

## Indicator: Particulate matter reduction (%)

**Naturvation challenges:** Environmental quality, including air quality and waste management; Health and well-being

**SDG: 3**

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### Indicator description

Air pollutants such as nitrogen dioxide (NO<sub>2</sub>), sulphide dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>) and particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>) have been recognised as serious threats to human health. Growing mortality and morbidity for major cardiovascular and respiratory diseases, as well as lung cancer and stroke have been related to an increase PM concentration. PM<sub>10</sub> is one of the most dominant air pollutants in urban areas where it is largely derived from vehicle emissions. Although some measurement have been taken to reduce the source of emissions (e.g. reducing cars in the cities), concentrations of air pollution in many urban areas consistently exceed public health standards. Hence, urban vegetation is promoted as a pollution control measure to improve urban's environmental quality and thus contributing to human health and well-being.

Studies have shown that there is a direct relationship between changes in PM concentration and the percentage of urban vegetation [1, 2]. PM concentration in the air are reduced by urban vegetation through a combination of dispersion (aerodynamic effect) and deposition on vegetation (air filtering effect). Deposition rates, a rate at which the surface 'cleans' a pollutant from the air, are much higher to vegetation than those to hard build surfaces. However, within literature, deposition velocities to vegetation are very wide, as deposition rates are influenced by several factors, such as the *type of vegetation & leaf area* (e.g. trees can take up more pollution than shorter vegetation [3], while coniferous trees capture more pollutants than broadleaf trees [4, 5], and *pollutant type*. Also the *distance to urban vegetation* [2], the *height where measured* [6] and the *background pollution concentration* influence the efficiency of air pollution reduction by urban vegetation. For example the higher the background concentration the higher the removal rates of pollutant by plants [7]. In addition, the reduction of air pollution is also influenced by *wind characteristics* (e.g. direction, speed) [6]. Although trees decrease pollutant concentration locally (close to where they are planted), along the road these trees can also act as an obstacles that block wind flow and hence reduce wind speed, and dispersion, resulting in high pollutant concentration before the barrier [2, 8, 9].

PM in the atmosphere is usually monitored as PM<sub>10</sub>, including all particles with a size smaller than 10µm, PM<sub>2.5</sub> that includes particles within an aerodynamic particular be diameter smaller than 2.5 µm. The latter represent the most harmful fraction for human health [4]. PM reduction is measured as the efficiency of urban vegetation to remove pollutants from the air. The indicator is assessed by empirical and modelling studies (e.g. dry deposition model, i-tree model). The method to assess the pollution reduction efficiency here is the pollution reduction efficiency that estimate the capture capacity of urban vegetation when compared to the background pollutant concentration or traffic emissions [e.g. 2, 10, 11].

### Indicator scoring

The values used for the indicator PM reduction scoring are based on xx peer-reviewed studies measuring the reduction of PM concentration in the air in different urban settings by field measurements and modelling studies. Scores were derived by normalising the values between 0 and the maximum value onto the scale 1 to 5.



Scores, particulate matter reduction (%) compared to background concentration/city's (traffic) emission		
Nature-based solution	Score	Mean value PM reduction efficiency (min – max)
Parks and (semi)natural urban green areas	3	10.3 (4.7-15.9)
Urban green areas connected to grey infrastructure	1	0.21 (0.003-2.8)
Blue areas	No score	No values found
External building greens	5	19 (1.1-61.9)
Allotments and community gardens	No score	No values found
Green areas for water management	No score	No values found

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