

## 12 ADDITIONAL INDICATORS OF AIR QUALITY

### 12.1 Removal of atmospheric pollutants by vegetation

**Project Name:** URBAN GreenUP (Grant Agreement no. 730426)

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Removal of atmospheric pollutants by vegetation (leaves, stems and roots)	Air Quality
<b>Description and justification</b>	Air pollution is one of the main problems of urban areas. Many cities experience air pollution during months owing to the combustion of fossil fuels. The air pollutant removal capacity of trees is estimated based on dry deposition that is considered as the rate of air pollutants removed from the atmosphere (Lovett, 1994; McPherson et al., 1998; Scott et al., 1998). Pollutants are removed on leaf surfaces primarily through leaf stomata uptake of gaseous pollutants and leaf interception of particulate matter (Nowak et al., 2006). The first process leads to the diffusion of pollutant into the inner part of leaves. Gases may also be absorbed or react with plant surfaces, whereas removal through the latter process may be reduced by the suspension of intercepted particles from the leaf surfaces through wind action (Selmi et al., 2016). Air pollutant deposition on vegetation cover other than trees (such as shrubs, grass) and land cover types (like water bodies, and buildings) are not included in the calculation presented herein.
<b>Definition</b>	With this KPI the main aim is to calculate the pollutions removed by vegetation (in stem, leaves and roots) (kg ha <sup>-1</sup> year <sup>-1</sup> ) using formulas and equations in order to assess the impact of the NBS.
<b>Strengths and weaknesses</b>	+ This method does not required field work. - Modelled method and specific software are required.
<b>Measurement procedure and tool</b>	The capacity of trees to attenuate air pollutants is calculated based on the formulas below (Baldocchi and Camara, 1987): The <i>pollutant flux</i> ( $F_i$ ) is calculated as the product of the <i>deposition velocity</i> ( $V_d$ ) and the <i>concentration of air pollutant i</i> ( $C_i$ ), Eq.(1): $F_i = V_d \times C \quad (1)$ <i>Total flux into urban trees of air pollutant i</i> ( $F_{it}$ ) can be estimated by multiplying $F_i$ by tree cover ( $A$ ) across a time period ( $T$ ), Eq.(2): $F_{it} = F_i \times A \times T \quad (2)$

	<p>The <i>quantity of air pollutants removed by trees</i> (F) can be quantified by Eq. (3);</p> $F = \sum_{i=1}^3 F_{it} \quad (3)$ <p>The land use-land cover map can be derived from satellite imagery using screen digitalizing in ArcGIS 10. The percentage of tree cover is calculated for each Demo Site separately in ArcGIS 10. The maps and models needed can easily be converted to an open platform such as QGIS.</p>
<b>Scale of measurement</b>	Building to street scale
<b>Data source</b>	
<b>Required data</b>	Atmospheric pollutant concentration data from monitoring stations and tree cover data from (municipal) maps and models.
<b>Data input type</b>	
<b>Data collection frequency</b>	Annually
<b>Level of expertise required</b>	High
<b>Synergies with other indicators</b>	None identified
<b>Connection with SDGs</b>	SDG3 / SDG11
<b>Opportunities for participatory data collection</b>	None identified.
<b>Additional information</b>	
<b>References</b>	<p>URBAN GreenUP Deliverable D2.4 - Monitoring program to Valladolid.  <a href="https://www.urbangreenup.eu/insights/deliverables/d2-4--monitoring-program-to-valladolid.kl">https://www.urbangreenup.eu/insights/deliverables/d2-4--monitoring-program-to-valladolid.kl</a></p> <p>URBAN GreenUP Deliverable D3.4 - Monitoring program to Liverpool  <a href="https://www.urbangreenup.eu/insights/deliverables/d3-4--monitoring-program-to-liverpool.kl">https://www.urbangreenup.eu/insights/deliverables/d3-4--monitoring-program-to-liverpool.kl</a></p> <p>URBAN GreenUP Deliverable D4.4 – Monitoring program to Izmir  <a href="https://www.urbangreenup.eu/insights/deliverables/d4-4--monitoring-program-to-izmir.kl">https://www.urbangreenup.eu/insights/deliverables/d4-4--monitoring-program-to-izmir.kl</a></p> <p>URBAN GreenUP Deliverable D5.3: City Diagnosis and Monitoring Procedures  <a href="https://www.urbangreenup.eu/insights/deliverables/d5-3-city-diagnosis-and-monitoring-procedures.kl">https://www.urbangreenup.eu/insights/deliverables/d5-3-city-diagnosis-and-monitoring-procedures.kl</a></p>

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SDG indicator 11.6.2.  
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## 12.2 Total particulate matter removed by NBS vegetation

**Project Name:** proGIreg (Grant Agreement no. 776528)

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Particulate Matter Removed by NBS Vegetation	Air Quality
<b>Description and justification</b>	Particulate matter (PM) abatement, due to the green surface is a key indicator of the amelioration of the environmental quality due to the implementation of NBS in urban areas. Indeed, PM has become a serious environmental problem and harms human health.
<b>Definition</b>	The PM abatement is defined as the PM deposited on tree and shrub leaves.
<b>Strengths and weaknesses</b>	It allows to detect the abatement of PM at different particle size fraction. The limit is that the survey is discrete and not continuously during the time.