

Protocol for the design of an impact evaluation framework that can be used in an adaptive management approach with the demonstrated nature-based solutions projects

Prepared by the EKLIPSE Expert Working Group on Nature-based Solutions to Promote Climate Resilience in Urban Areas

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Christopher Raymond¹, Carlo Calfapietra², Nadja Kabisch³, Margaretha Breil⁴, Holger Robrecht⁵, Pam Berry⁶, Marco Cardinaletti⁷, Leor Lovinger⁸, Corina Basnou⁹, Mark de Bel¹⁰, Vera Enzi¹¹, Davide Geneletti¹², Ana Monteiro¹³, Mihai Razvan Nita¹⁴, Niki Frantzeskaki¹⁵

¹ Department of Landscape Architecture, Planning and Management, SLU, Sweden

² Institute of Agro-Environmental & Forest Biology (IBAF) National Research Council (CNR)

³ Department of Geography, Humboldt University, Berlin

⁴ Fondazione Eni Enrico Mattei (FEEM) and Euro-Mediterranean Center on Climate Change (CMCC), Italy

⁵ Local Governments for Sustainability, European Secretariat

⁶ Environmental Change Institute, University of Oxford, Oxford

⁷ EUROCUBE srl

⁸ International Federation of Landscape Architects Europe

⁹ Centre for Ecological Research and Forestry Applications (CREAF), Barcelona

¹⁰ Deltares, Utrecht

¹¹ European Federation of Green Roof and Wall Associations

¹² University of Trento

¹³ University of Porto

¹⁴ University of Bucharest

¹⁵ Erasmus University Rotterdam, The Netherlands

Opportunity to Comment

We welcome your comments on this draft protocol.

The Expert Working Group in consultation with the Knowledge Coordination Body will decide on the inclusion of comments.

Please send your comments to: peer-review@eklipse-mechanism.eu

Term	Definition	Key references
Climate mitigation potential	The potential of reducing the GHG emissions (in particular carbon emissions) through the implementation of NBS at different spatial scales, thus contributing to the global issue of climate change.	Adapted from IPCC (2014)
Co-benefits	The various benefits that can be provided by a NBS simultaneously.	Jiang et al. (2016)
Cost-benefit analysis	Process of quantifying costs and benefits of a NBS (over a certain period), and those of its alternatives (within the same period), in order to have a single scale of comparison for unbiased evaluation.	Adapted from Atkinson and Mourato (2015)
Environmental benefit	Any improvement of the environmental conditions including air, water and soil as a consequence of NBS implementation.	Livesley et al. (2016)
Economic cost	The cost of designing and implementing a NBS over a certain period. Can include acquisition costs, management costs, transaction costs, damage costs and opportunity costs.	Naidoo et al. (2006)
Economic benefit	The economic benefits (quantifiable in terms of revenue, net cash flow, net income) of designing and implementing a NBS over a certain period.	
Ecosystem services	Ecosystem services are the contributions of ecosystem structure and function – in combination with other inputs – to human well-being.*	Burkhard et al. (2012)
Ecosystem disservices	Negative contributions of ecosystems to human well-being; undesired and harmful impacts on the environment (that relate to the generation of ecosystem services).	Potschin et al. (2016) Von Dohren et al. (2015)
Effectiveness	The degree to which objectives are achieved and the extent to which targeted problems are solved. In contrast to efficiency, effectiveness is determined without reference to costs. E.g., <ul style="list-style-type: none"> • Does the NBS lead to enhanced climate resilience in the urban area? • Does the NBS lead to environmental benefits? • Does the NBS lead to social benefits? • Does the NBS lead to economic benefits? 	Oxford Dictionary (2016)
Impact	The effect of a NBS in achieving a specified objective and/or dealing with an urban challenge evidenced as a change in environmental, social, economic, and ecological conditions and functions	
Performance	The degree in which a NBS addresses an	Adapted from Dunn (2004)

	identified challenge (e.g., climate resilience) and/or fulfils a specified objective in a specific place (territory), time and socio-economic context.	
Relevant	The degree to which a NBS contributes to dealing with the primary problem (performance)	
Reliable	The ability of a method to produce consistent results.	
Reliable NBS	A NBS whose performance is guaranteed over time.	
Robust	The capacity of an analytic procedure to remain unaffected by small, but deliberate variations in parameters.	
Robust NBS	A NBS that achieves the expected objectives and solves the targeted problem under different uncertain future situations.	
Social benefit	The range of ways in which individuals and societies can be positively impacted by a NBS.	
Social cost	The range of ways in which individuals and societies can be negatively impacted by a NBS.	
Synergy	Arises when increased provision of one ESS causes improvement in the provision of another ESS.	Potschin et al. (2016)
Trade-offs	Situations in which one ecosystem service increases and another one decreases. This may be due to simultaneous response to the same driver or due to true interactions among services.	Potschin et al. (2016)

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38 **Introduction**

39 EKLIPSE called for expertise to develop an impact evaluation framework (No.1/2016) to guide
40 demonstration projects in the design, development, implementation and assessment of Nature-
41 Based Solutions (NBS) in urban contexts. The call followed a request by EC DG R&I aiming to enhance
42 the framework conditions for NBS at EU policy level and provide the evidence and knowledge base
43 for NBS.

44 For the purpose of this work, we will draw upon the NBS definition proposed by the H2020 Expert
45 group that states: “nature-based solutions are actions which are inspired by, supported by or copied
46 from nature. They have tremendous potential to be energy and resource-efficient and resilient to
47 change, but to be successful they must be adapted to local conditions...Many nature-based solutions
48 result in multiple co-benefits for health, the economy, society and the environment, and thus they
49 can represent more efficient and cost-effective solutions than more traditional approaches”
50 (European Commission, 2015, p. 6).

51 The EKLIPSE expert working group (EWG) met in person and online on Thursday 28th July, 2016 and,
52 had several additional meetings remotely afterwards. After intensive discussions and receiving a
53 background to EKLIPSE and the scope and purpose of the project, the EWG identified a structured
54 process for organising the work tasks. This document outlines the nature of the request, choice of
55 methodology, details of the methodology and expected outcomes. It is important to note that due
56 to time constraints the protocol cannot be considered exhaustive nor comprehensive in the
57 indicators it includes. As such, the open consultation process seeks to obtain insights and feedback
58 (i.e., comments) on the existing methodological and structural outline of the protocol as presented
59 in this draft.

60 **The request**

61 EKLIPSE called for expertise to develop an impact evaluation framework (No.1/2016) to guide
62 demonstration projects in the design, development, implementation and assessment of NBS
63 demonstration projects on climate resilience in urban areas. The aim is to devise an assessment
64 framework that can be applied across the projects so that their outputs can be compared. The
65 framework should also be compatible with MAES Urban Pilot framing, ecosystem-based adaptation
66 and relevant information on Climate Adaptation, natural water retention, green infrastructure,
67 greening cities and other Commission-based initiatives.

68 **Characteristics/components/capabilities**

69 The framework should include criteria of NBS that should be measured, scored or assessed, using
70 the SDGs as a reference as a globally agreed upon frame of reference of global goals, including:

- 71 1. multiple or co-benefits;
- 72 2. disservices;
- 73 3. trade-offs;
- 74 4. synergies;
- 75 5. cost-effectiveness;
- 76 6. environmental impacts;
- 77 7. socio-economic impacts.

78 **Outputs**

- 79 1. A framework with a list of criteria for assessing NBS' performance in dealing with the
80 identified challenges;
- 81 2. The identification of research and knowledge gaps according to the criteria presented in
82 the impact evaluation framework, and;
- 83 3. An application guide to accompany the framework for measuring how of NBS projects
84 fare against the identified indicators in delivering multiple (environmental, economic
85 and societal) benefits.

86 **Methodological approach**

87 The EWG methodological approach involves setting up two working groups, each tasked with
88 different elements of literature scoping and expert consultation.

89 **Literature scoping**

90 WG1 will undertake a review of the scientific literature in order to:

- 91 1. establish where and how NBS have been applied to address climate resilience in urban areas
92 and selected environmental, social and economic challenges;
- 93 2. identify sources of good practice on the assessment of multiple benefits, trade-offs and
94 synergies;
- 95 3. identify measurement and assessment tools including the identification of indicators to
96 assess the impacts of NBS which are further relevant, reliable, and robust.

97
98 Each of these three objectives will be considered with respect to factors that increase an urban
99 ecosystems' resilience with respect to impacts from climate variation (i.e., reduced vulnerabilities).
100 The selected eight challenges were drawn from the expert report on NBS supported by DG Research
101 and Innovation (European Commission 2015) and recent reviews of nature-based solutions
102 frameworks (Kabisch et al., 2016).

- 103 1. Water management;
- 104 2. Coastal resilience;
- 105 3. Green space management;
- 106 4. Air/ambient quality*;
- 107 5. Participatory planning and governance **;
- 108 6. Social justice **;
- 109 7. Public health and well-being**;
- 110 8. Potential for new economic opportunities and green jobs in Europe and on global
111 markets**.

112 *to reduce urban heat island effect and/or improve air quality are thus reflected in the assessment
113 criteria.

114 ** also cross-cut challenges 1-4

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117 To identify potentially relevant frameworks with a focus on each urban climate resilience challenge,
118 we will follow a rapid evidence assessment methodology (adapting procedures and insights from
119 Collins et al., 2015; Dicks et al. 2014; Pullin et al. 2016):
120

121 **1. Develop a protocol**

- 122 a. Complete protocol template outlining details of the review and methodology to be
123 used (this document).

124 **2. Search for the evidence**

- 125 a. Conduct a key word title search in ISI Web of Science using the term “framework”
126 AND “challenge area” (e.g., water management) (or synonyms thereof) AND one of
127 terms noted in the columns in the search strategy (Table 1).
128 b. Undertake multiple separate searches to avoid masses of literature hits. The
129 glossary will support shared understanding of terms across the EWG. All search
130 results will be recorded in an Excel file.
131 c. Read the title, abstract (or Executive Summary, if report) for relevance of paper to
132 the challenge area and the key words used in the search. If the paper is deemed
133 irrelevant, omit from the list.
134 d. For each remaining paper, document the presence or absence of each attribute
135 (using a tick or cross respectively) in an Excel table (Table 1) based on titles and
136 abstracts only. Some qualitative comments are also to be made as indicated in Table
137 1.

138 **3. Screen the search results and shortlist papers for further analysis**

- 139 a. Using the completed Table 1 as a guide, select approximately the 10 most important
140 papers per challenge according to the relevance of the literature to the challenge
141 topic and the diversity of attributes covered (as per the ticks and crosses in the Excel
142 file).
143 b. To ensure inter-rater reliability, arrange two people to undertake the final ranking of
144 approximately the 10 most important papers per challenge area. Any major
145 differences in rankings need to be subject to a third appraisal.

146 **4. Extract and appraise the evidence of the short-listed papers**

- 147 a. For each of the 10 selected papers, read the full paper to establish where and how
148 NBS have been applied, and identify measurement and assessment tools. The
149 information will need to be captured in a consistent manner in another excel
150 spreadsheet (to be developed after the literature screening), in order to facilitate
151 cross-comparison and to identify frameworks which are strong on particular
152 components.
153 b. To establish where and how NBS have been applied, describe the performance of
154 each NBS in a given challenge area with reference to the indicators noted in Table 1.
155 c. To identify measurement and assessment tools for evaluating the performance of
156 the NBS, evaluate each of the 10 papers per challenge area in terms of the
157 relevance, reliability and robustness of the methodology using the following guide:
158 i. The methodology used is clearly and transparently presented;
159 ii. The degree to which the methodology reduces and addresses sampling bias
160 (recognising that qualitative and quantitative approaches have different
161 procedures for identifying bias);
162 iii. The methods employed are appropriate for the research question(s) and
163 result in the conclusions reached by the study;
164 iv. The assumptions made are outlined and are consistent with the research
165 question(s);
166 v. The methods used for measurements and for the analysis of the collected
167 data are reliable and suitable to address the research question(s);

- 168 vi. Measurements and analysis results have been validated and verified;
169 vii. Limitations and replicability of the methodology have been discussed.
170 d. To identify sources of good practice of NBS, 6-8 case cities will be selected and
171 analysed in detail with respect to the attributes in Table 1. See *** for further
172 details.

173 **5. Synthesise the results**

- 174 a. Highlight implications of the findings for policy and/or practice and/or community;
175 b. Identify knowledge gaps and make recommendations for further research.

176 **6. Communicate findings**

- 177 a. Produce a draft report for external review;
178 b. Revise and submit a final report.

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180 ***WG2 will focus on the same challenges and attributes as WG1 (as shown in Table 1), but their
181 searches will be focused on specific case examples (where possible, 1 best case for each challenge in
182 Europe and 2-3 cases outside of Europe), with specific reference to the grey literature. Each search
183 will be conducted using Google and *BASE* (<https://www.base-search.net>). Each case will focus on
184 one of the challenges listed above (and in Table 1). WG2 will present final report findings using a
185 case study learning approach to represent cities that have exemplar NBS relevant to the challenges
186 in Table 1 (similar to Connop et al. 2016).

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188 Prior to commencing the literature scoping, WG2 will develop a rationale for city selection which will
189 be based on:

190

- 191 1. Diversity of city locations across Europe such as: coastal, inland/mountain, metropolitan and
192 large metropolitan areas (population over 500,000 as classified by OECD);
- 193 2. Planning tools (used for city development) and projects which have implemented NBS with
194 respect to the considered challenges.

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195 In both WG1 and WG2, the review will be carried out by members of the Expert group and again
196 information collected in a consistent manner to allow comparison between different examples and
197 the challenges.

Air/ambient quality*	Mitigate urban heat island effect, capture air pollutants, reduce BVOCs and pollen emission															
Participatory planning and governance **	<i>Planning processes or governance arrangements respond to risks by drawing upon a range of systems and types of knowledge</i>															
Social justice **	<i>Provide access to green areas containing a diversity of environmental qualities or user experiences to citizens from both low and high socio-economic groups</i>															
Public health and well-being**	Encouraging use of green space to support physical, psychological and emotional outcomes															
Potential for new economic opportunities in Europe**	Boost for jobs, growth and investment (including green jobs)															
Marketing of NBS **	Promotion, positioning and branding of NBS to the global market															

191 **Expected analysis**

192 For the 10 papers (approximately) per each challenge area, analysis will involve:

- 193 1. Assessment of the main types of indicators and methods used to assess multiple benefits,
194 disservices, trade-offs, synergies; environmental and socio-economic impacts, services,
195 disservices, costs, benefits and co-benefits.
- 196 2. Identification of the key knowledge gaps identified by the authors.
- 197 3. Synthesis of potential future research directions on NBS relevant to the impact evaluation
198 framework (to assist moving beyond the state-of-the-art).

199 **Limitations**

200 Both WG1 and WG2 will focus on challenges relevant to climate resilience in urban areas only.

201 The literature scoping of WG1 will focus on the international peer-reviewed journal article literature
202 which is written in English and accessible from Web of Science.

203 The literature scoping of WG2 will focus on planning and policy documents which are available from
204 the websites of regional and national municipalities and agencies, as well as consultancies and
205 Google Scholar. Documents written in English and various European languages (accessible to WG2)
206 will be considered.

207 Given cost constraints, only literature that is freely available and accessible via university or
208 organisational licences will be considered by both WG1 and WG2.

209 **Expert consultation**

210 Feedback on the framework will be sought from a range of stakeholders (e.g. the requester and
211 other stakeholders), as well as through peer-review, and the framework refined appropriately.
212 Specifically, there will be three rounds of expert consultation:

- 213 1. DG Research and Innovation review of the draft protocol to ensure EWG is designing a
214 product in line with the requirements of the call.
- 215 2. Informal meetings with co-ordinators of existing EU projects related to NBS (e.g., OPERAs,
216 OpenNESS) to fill knowledge gaps identified during the literature scoping and EWG meeting
217 in Brussels on October 3-4.
- 218 3. One month of external peer review of draft report in November 2016. We will select an
219 expert according to the following criteria: challenge expertise (representation from each of
220 the challenges); involvement in established NBS projects at an EU level (yes, no); gender
221 balance.

222 **Expected outcomes and format of reporting:**

223 There will be two outcomes of this work:

- 224 1) A peer-reviewed report synthesising the key findings relevant to the three research
225 questions/objectives. The report will be divided into two areas:
 - 226 a. An Executive Summary which illustrates the impact evaluation framework, outlines a
227 list of criteria and indicators for assessing it, identifies research gaps relevant to the
228 criteria, and provides a set of practical guidelines for H2020 project co-ordinators
229 and team members seeking to implement or compare NBS projects.

- 230 b. A theoretical justification for the design of the impact evaluation framework,
231 including a more in-depth background to the indicators and methods to guide
232 evaluation of projects, as well the EWG methods used to select key literature in the
233 scoping exercise.
234 2) Two PowerPoint presentations at EKLIPSE supported conferences in December 2016.

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236 **Project timelines**

- 237 1) Prepare and submit draft protocol – 19th August 2016;
238 2) Revise and finalise protocol based on open consultation – 2nd September 2016;
239 3) Each work group to prepare a first draft of their contributions by the 10th September 2016;
240 4) Review of first draft contributions by co-chairs;
241 5) Second draft of contributions by the 30th September 2016;
242 6) Brussels meeting: 3-4 October 2016 – integration of outputs from the two working groups;
243 7) Expert consultation on key knowledge gaps identified at the Brussels meeting (second week
244 of October 2016);
245 8) Third (polished) draft of EWG report for expert review: 21st October 2016;
246 9) Expert review: 22nd October through to 18th November;
247 10) 18th November – 15th December 2016: review and refine report;
248 11) 8th December – present findings at 2 conferences supported by EKLIPSE, and;
249 12) 16th December – submit final report to EKLIPSE.

250 **Other limitations of work**

- 251 • The EKLIPSE EWG decided to consider the NBS literature and demonstration projects at a
252 global scale, but to discuss their applicability to European NBS projects.
- 253 • The EKLIPSE EWG unanimously recognised that time was a constraining factor to the
254 literature scoping. Consequently a rapid evidence assessment approach was adopted.
- 255 • The EWG chose to design an impact evaluation framework despite varying references to
256 frameworks used in the call.
- 257 • While there is likely to be a range of academic, policy and practical interest in the produced
258 framework, for the purpose of clear and targeted communication the EKLIPSE EWG agreed
259 that they would write the report to inform project teams (specifically project co-ordinators)
260 of EU H2020 projects with interests in NBS in urban areas, including the demonstration of
261 NBS projects.
- 262 • The request included varying references to effects and impacts. The EKLIPSE EWG agreed
263 that effects and impacts are synonyms, and have therefore decided to focus on
264 environmental, economic and social impacts.

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266 **References**

- 267 Atkinson, G and Mourato, S, 2015. Cost-Benefit Analysis and the Environment. OECD Working Papers
268 No. 97. OECD Publishing, Paris. <http://dx.doi.org/10.1787/5jrp6w76tstg-en>
- 269 Burkhard, B.; de Groot, R.; Costanza, R.; Seppelt, R.; Jørgenses, S.E. and M. Potschin (2012): Solutions
270 for Sustaining Natural Capital and Ecosystem Services. *Ecological Indicators* 21: 1-6.
- 271 Collins, A., Coughlin, D., Miller, J., Kirk, S., 2015. The Production of Quick Scoping Reviews and Rapid
272 Evidence Assessments: A How to Guide. DEFRA, UK.
- 273 Connop, S., Vandergert, P., Eisenberg, B., Collier, M.J., Nash, C., Clough, J., Newport, D., 2016.
274 Renaturing cities using a regionally-focused biodiversity-led multifunctional benefits approach
275 to urban green infrastructure. *Environ. Sci. Policy* 62, 99–111.
- 276 Dicks, L. V., Walsh, J.C., Sutherland, 2014. Organising evidence for environmental management
277 decisions: a “4S” hierarchy. *Trends Ecol. Evol.* 29, 607–613.
- 278 Dunn, W. N., 2004, Public policy analysis: An Introduction. Pearson Publishing.
- 279 European Commission. 2015. Towards an EU Research and Innovation policy agenda for Nature-
280 Based Solutions & Re-Naturing Cities: Final Report of the Horizon 2020 Expert Group on
281 “Nature-Based Solutions and Re-Naturing Cities.” Brussels.
- 282 IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change.
283 Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental
284 Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S.
285 Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J.
286 Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University
287 Press, Cambridge, United Kingdom and New York, NY, USA.
- 288 Jiang, P., Xu, B., Dong, W., Chen, Y., Xue, B., 2016. Assessing the environmental sustainability with a
289 co-benefits approach: a study of industrial sector in Baoshan District in Shanghai. *J. Clean. Prod.*
290 114, 114–123.
- 291 Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S.,
292 Korn, H., Stadler, J., Zaunberger, K., Bonn, A., 2016. Nature-based solutions to climate change
293 mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers,
294 and opportunities for action. *Ecol. Soc.* 21, art39.
- 295 Livesley, SJ, McPhearson, E.G., Calfapietra, C. 2016. The urban forest and ecosystem services:
296 impacts on urban water, heat and pollution cycles at the tree, street and city scale. *Journal of*
297 *Environmental Quality*, 45: 119-124.
- 298 Naidoo, R., Balmford, A., Ferraro, P.J., Polasky, S., Ricketts, T.H., Rouget, M., 2006. Integrating
299 economic costs into conservation planning. *Trends Ecol. Evol.* 21, 681–687.
- 300 Oxford Dictionary (2016). Definition of Effectiveness in English.
301 <http://www.oxforddictionaries.com/definition/english/effectiveness>
- 302 Potschin, M.; Haines-Young, R.; Heink, U. and K. Jax] 2016: OpenNESS Glossary (V3.0), 39 pp. Grant
303 Agreement No 308428. Available from: <http://www.openness-project.eu/glossary>
- 304 Pullin, A., Frampton, G., Jongman, R., Kohl, C., Livoreil, B., Lux, A., Pataki, G., Petrokofsky, G.,
305 Podhora, A., Saarikoski, H., Santamaria, L., Schindler, S., Sousa-Pinto, I., Vandewalle, M.,
306 Wittmer, H., 2016. Selecting appropriate methods of knowledge synthesis to inform

- 307 biodiversity policy. *Biodivers. Conserv.* 25, 1285–1300.
- 308 Viguié, V & Hallegatte, S., 2012. Trade-offs and synergies in urban climate policies. *Nature Climate*
309 *Change*. doi:10.1038/nclimate1434
- 310 Von Dohren, P and Haase, D., (2015), Ecosystem disservices research: A review of the state of the art
311 with a focus on cities, *Ecological Indicators*, 52, 490-497.

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