). Singapore: National Parks Board, Singapore.

10.20 Bird species richness

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

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Bird Species Richness	Biodiversity
Description and justification	Based on the European Urban Biodiversity Index (EUBI) metric, this indicator uses bird species richness as a proxy for habitat quality in urban areas. Species richness is a crucial component of biodiversity and species density describes how many bird species are encountered within the Formal Urban Area. The concept is based on the idea of umbrella species, whereby bird species richness is considered to be indirectly linked to the conservation and protection of other species within their ecosystem.
Definition	Count of bird species per hexagonal grid cell, derived from modified Article12 datasets from the EU Birds Directive (Number of species per hexagonal grid cell).
Strengths and weaknesses	+ can be aligned with Birds Directive reporting - can represent a substantial amount of survey work, if such a survey protocol is not already established. - the value of the outcomes are proportional to the effort of the survey - whilst birds can represent a good indication of habitat quality, they are not an accurate proxy for all biodiversity.
Measurement procedure and tool	Based on the EUBI metric: C06 Art. 12 Bird species richness The process involves several steps to obtain the Article 12 species count per hexagonal cell. At first a hexagonal grid with a unique identifier for each grid cell is created. This grid is merged with Urban Area polygons which have been assigned towards specific MAES habitats with a crosswalk using the GIS Tool "Union". In a second step, the Article 12 GIS- data is clipped to the Formal Urban Area Boundary and also merged with the grid. Through this process the created datasets obtain a

	common identifier within the hexagonal grid, which is the basis for further processing steps. The data is imported into a database system (MS-SQL) for further processing and cleaning operation. Article 12 hex-grid data are assigned towards specific MAES habitats using the species-habitat linkages database. The data is then joined using the common identifier assigned, as well as by the MAES habitat. This enables filtering out of species which may cover a grid cell, but which are not assigned to a habitat within the cell and thus are unlikely to occur at that location.
Scale of measurement	Number of species in a defined area
Data source	
Required data	Survey data and GIS mapping data
Data input type	Quantitative and Spatial
Data collection frequency	Ideally annual. Can be less frequent if resources do not permit this (e.g., 6-yearly to coincide with Birds Directive reporting).
Level of expertise required	Expertise is typically required for species identification if survey is part of the metric. If using existing survey data, then methodology only requires basic GIS skills for data analysis.
Synergies with other indicators	Synergies with other biodiversity indicators and greenspace mapping indicators
Connection with SDGs	SDG 15.
Opportunities for participatory data collection	Surveying represents an excellent opportunity for widening participation.
Additional information	
References	Ruf, K., Gregor, M., Davis, M., Naumann, S. and McFarland, K., 2018. The European Urban Biodiversity Index (EUBI): a composite indicator for biodiversity in cities. ETC/BD report to the EEA. Urban Atlas (2012), Art. 12, WISE WFD reference spatial data sets – Surface Water Body (2016), Linkages of species and habitat types to MAES ecosystems