2.1.2 *Carbon storage and sequestration in vegetation – annual determination*

Project Name: Nature4Cities (Grant agreement: No. 730468)

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Annual carbon storage and sequestration in vegetation per unit area	**Climate Resilience**
Description and justification	The storing and sequestration of carbon (dioxide) can be quantified and monitored relatively easily, and enable spatial and temporal comparisons of the capacities of different nature-based solutions. The amount of sequestered carbon is directly proportional to biomass growth, for which a sort of biomass functions and equations are available in the fields of forestry and agricultural sciences (McPherson et al. 2016, USDA 2015). The carbon content is around 50% of the amount of biomass. This kind of knowledge is available mainly for trees which can be considered as good indicators of the whole ecosystem's capacity in areas with lack of data (as they have an outstanding role in carbon sequestration and storage). Natural and management-related mortality of biomass (and life of products if relevant) should be considered to get a total carbon balance of the investigated NBS.
Definition	The annual carbon sequestration is a commonly used indicator of the global climate regulation ecosystem service of different vegetation types.
Strengths and weaknesses	
Measurement procedure and tool	Self-developed equations, e.g., in the case of trees: $Cb_{t+1} = Cb_t + Kc[Gb_t – Ms_t – T_t – H_t]$ where: Cb_t: carbon stored in living biomass at time 't' (tC/ha) Gb_t: biomass growth at time 't' T_t: biomass turnover at time 't' Ms_t: tree mortality due to senescence at time 't' H_t: harvest at time t' $Gb = Kv * Ys$ where: Kv: constant to convert volume yields into dry biomass (basic wood density, in tons of dry biomass per m^3 of fresh stemwood volume Ys: the volume yield of stem wood ($m^3ha^{-1}yr^{-1}$) ecosystem-specific proxies

	Tools: - clinometer for tree height, and tape measure for crown diameter and DBH measurement - precipitation and temperature sensors for climatic data - modelling tool (i-Tree Eco, CUFR Tree Carbon Calculator) Measurement unit: tC/ha/year
Scale of measurement	Neighbourhood and city scale
Data source	
Required data	- Measured data of biomass size (e.g., diameter at breast height (DBH), full height, trunk height, crown diameter of trees) - Basic climatic data (average temperatures and sum of precipitation, length of vegetation period) These data can come from: - measurement/monitoring - remote sensing in some cases
Data input type	Quantitative
Data collection frequency	At least before and after the project's implementation, to characterize the vegetation or occasional measurement (and long-period monitoring) of biomass size or continuous measurement of climatic data
Level of expertise required	Low - Relatively easy to understand
Synergies with other indicators	
Connection with SDGs	SDG 3 Good Life and Well-being, SDG 11 Sustainable Cities and Communities, SDG 13 Climate action, SDG 15 Life on land
Opportunities for participatory data collection	None identified
Additional information	
References	Davies, Z.G, et al. (2011): Mapping an urban ecosystem service: quantifying above-ground carbon storage at a city-wide scale. Journal of Applied Ecology 48, 1125–1134. doi:10.1111/j.1365-2664.2011.02021.x Kiss, M., et al. (2015): The role of ecosystem services in climate and air quality in urban areas: Evaluating carbon sequestration and air pollution removal by street and park trees in Szeged (Hungary). Moravian Geographical Reports 23, 36-46. doi:10.1515/mgr-2015-0016

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2.1.3 Total Leaf Area

Project Name: Nature4Cities (Grant agreement: No. 730468)

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Leaf Area (LA)	**Green Space Management** **Climate Resilience** **Air Quality**
Description and justification	The LA (Leaf Area) is a Key Performance Indicator of the GREENPASS® system. It expresses the sum of leaf area of NBS within project area. The Leaf Area is the operating surface of NBS and