



NBS-Alternative Designs	Description	Benefits/ Co-Benefits	Barriers	Overcome



## Climate Mitigation and Adaption

<p><b>Carbon savings per unit area (environmental, chemical)</b> Carbon storage and sequestration in vegetation and soil (Davies et al., 2011; Demuzere et al., 2014).</p>	<p>Tonnes of carbon removed or stored per unit area per unit time (Zheng et al., 2013), total amount of carbon (tonnes) stored in vegetation (Davies et al., 2011).</p>	
	<p>Comparison with calculations of carbon consumption of equivalent non-NBS actions (e.g. through Life Cycle Assessment).</p>	
	<p>Allometric forest models of carbon sequestration, developed using proxy data obtained from Lidar data (Giannico et al., 2016).</p>	
	<p>Growth rates derived from Forest Inventory Analysis (Zheng et al., 2013).</p>	
	<p>Other metrics</p>	
<p><b>Carbon savings per unit area (economic)</b> Value of carbon sequestration by trees (Baró et al., 2014).</p>	<p>Measurements of gross and net carbon sequestration of urban trees based on calculation of the biomass of each measured tree (i-Tree Eco model), translated into avoided social costs of CO2 emissions (USD t-1 carbon).</p>	
	<p>Other metrics</p>	
<p><b>Temperature reduction (environmental, physical)</b></p>	<p>Decrease in mean or peak daytime local temperatures (oC) (Demuzere et al., 2014).</p>	
	<p>Measures of human comfort e.g. ENVIMET PET — Personal Equivalent Temperature, or PMV — Predicted Mean Vote.</p>	
	<p>Heatwave risks (number of combined tropical nights (&gt;20oC) and hot days (&gt;35oC)) following Fischer, Schär, 2010, cited by Baró et al. (2015).</p>	
	<p>Other metrics</p>	
<p><b>Energy and carbon savings from reduced building energy consumption (environmental, physical)</b></p>	<p>kWh/y and t C/y saved.</p>	
	<p>Other metrics</p>	



# Water Management

<b>Physical indicators</b>	Run-off coefficient in relation to precipitation quantities (mm/%) (Armson et al., 2013; Getter et al., 2007; Iacob et al., 2014; Scharf et al., 2012)	
	Flood peak reduction (Iacob et al., 2014), Increase in time to peak (Iacob et al., 2014) (%).	
	Reduction of drought risk (probability).	
	Increasing ground water availability, (depth to groundwater) (Feyen and Gorelick, 2004).	
	Absorption capacity of green surfaces, bioretention structures and single trees (Armson et al., 2013; Davis et al., 2009)	
	Increased evapotranspiration measured/modelled (Litvak and Pataki, 2016).	
	Temperature reduction in urban areas (°C, % of energy reduction for cooling) (Demuzere et al., 2014).	
	Other metrics	
<b>Chemical indicators (water quality)</b>	Nutrient abatement, abatement of pollutants (% , nutrient load, heavy metals).	
	Increase of ground water quality (nutrient load, heavy metals).	
	Other metrics	
<b>Economic indicators (benefits)</b>	Economic benefit of reduction of stormwater to be treated in public sewerage system (€) (Deng et al., 2013; Soares et al., 2011; Xiao and McPherson, 2002)	
	Reduction of inundation risk for critical urban infrastructures (probability) (Pregnolato et al., 2016)	
	Stage-damage curves relating depth and velocity of water to material damages (€) (de Moel et al., 2015).	
	Other metrics	

## Coastal Resilience

<b>Physical indicators</b> (Fagherazzi, 2014; Gedan et al., 2011; Grabowski et al., 2012; Stark et al., 2016).	Shoreline characteristics and erosion protection	
	Soil, temperature, drainage	
	Flooding characteristics	
	Other metrics	
<b>Economic indicators</b> (Gedan et al., 2011; Narayan et al., 2016; Shuster and Doerr, 2015).	Avoided damage costs	
	Changes in property value	
	Other metrics	
<b>Social and education indicators</b> (Piwowarczyk et al., 2013; Schuster & Doerr, 2015).	Recreation and public access	
	Number of students benefiting from education and research about coastal resilience/amenity	
	Other metrics	
<b>Biological indicators</b> (Bell, 1997; Yepsen et al., 2016).	Estimates of species, individuals and habitats distribution	
	Invasive and planted species	
	Algal bloom	
	Other metrics	
<b>Chemical indicators</b> (Grabowski et al., 2012; Yepsen et al., 2016).	Concentration of nutrients	
	Salinity, pH	
	Other metrics	

## Green Space Management

<b>Social indicators (benefits)</b>	Distribution of public green space – total surface or per capita (Badiu et al., 2016; Gómez-Baggethun and Barton, 2013; La Rosa et al., 2016).	
	Accessibility (measured as distance or time) of urban green spaces for population (Tamosiunas et al., 2014).	
	Recreational (number of visitors, number of recreational activities) or cultural (number of cultural events, people involved, children in educational activities) value (Kabisch and Haase, 2014).	
	Other metrics	
<b>Environmental (biological)</b>	Changes in the pattern of structural and functional connectivity (Iojă et al., 2014).	
	Species richness and composition in respect to indigenous vegetation and local/national biodiversity targets (Cohen et al., 2012; Krasny et al., 2013).	
	Other metrics	



## Air Quality

<b>Environmental (chemical)</b>	Non-spatial indicators of gross quantities: annual amount of pollutants captured by vegetation (Bottalico et al., 2016).	
	Non-spatial indicators of net quantities: net air quality improvement (pollutants produced – pollutants captured + GHG emissions from maintenance activities) (Baró et al., 2014).	
	Non-spatial indicators of shares: share of emissions (air pollutants) captured/sequestered by vegetation (Baró et al., 2014).	
	Spatial indicators: pollutant fluxes per m <sup>2</sup> per year (Manes et al., 2016; Tallis et al., 2011).	
	Other metrics	
<b>Economic</b>	Monetary values: value of air pollution reduction (Manes et al., 2016); total monetary value of urban forests including air quality, run-off mitigation, energy savings, and increase in property values (Soares et al., 2011).	
	Other metrics	
<b>Social (physiological)</b>	Other indicators: health impact indicators such as premature deaths and hospital admissions averted per year (Tiwary et al., 2009).	
	Other metrics	

## Urban Regeneration

<b>Urban green indicators (environmental, biological)</b>	Urban green: Index of biodiversity, provision and demand of ecosystem services.	
	Ecological connectivity (Pino and Marull, 2012).	
	Accessibility (Schipperijn et al., 2010): distribution, configuration, and diversity of green space and land use changes (multi-scale; Goddard et al., 2010).	
	Ratio of open spaces to built-form.	
	Reclamation of contaminated land: percentage of contaminated area reclaimed.	
	Other metrics	
<b>Building efficiency and environmental design indicators</b>	Reclamation of building materials: percentage reclaimed from existing buildings.	
	Energy efficiency: building materials/construction methods based on points awarded according to energy efficiency checklist.	
	Incorporation of environmental design: percentage of total building stock.	
	Land devoted to roads: percentage of site area occupied by roads.	
	Other metrics	
<b>Socio-cultural indicators</b>	Conservation of built heritage resources: percentage of built from retained for culture.	
	Land dedicated to pedestrians: percentage of road network.	
	Public transport links: walking distance to nearest facilities.	
	Access to open space: average journey time for residents/employees by foot or average distance to sports centre, recreation area, or green space.	
	Access to cultural facilities: average journey time for residents on foot or average distance to cultural centre.	
	Access to housing: affordability and choice.	
	Level of devices contributing to the safety of users in the neighbourhood: lighting of common areas, access control, presence of technical, or specialized staff, etc.	
	Other metrics	

## Participatory Planning and Governance

<b>Social</b>	Openness of participatory processes (Frantzeskaki and Kabisch, 2016; Luyet et al., 2012; Uittenbroek et al., 2013).	
	Legitimacy of knowledge in participatory processes (Frantzeskaki and Kabisch, 2016; Luyet et al., 2012).	
	Social learning concerning urban ecosystems and their functions/services (Colding and Barthel, 2013).	
	Policy learning concerning adapting policies and strategic plans by integrating ecosystem services and possibly their valuation (Crowe et al., 2016; Uittenbroek et al., 2013; Vandergert et al., 2015).	
	Perceptions of citizens on urban nature (Buchel and Frantzeskaki, 2015; Colding and Barthel, 2013; Gerstenberg and Hofmann, 2016; Scholte et al., 2015; Vierikko and Niemelä, 2016).	
	Social values for urban ecosystems and biodiversity (Brown and Fagerholm, 2014; Kenter et al., 2015; Polat and Akay, 2015; Raymond et al., 2014, 2009; Scholte et al., 2015).	
	Other metrics	

## Social Justice and Social Cohesion

<p><b>Social justice,</b> informed by the capability framework of social justice (Comim et al., 2008; Nussbaum, 2011; Sen, 2005).</p>	<p>The availability and distribution of different types of parks and/or ecosystem services with respect to specific individual or household socioeconomic profiles and landscape design (Cohen et al., 2012; Ernstson, 2013; Ibes, 2015; Kabisch and Haase, 2014; Raymond et al., 2016b; Shanahan et al., 2014).</p>	
	<p>Access to financial resources, including indicators of income per capita in a given neighbourhood, or urban area (Klasen, 2008).</p>	
	<p>Bodily integrity - Being able to move freely from place to place; to be secure against violent assault, including indicators of crime by time of day (Felson and Poulsen, 2003).</p>	
	<p>Senses, imagination and thought: being able to use the senses, to imagine, think, and reason about the environment, informed by indicators of levels of literacy, mathematics and science knowledge (Chen and Luoh, 2010; Elliott et al., 2001).</p>	
	<p>Emotions: being able to have attachments to things and people outside ourselves; to love those who love and care for us, including indicators of place attachment, empathy and love (Lawrence et al., 2004; Manzo and Devine-Wright, 2014; Perkins et al., 2010; Raymond et al., 2010).</p>	
	<p>Being able to participate effectively in political choices that govern one's life, including indicators on level and quality of public participation in environmental management (Reed, 2008; Reed et al., 2009).</p>	
	<p style="color: red;">Other metrics</p>	
<p><b>Social cohesion</b></p>	<p>Structural aspects: indicators of family and friendship ties; participation in organised associations; integration into the wider community (Cozens and Love, 2015; Stafford et al., 2003).</p>	
	<p>Cognitive aspects: indicators of trust, attachment to neighbourhood, practical help, tolerance and respect (Mihaylov and Perkins, 2014; Uzzell et al., 2002).</p>	
	<p style="color: red;">Other metrics</p>	

## Public Health and Well-Being

<p><b>Psychological indicators</b> (Relaxation and restoration, sense of place, exploratory behaviour, socializing).</p>	Reduction in chronic stress and stress-related diseases measured through repeated salivary cortisol sampling (Roe et al., 2013; Ward Thompson et al., 2012) and hair cortisol (Honold et al., 2016); use cortisol slope and average cortisol levels as an indicator of chronic stress.	
	Cognitive and social development in children: indicators related to improvement in behavioural development and symptoms of attention deficit/hyperactivity disorder (ADHD) related to green space use; questionnaire indicators on sociodemographic and household characteristics, the time spent playing in green and blue spaces, ADHD symptom criteria, such as emotional symptoms, inattention, conduct problems, hyperactivity/inattention, and peer relationship problems; and a strengths subscale for prosocial behaviour (Amoly et al., 2014).	
	Mental health changes measured through Mental Well-being scales asking participants how they have felt over the previous four weeks in relation to a number of items (e.g., feeling relaxed, feeling useful), with responses rated on a 5-point scale from “none of the time” to “all of the time” (Roe et al., 2013).	
	Other metrics	
<p><b>Health indicators related to physical activity</b> (Sports and leisure activities including e.g. walking, cycling).</p>	Number and share of people being physically active (min. 30 min 3 times per week).	
	Reduced percentage of obese people and children; reduced overall mortality and increased lifespan.	
	Reduced number of cardiovascular morbidity and mortality events (Tamosiunas et al., 2014).	
	Other metrics	
<p><b>Health indicators related to ecosystem service provision</b> (Buffering of noise and air pollution, reduced heat, exposure to microflora).</p>	Reduced autoimmune diseases and allergies (potentially) (Kuo, 2015).	
	Reduced cardiovascular morbidity and mortality (Tamosiunas et al., 2014).	
	GIS related indicators: NDVI, proximity measures (green space of min. 2 ha within 300m, (Maas et al., 2006; Vries et al., 2003)), percentage of green space (Kabisch and Haase, 2014; van den Berg et al., 2010).	
	Other metrics	

## Economic Opportunities and Green Jobs

<b>Economic</b>	Number of subsidies or tax reductions applied for (private) NBS measures (Meulen et al., 2013).	
	Number of jobs created (Forestry Commission, 2005); gross value added (Forestry Commission, 2005).	
	Change in mean or median land and property prices (Forestry Commission, 2005).	
	New businesses attracted and additional business rates (Eftec, 2013).	
	Resource efficiency in the urban system (CO2 emissions per capita, CO2 emissions for transportation per capita, etc.) (OECD, 2013).	
	Public-sector cost per net additional job (Tyler et al., 2013).	
	Net additional positive outcomes into employment (Tyler et al., 2013).	
	Net additional jobs (Tyler et al., 2013) in the green sector enabled by NBS projects.	
	Gross value added per employees based on full-time equivalent jobs (Tyler et al., 2013) in the green sector.	
	Production benefit: earnings uplift arising from skills enhancement (Tyler et al., 2013) in the design and implementation of NBS.	
	Consumption benefits: property betterment and visual amenity enhancement (Tyler et al., 2013) resulting from NBS.	
	<b>Other metric/s:</b>	