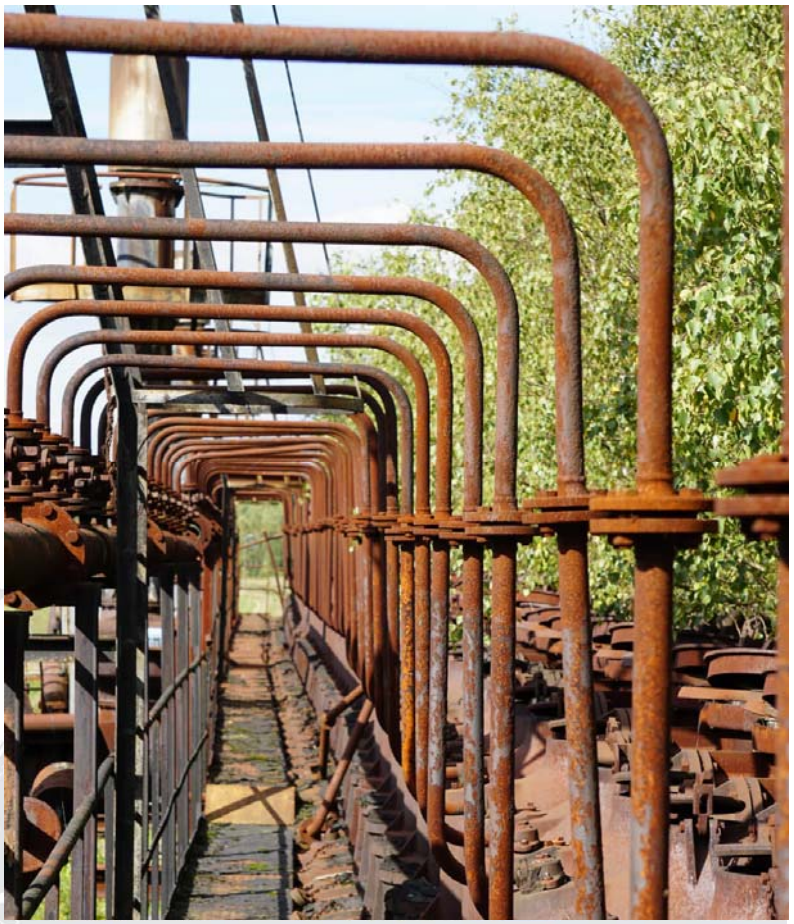
proGIreg



Hansa Coking Plant © ICLEI

Monitoring and Assessment Plan

Deliverable 4.1, Amendment 01

Work package: 4

Dissemination level: PU

Lead partner: CNR

Author: Chiara Baldacchini

Due date: 31/03/2019

Submission date: 23/12/2019

Deliverable	**Monitoring and Assessment Plan**
Deliverable No.	4.1
Work Package	4
Dissemination Level	PU
Author(s)	Chiara Baldacchini, CNR.
Co-Author(s)	Carlo Calfapietra, Gabriele Guidolotti, CNR; Giovanni Sanesi, Giuseppina Spano, Yole de Bellis, UNIBA; Payam Dadvand, Carmen de Keijzer, ISGLOBAL; Elizabeth Gil-Roldán, SL; Federica Larcher, Federica Paradiso, Chiara Ferracini, Simona Bonelli, UNITO; Yaoyang Xu, Tian Ruan, IUE-CAS.
Date	23/12/2019
File Name	D4.1_Monitoring and Assessment Plan_proGIreg_CNR_Amendment_01_2019-12-23
Status	
Revision	Amendment 01, 23/12/2019
Reviewed by (if applicable)	Axel Timpe, Rieke Hansen and Margot Olbertz, RWTH; Bernd Pölling, SWUAS; Dagmar Knappe, DORTMUND; Iva Bedenko, ZAGREB; Elena Deambrogio, COTO.
Information to be used for citations of this report	Baldacchini, C. (2019): Monitoring and Assessment Plan, Deliverable No. 4.1, proGIreg. Horizon 2020 Grant Agreement No 776528, European Commission, 124.

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement no. 776528.

CONTACT:
Email: **progireg@la.rwth-aachen.de**
Website: **www.proGIreg.eu**

This work was financially supported by the National Key Research and Development Program of China (2017YFE0119000).

Contents

Tables

Figures

Document revision history

Version	Date	Modification reason	Modified by
1	18/12/2019	Inclusion of Ningbo city in the project; changes in the implementation plans as a consequence of the co-design process; improvement of the indicators' methodology and definition due to the involvement of proGIreg in the European Task-force 2. Minor language corrections	Chiara Baldacchini Margot Olbertz

Partner organisations

No.	Name	Short name	Country
1	Rheinisch-Westfaelische Technische Hochschule Aachen	RWTH	Germany
2	Stadt Dortmund	DORTMUND	Germany
3	Comune di Torino	COTO	Italy
4	Grad Zagreb	ZAGREB	Croatia
17	Starlab Barcelona SL	SL	Spain
20	Fundacion Privada Instituto de Salud Global Barcelona	ISGLOBAL	Spain
21	Università degli Studi di Torino	UNITO	Italy
22	Consiglio Nazionale delle Ricerche	CNR	Italy
24	Università degli Studi di Bari Aldo Moro	UNIBA	Italy
33	The Forestry Bureau of Ningbo City (FBNC), City	FBNC	China (People's Republic of)
34	Institute of Urban Environment, Chinese Academy of Sciences	IUE-CAS	China (People's Republic of)

Abbreviations

BASE:	spatial data from existing databases
Dx.x:	deliverable
EC:	European Commission
EWG:	Expert Working Group
FC:	Follower City
FRC:	Front-Runner City
FTE:	Full Time Equivalent
GA:	Grant Agreement
GDP:	Gross Domestic Product
GI:	Green Infrastructure
GIS:	geographic information system
GQ:	general questionnaire
HIA:	Health Impact Assessment
LCA:	Life-Cycle Assessment
LL:	Living Lab
NBS:	nature-based solutions
NDVI:	Normalized Difference Vegetation Index
NGO:	non-governmental organization
PM:	person month
proGIreg:	productive Green Infrastructure for post-industrial urban regeneration
SME:	small and medium enterprise
SOPARC:	system for observing play and recreation in communities
WP:	work package

Executive Summary

The project entitled “productive Green Infrastructure for post-industrial urban regeneration (proGIreg)” aims at implementing eight different types of nature-based solutions (NBS) in specific post-industrial sites of four different cities (called front runner cities - FRC). One of the main goals of the project is to assess the benefits produced by the implemented NBS and the present document describes the monitoring and assessment plan adopted within proGIreg consortium. The experimental approaches that will be adopted are here described, together with expected results and the case studies selected. The document also serves as a guide for the future assessment of benefits from similar NBS implemented in the follower cities (FC) involved in the project. It represents a key deliverable for the Work Package 4 (“NBS benefit assessment and monitoring”). This manual will be reviewed and updated when necessary.

1. Introduction

1.1. Introduction to the project

Productive Green Infrastructure for post-industrial urban regeneration (proGIreg) is developing and testing nature-based solutions (NBS) co-creatively with public authorities, civil society, researchers and businesses. Eight nature-based solutions supporting the regeneration of urban areas affected by deindustrialisation will be deployed in Dortmund (Germany), Turin (Italy), Zagreb (Croatia) and Ningbo (China). The cities of Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece) and Zenica (Bosnia and Herzegovina) will receive support in developing their strategies for embedding nature-based solutions at local level through co-design processes.

1.2. Introduction to the deliverable

This document is intended to serve as a manual describing a general procedure to monitor and assess benefits of NBS and to be adopted in the proGIreg Front Runner Cities (FRC). The NBS to be implemented in proGIreg are also described.

WP4 is a collaborative action involving local authorities, the civic sector, SMEs, and research institutes, with the aim of providing a significant and comprehensive evaluation of NBS, which ultimately can be translated into informed policies and targeted interventions aimed at promoting healthy, equitable, sustainable, and economically thriving urban environments.

Accordingly, NBS evaluation should proceed as a four-steps process:

First, the assessment domains of interest have to be defined, in line with the guidelines of the EKLIPSE – Expert Working Group (EWG) on nature-based solutions evaluation[1]. In proGIreg, they were already described in the Grant Agreement (GA), and correspond to the first four Tasks of WP4:

- 4.1 – Assessing socio-cultural inclusiveness;
- 4.2 – Increased human health and wellbeing;
- 4.3 – Ecological and environmental restoration;
- 4.4 – Economic and labour market benefits.

Second, the scales at which monitoring and assessment are to be performed need to be defined. In particular, the monitoring scale and times need careful definition in order to be able to highlight measurable impacts, depending on the NBS.

[1] Raymond, Berry, Breil, Nita, Kabisch, de Bel, Enzi, Frantzeskaki, Geneletti, Cardinaletti, Lovinger, Basnou, Monteiro, Robrecht, Sgrigna, Munari and Calfapietra (2017) An Impact Evaluation Framework to Support Planning and Evaluation of Nature-based Solutions Projects. Report prepared by the EKLIPSE Expert Working Group on Nature-based Solutions to Promote Climate Resilience in Urban Areas. Centre for Ecology & Hydrology, Wallingford, United Kingdom.

Third, specific tools have to be developed, considering the scale, the macro sectors of interest, and the implementation time (since reliable assessment should be provided within the project duration). Also, the tools have been developed according to the guideline specified by the EKLIPSE – EWG. A number of stakeholders will be involved in the data collection in order to develop a common positive consciousness of the benefits related to NBS. Upon systematic observation and recording of current and changing conditions, the collected data will then be evaluated to assess the obtained benefits at the selected scale. **Finally**, methods to transform/interpolate the impact evaluated at the local NBS level to other levels of major interest (such as neighbourhood, district, or city level) are described; this being important for administrators, planners, policy makers at the national and European level, and stakeholders in general are described.

2. proGIreg NBS types

During the proGIreg project, eight different types of NBS will be implemented and monitored to assess their benefits. Not all the NBS types will be implemented in all FRC, given to local settings and available expertise. However, when possible, cross-city assessment will also be performed. The different NBS types, which will be described in detail in D3.2 ("Four Implementation Plans: Dortmund, Turin, Zagreb, Ningbo"), are:

- NBS1: Renaturing landfill sites for leisure use and energy production;
- NBS2: New regenerated soil thanks to biotic compounds for urban forestry and urban farming;
- NBS3: Community-based urban farming and gardening on post-industrial sites;
- NBS4: Aquaponics as soil-less agriculture for polluted sites;
- NBS5: Capillary GI on walls and roofs;
- NBS6: Making post-industrial sites and renatured river corridors accessible for local residents;
- NBS7: Establishing protocols and procedures for environmental compensation at local level;
- NBS8: Pollinator biodiversity improvement activities and citizen science project.

3. Assessment domains

The EKLIPSE EWG on NBS evaluation[1] indicates that each methodological approach to be used in NBS evaluation should be based on the ten challenges defined by the expert report on NBS supported by DG Research and Innovation[2] and by a recent review of NBS frameworks[3]. These challenges are:

1) Climate mitigation and adaptation;
2) Water management;
3) Coastal resilience;

[2] European Commission, 2016. Policy topics: Nature-based Solutions. https://ec.europa.eu/research/environment/index.cfm?pg=nbs.
[3] Kabisch, Frantzeskaki, Pauleit, Naumann, Davis, Artmann, Haase, Knapp, Korn, Stadler, Zaunberger, Bonn (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: Perspectives on indicators, knowledge gaps, barriers, and opportunities for action. Ecol. Soc. 21, art39.

4) Green space management (including enhancing/conserving urban biodiversity);
5) Air/ambient quality;
6) Urban regeneration;
7) Participatory planning and governance;
8) Social justice and social cohesion;
9) Public health and well-being;
10) Potential for new economic opportunities and green jobs.

Within this framework, four assessment domains have been defined, to be explored within proGIreg by the scientific partners in Work Package 4 (WP4) with the collaboration of the FRC. Scientific partners will define the experimental approach and will perform the data analysis. FRC will support the experimental design and will collect the data, under the guidance and with the support of the scientific partners. Each one of the four domains contain some of the above-mentioned challenges, chosen according to the local situation before NBS implementation (see Figure 1):

- Socio-cultural inclusiveness (including challenges 7 and 8);
- Human health and wellbeing (challenge 9);
- Ecological and environmental restoration (including challenges 1, 4, 5, 6);
- Economic and labour market (challenge 10).

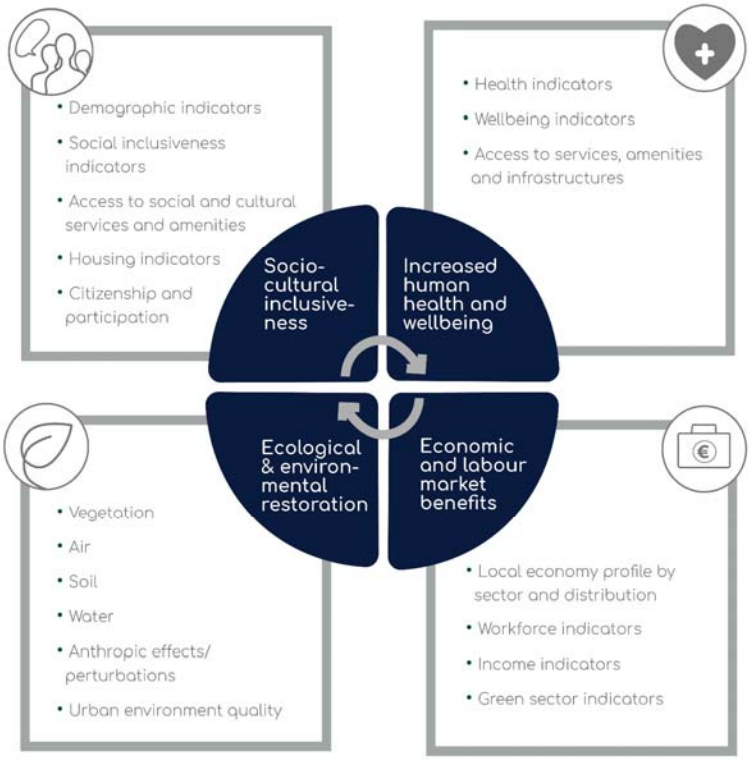


Figure 1 – WP4 assessment domains (Source: ICLEI)

The NBS derived benefit assessment associated to each domain will be the activity of the first four Tasks of WP4. Each of these Tasks will be handled by a proGIreg scientific partner having a clear expertise in the related field. Namely:

- Task 4.1: Assessing socio-cultural inclusiveness, in charge of UNIBA;
- Task 4.2: Increased human health and wellbeing, in charge of ISGLOBAL;
- Task 4.3: Ecological and environmental restoration, in charge of CNR, with UNITO and IUE-CAS support for biodiversity and water quality assessment;
- Task 4.4: Economic and labour market benefits, in charge of SL.

CNR will also coordinate WP4 and will be responsible for the data storage and management (Task 4.5), as further described in D4.2[4].

The scientific background of the four assessment domains is described in Sub-chapter. 3.1 below. A graphical representation of the partners involved in WP4 is shown in Figure 2.

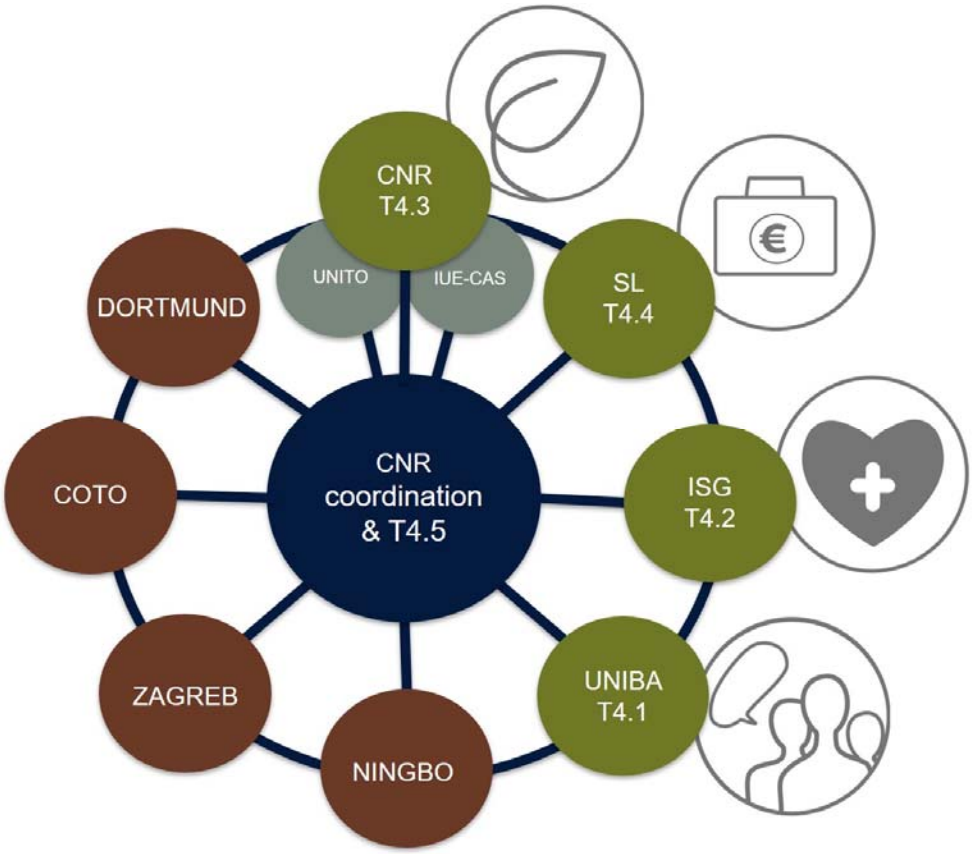


Figure 2 – WP4 partners. Task responsibilities are highlighted, together with the corresponding assessment domains, represented by icons (Source: ICLEI)

[4] Mattioni, M. (2019): Data Management Plan, Deliverable No. 4.2, proGIreg. Horizon 2020 Grant Agreement No 776528, European Commission.

3.1. Task 4.1: Assessing socio-cultural inclusiveness

Previous findings have identified the importance of exposure to GI for public health[5,6]. In particular, NBS-led regeneration processes are associated with enhancing positive social inclusiveness, including psycho-social benefits (e.g., increased social contacts and interactions and strengthened social cohesion) and socio-cultural benefits (e.g., information about accessibility of public urban green spaces and socio-spatial inequalities)[7]. Also, the perception of restorativeness through exposure to natural environments is essential for the psychological benefit of humans and their general improvement in quality of life and wellbeing[8]. In support of the above, findings highlight that installing new GI and NBS in urban environments enhances human wellbeing and the attractiveness of open urban spaces[6]. Furthermore, in developing greener cities, social inclusiveness – defined as the cumulative social benefits created and supported by GI and NBS in cities[9] – is derived through a balanced approach that combines both "social" (e.g., benefits to people) and "inclusive" (e.g., equal accessibility to the benefit) aspects[6].

Task 4.1 aims to identify the multiple social benefits provided by several NBS implementation types. Data on perceived restorative and affective qualities attributed to nature, emotions experienced, and overall wellbeing derived from nature and social inclusiveness will be collected in FRC before and after NBS implementation at LL district and NBS level.

Several stakeholders are involved in the socio-cultural inclusiveness assessment, such as the FRC where the proGIreg NBS will be implemented, research institutes, local NGOs and SMEs.

3.2. Task 4.2: Increased human health and wellbeing

This task aims to evaluate the impact of the NBS on human health and wellbeing. Previous studies have found that during nature exposure, we may have better cognitive functioning, lower levels of stress, improved cardiovascular health including the heart rate, heart rate

[5] van den Bosch, Ode Sang, (2017). Urban natural environments as nature-based solutions for improved public health – A systematic review of reviews. Environmental Research, 158, 373-384.
[6] Haase, Kabisch, Haase, Andersson, Banzhaf, Barò, Brenck, Fischer, Frantzeskaki, Kabisch, Krellenberg, Kremer, Kronenberg, Larondele, Mathey, Pauleit, Ring, Rink, Schwarz, Wolff, (2017). Greening cities – To be socially inclusive? About the alleged paradox of society and ecology in cities. Habitat International, 64, 41-48.
[7] Camps-Calvet, Langemeyer, Calvet-Mir, Gómez-Baggethun, (2015). Ecosystem services provided by urban gardens in Barcelona, Spain: Insights for policy and planning. Environmental Science and Policy, 62, 14-23.
[8] Tomao, A., Secondi, L., Carrus, G., Corona, P., Portoghesi, L., & Agrimi, M. (2018). Restorative urban forests: Exploring the relationships between forest stand structure, perceived restorativeness and benefits gained by visitors to coastal pinus pinea forests. Ecological Indicators, 90, 594-605.
[9] European Commission (EC) (2015). Towards an EU Research and Innovation policy agenda for nature-based solutions & Re-Naturing cities. Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities'. Brussels, Belgium.

variability, and blood pressure[10,11]. Moreover, reviews of the evidence have found that higher long-term exposure to green spaces is associated with better mental[12] and physical health[5,13]. However, only few studies have investigated and quantified public health benefits of providing new opportunities for nature exposure (i.e. new parks, greening of buildings, providing access to a riverbank etc). The implementation of new NBS allows the evaluation of these potential improvements in health. We will collect health data at LL district level before and after the NBS implementation to detect a change in health status that can be attributed to the NBS implementations. In addition, we aim to disentangle the impact of the different NBS by quantifying the number and demography of visitors and their physical activity levels in the surroundings of the implementation sites, before and after NBS implementation. Additionally, we will assess the perceived quality of and satisfaction with the different NBS. The collected data will include indicators on general health, mental health, well-being, lifestyle habits, physical activity, and time spent in and perceived quality of the NBS.

Task 4.2 aims to evaluate the health effects of the NBS. In addition, we will use Health Impact Assessment (HIA) tools to upscale the results, for example, to quantify the number of cases for different adverse health conditions that could be prevented by NBS. In addition to estimating health benefits of NBS conducted in the context of proGIreg, these tools can also be used to upscale the findings by predicting health benefits of future NBS. HIA can be used to predict health benefits of different "scenarios", for which we can use the input from various stakeholders.

3.3. Task 4.3: Ecological and environmental restoration

Urban green and blue spaces of all typologies, the so-called Green and Blue Infrastructures, provide to citizen several well-recognized environmental services thanks to the interactions that establish by means of physical, chemical and biological processes[14]. The environmental benefits are provided both at global and local scale.

At global scale there are direct and indirect interactions with the carbon biogeochemical cycle[15]. GI directly interacts with the carbon cycle because its elements remove carbon

[10] Bratman, Hamilton, Hahn, Daily, and Gross. 2015. "Nature Experience Reduces Rumination and Subgenual Prefrontal Cortex Activation." Proceedings of the National Academy of Sciences 112, 8567–8572.
[11] Triguero-Mas, et al. (2017). The Effect of Randomised Exposure to Different Types of Natural Outdoor Environments Compared to Exposure to an Urban Environment on People with Indications of Psychological Distress in Catalonia. PloS one 12, e0172200.
[12] Gascon, Triguero-Mas, Martínez, Dadvand, Forns, Plasència, Nieuwenhuijsen (2015). Mental Health Benefits of Long-Term Exposure to Residential Green and Blue Spaces: A Systematic Review. Int J Environ Res Public Healt; 12: 4354–4379.
[13] Nieuwenhuijsen, Khreis, Triguero-Mas, Gascon, Dadvand (2017). Fifty Shades of Green: Pathway to Healthy Urban Living. Epidemiology 28, 63–71.
[14] Turner, Chapin, 2005. Causes and consequences of spatial heterogeneity in ecosystem function. In: Lovett, G., Jones, C., Turner, M., Weathers, K. (Eds.), Ecosystem Function in Heterogeneous Landscapes. Springer, NY.
[15] Nowak, Crane, Stevens, Hoehn, Walton, Bond, 2008. A ground-based method of assessing urban forest structure and ecosystem services. Arboric. Urban For. 34; 347–358.

dioxide (CO_2) form the atmosphere, while, thanks to temperature regulation, reduce energy demands and the associated carbon emission[16].

NBS can regulate local thermal conditions, enhancing water evapotranspiration, thus increasing the evaporative latent cooling. This peculiarity is valid for both Green and Blue Infrastructure and even for a mix of the two as the aquaponics systems[17].

Major effects, at local scale, are related to air quality and microclimate regulation. GI impacts air pollution formation and deposition: vegetation through stomata removes oxides and other secondary pollutants as ozone[18]. For other pollutants such as particulate matter, the deposition on surfaces occurs at different rates according to surface nature. Deposition rates in leaf surfaces are higher than on concrete surfaces, for this reason the implementation of GI is increasingly recognized as a practical mitigation method for reducing urban particulate concentration[19].

Moreover, GI is also important for biodiversity enhancement and conservation. Thanks to a proper planning, conservation and management of GI, cities can play an important role in maintaining/increasing biodiversity[20].

Finally, some NBS applications such as soil regeneration and aquaponics can contribute to solving issues related to soil consumption and use of natural resources in the urban environment[17], which are increasing due to the global urbanisation processes.

In this context, the objective of Task 4.3 is the evaluation of ecological and environmental restoration benefits linked to the proGIreg NBS implementation.

All the above-mentioned aspects will be monitored within the project, with suitable tuning of the experimental approach with respect to the expected NBS field of impact. Direct information on the benefits will be experimentally obtained on local level (i.e. in the proximity of the NBS). Upscaling to the city level will be performed, when possible.

There are a number of stakeholders engaged in the environmental assessment proposed in Task 4.3. The principal is municipal administrations where NBS will be implemented. Other stakeholders include involved NGOs and the SMEs in the NBS realization and maintenance.

[16] Nowak, Kuroda, Crane, 2004. Tree mortality rates and tree population projections in Baltimore Maryland, USA. Urban For. Urban Greening 2; 139–147.
[17] Junge, König, Villarroel, Komives, Jijakli, (2017). Strategic points in aquaponics. Water 9, 182.
[18] Calfapietra, Morani, Sgrigna, Di Giovanni, Muzzini, Pallozzi, Guidolotti, Nowak, Fares, 2015. Removal of ozone by urban and peri-urban forests: evidence from laboratory, field, and modeling approaches. J. Environ. Qual. 45, 224–233.
[19] Tallis, Amorim, Calfapietra, Freer-Smith, Grimmond, Kotthaus, Lemes de Oliveira, Miranda, Toscano, (2015). The impacts of green infrastructure on air quality and temperature Handbook on Green Infrastructure: Planning, design and implementation Ed. D Sinnett, N Smith, S Burgess, Chapter 2, 30-49.
[20] Aronson, et al. 2017, Biodiversity in the city: key challenges for urban green space management, Frontiers in Ecology and the Environment 15; 189-196.

3.4. Task 4.4: Economic and labour market benefits

Extensive research has shown that increasing GI in cities is accompanied by multiple direct and indirect economic and labour benefits (OECD 2013[21]). Effects such as increased real estate values, new commercial initiatives, new (and frequently green) job opportunities and new business opportunities, among others, are all possibilities when implementing NBS in a city. This task aims to quantify the economic and labour market benefits and co-benefits of the proGIreg project in the FRC where NBS will be implemented. The project has the objective of demonstrating the integration of NBS into business models that are economically self-sustaining and provide multiple benefits for the economic, ecological and social regeneration of deprived urban areas suffering from the consequences of de-industrialisation. It aims to develop new NBS orientated economies shared between public authorities, civil societies and industry. It will build upon the methods suggested in challenge area 10 on the potential for economic opportunities and green jobs of the Assessment Framework developed by the EKLIPSE – EWG[1].

Direct economic and labour impacts of the implemented NBS:
The direct economic impact of the NBS is mainly constituted by the impact of implementation and maintenance. As suggested by EKLIPSE - EWG, a cost effectiveness assessment of the performance of the measures against their costs (both in terms of implementation and long-term maintenance) is necessary. Essentially, a cost-benefit analysis will be conducted per NBS comparing all direct/indirect costs and benefits identified, as described below.
The direct economic and labour impact (both costs and benefits) will only be evaluated post-implementation of the NBS.

The **direct economic costs and labour effects of** NBS **implementation** are based on information attained from the institutions in charge of construction of GI implemented, i.e. construction cost including costs of permissions/licences, construction material and other equipment, human resources (both in terms Full Time Equivalent - FTE - and cost), land access, machinery rental, usage fees, taxes, etc.

The **direct economic costs and labour effects of the long-term maintenance** of the infrastructure may only be known once the particular NBS has been functioning for a certain period of time (i.e. 2 or more years, depending on the nature of the NBS) and again maintenance costs and labour implications will vary greatly among the different kinds of infrastructures. This information will be determined by completing a detailed questionnaire with the relevant actor responsible for the management of the NBS in the post-implementation period.

The direct economic benefits of NBS refer to 'productive' NBS after implementation, i.e. selling products and services produced by the new infrastructure or producing new income streams that previously did not exist. Considering the current state of the information available on the NBSs, this would be the case for the following:

[21] OECD, (2013). Green Growth in Cities. OECD Publishing. Doi:10.1787/9789264195325-en.

- NBS1 (renewable energies produced). For this specific NBS, depending on national energy market regulations economic benefit can be two-way: (1) the consumption of energy self-produced represents a monetary saving and (2) the income generated from selling the excess energy to the grid. Also, the carbon emissions offset in the process will be evaluated, although for this it would be necessary to know the origin of the energy that would have been consumed otherwise (non/renewable).
- NBS 2 (selling of newly generated soil),
- NBS 3 (selling of food produced)
- NBS 4 (selling of aquaponic fish and vegetable products)
- NBS 7 (funding of the MultiAnnual Environmental Compensation Plan in Turin and new income streams produced in Zagreb from development of this NBS)
- NBS 8 (sale of honey produced)

For assessing the benefits produced by NBS 2, 3, 4, and 8, it will be essential that the entities in charge of managing these lines of business monitor the metrics of their commercial activity (weight of soil/food produce sold, typology, sale price, etc). Should the produce (whether soil or food) not be sold on the open market but used for self-consumption, sharing or other use mechanisms, obtaining detailed information on weight and type of product will allow us to calculate the value of this soil/food that would have otherwise been bought at regular market price and therefore the dimension of cost avoidance. The list above may be expanded or contracted depending on the evolution of the NBS design and final implementations, and therefore the relevant questionnaires will be elaborated at a later date and tailored to the final productive activities in the NBS.

The direct economic and labour impacts of the implemented NBS will be assessed mainly via the Economic and labour impact questionnaire, described succinctly in section 4.2.2 and to be developed at a future date.

Indirect impacts of the implemented NBS

The indirect impacts of the actions implemented cross-cut thematically and hence are to a certain extent more complex than the assessment of the direct economic impacts explained above. Indirect effects will be analysed by merging information from different sources and tools and seeking to focus on the subthemes that were also outlined in Challenge 10 of the EKLIPSE – EWG assessment framework[1].

Spatial data (see following Sub-chapter 4.1) will always provide the baseline and the general trends against which to compare any changes detected through the different proGIreg assessment tools.

These themes are specifically:

Indirect economic impacts of the implemented NBS

The city and LL district level spatial data outline the economic development and trend in each of the analysed areas. This will allow us to know how the LL area generally evolves in terms of Gross Domestic Product (GDP)/capita and business activity, with respect to other similar areas of the city and the city as a whole. If data availability allows, the evolution of business activity in each area and in the city as a whole will be analysed, in terms of number of busi-

ness registered, their turnover and the economic sectors they are active in, to be able to assess what proportion are transfer to or are newly created to be active in the environmental economy[22].
The second source of information will be an economic survey that will be conducted at the LL district level (see Sub-chapter 4.2.1). This will allow the determination of the personal economic trends in population analysed in the LL district and to eventually see how it evolves, compared to a control district.

Thirdly, economic and labour data will be obtained by the entities/authorities in charge of maintenance of NBS. It will be asked specifically whether any other economic activity (for example guided tours, horticultural expositions/training, etc.) have been fostered taking advantage of the NBS. This will prompt a subsequent set of questions about these economic activities to assess their dimension (in terms of economic activity and potential for green job creation).

Indirect labour impacts of the implemented NBS (including green job creation)
The labour impact of the actions undertaken by the project will be analysed from multiple perspectives; just as the previous theme.
On one hand, the changes in labour-related indicators provided by the city at municipal and LL district level will show the general picture of the labour sector; in particular, un/employment rate, number of green jobs (i.e. jobs in the categories belonging to the environmental economy), gender balance of un/employment rate, etc.

On the other hand, information on the employment status of the LL district residents, the sector they work in, income, whether they have changed jobs, etc. will be collected by a survey, at two times. Then, we might be able to assess whether people in the LL district are more likely to be employed due to the NBS implemented and whether there has really been a shift in sector of employment towards green jobs, among other questions.

Finally, the entities/authorities in charge of maintenance of NBS will be asked to cover questions related to the required labour force for construction of the NBS and the labour required to ensure maintenance, both in terms of paid (whether regular workers, proGIreg staff, FRC staff, internships, etc) and unpaid labour (volunteer, LL members, etc.).

Real estate
As mentioned in the EKLIPSE - EWG framework and the GA of the proGIreg project, property value can be a good indicator of effective improvements in areas that were previously degraded and unattractive for businesses and residents[1]. However, this desirable co-benefit does not come without its possible negative side effect: gentrification.
To evaluate both the evolution of property/rental prices and gentrification, the baseline indicators cover a comprehensive set of data that will allow to extract the trends at city and LL district level. Un/employment, available income, property value (Eur/m^2 for rental/sale for business/residential use), and the number free public services/facilities may all be indicators

[22] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_economy_–_statistics_on_employment_and_growth#Development_of_key_indicators_for_the_environmental_economy

of increasing attractiveness of an area and increasing risk of gentrification for the current residents. Some tourism related indicators are also required from the FRC since it is a common experience in some cities that tourism activities push residents out of certain areas of cities (see examples like Barcelona).

In addition to this, in the same survey previously mentioned, the LL district residents will be asked to provide information on their living status (rental/owner), the price paid, on when the respondent last moved and the motivations for doing so, which also aim to pinpoint whether gentrification is happening and to what degree.

Economic co-benefits related to effects detected by other tasks of WP4 (social, health and environment mainly)
Other co-benefits that will be assessed by T4.4 will be mainly in the social, health and environmental domains, so drawing on work done in Tasks 4.1, 4.2 and 4.3.
If the assessment done by T4.2 finds for example an increase in physical activity and in turn a reduction in cardiovascular deaths for the HIA, T4.4 will carry out together with partners from T4.2 the economic calculation of avoided costs of disability, disease, or death.

With regards to the economic assessment of certain environmental benefits detected by task 4.3, there are several aspects that will need to be converted to economic benefits. NBS 5 (green wall or green roof) may result in lower energy requirements for heating and cooling of the affected buildings. As part of the Economic and labour questionnaire that will be circulated to those in charge of long-term maintenance of these infrastructures, we will assess the consumption of energy in kWh before (by asking for data in electricity/heating bills before the installation) and after (also consulting electricity/heating bills), and evaluating the economic benefit of kWh savings and the respective carbon offset. Even though this analysis will draw on historic data (previous to installation of NBS), the survey will be conducted as part of the economic and labour questionnaire post-NBS implementation. Task 4.4 will also support Task 4.3 when necessary to calculate the monetary value provided by the trees planted as part of NBS implementation. This would mainly be the case for the orchard planned to be planted in Turin (NBS2), but could also be applied to any other trees planted, given the necessary data is available (mentioned in T4.3 description above).

4. Data collection, monitoring scales and update

The monitoring of the NBS will be performed by using two different kinds of data over three different scales. Spatial data from existing databases will be collected both at the city and at the living lab (LL) district level. New experimental data will be collected at the LL district and at the NBS level. The definition of the three scale levels has been extensively discussed in proGIreg D2.2[23] and the same administrative borders already defined will be adopted here.

[23] Leopa, S.; Elisei, P. et al. (2019): Spatial Analysis in Front-Runner and Follower Cities, Deliverable No. 2.2, proGIreg. Horizon 2020 Grant Agreement No. 776528, European Commission.

Benefits will be assessed at district/LL and NBS level, and the results will be presented in D4.5 (“Report on benefits produced by implemented NBS”) or D4.8 (“Updated report on benefits produced by implemented NBS”), depending on the implementation timeline.

The city level data will be used only to upscale the LL district and NBS level results, since no direct effect of the proGIreg implementations is expected at the city level due to the small size and number of the NBS. Moreover, it would not be possible to assign changes on city level indicators to the NBS implementations. An expert-based approach will be followed for the upscaling, depending on the parameter under investigation. Methods for upscaling will be presented in D4.6 (“Guideline for upscaling”) and results in D4.8 (“Updated report on benefits produced by implemented NBS”).

The data analysis will provide specific indicators for each of the four domains. These indicators will be easy-to-use descriptor tools, to be further used to compare proGIreg results with those from other sister projects, within the EC Taskforce 2 “NBS Impact Evaluation Framework 2.0”. The indicators will be defined in proGIreg D4.3[24], and more details on their upscaling will be provided there.

4.1. Spatial data

Spatial data will be collected at the city and LL district level.

A first version of the list of spatial data needed for benefit assessment and upscaling have been presented in proGIreg D2.1[25], together with those required by WP2 for the SWOT analysis. However, not all the requested data could be provided by the European FRC, as shown by D2.2[23]. Partners from Ningbo have not yet participated in the WP2 survey due to their delayed funding start. Based on the data already collected by the European FRC, and by the availability of other partners to separately provide the missing data, the final list of spatial data from existing databases (BASE) to be used for the benefit upscaling (City level) or assessment (LL district level) is reported in Table 1. They will be updated yearly by WP4, with the help of the FRC.

[24] Baldacchini, C. (2019): Protocols of Measurements, Deliverable No.4.3, proGIreg. Horizon 2020 Grant Agreement No 776528, European Commission.
[25] Elisei, P; Leopa, S. (2018): Methodology on spatial analysis in front-runner and follower cities, D2.1, proGIreg. Horizon 2020 Grant Agreement No 776528, European Commission, 53 pp.

Table 1 – Spatial data from existing databases to be collected yearly by the FRC.

1. SOCIO-CULTURAL INCLUSIVENESS		
Subdomains	**Parameter**	**Description**
1.1 Demographics	**1.1.1 Total population**	Total number of persons living in the specific area.
	1.1.2 Population density	Number of persons per square km of land area.
	1.1.3 Population growth rate	Average annual rate of change of population size (%).
	1.1.4 Migration rate	Net number of migrants per 1,000 persons.
1.2 Social and cultural inclusiveness	**1.2.1 Material deprivation rate**	Material deprivation rates gauge the proportion of people whose living conditions are severely affected by a lack of resources
	1.2.2 Work intensity	% employed out of total economically active population (15-64 years of age, according to the definitions of the International Labour Organisation)
	1.2.3 Diversity statistics	% foreign born residents (if available, for both scales, or)
		Population by ethnicity
1.3 Education and access to social and cultural services and amenities	**1.3.1 Educational attainment**	Average level of education completed by the 18 years of age and older population
	1.3.2 Recreational or cultural facilities	Relevant for LL/regeneration level: no. and identification of recreational and / or cultural facilities
	1.3.3 Accessibility of public urban green spaces	% population having access to green space within a 30 minutes walking distance or within 30 minutes travel time by public transportation.

1.4 Housing	**1.4.1 Housing quality**	Average useful floor area per person, calculated in sqm
	1.4.2 Public housing	Percentage of residents in public housing
	1.4.3 Housing affordability	Home ownership rate
	1.4.4 Density of the built environment	Building Coverage Ratio, or if unavailable,
		Floor Area Ratio (Total residential floor area divided by total residential area surface)
2. HUMAN HEALTH AND WELLBEING		
Subdomains	**Parameter**	**Description**
2.1 Health	**2.1.1 Incidence of cardio and respiratory diseases**	Rate of new (or newly diagnosed) cases of the disease per 1,000 persons
	2.1.2 Incidence of allergic disease	Rate of new (or newly diagnosed) cases of the disease per 1,000 persons
	2.1.3 Incidence of chronic stress, stress-related diseases, mental health diseases and NCDs	Rate of new (or newly diagnosed) cases of the disease per 1,000 persons
	2.1.4 Obesity rate	**Possibly available by region / in specific studies* (or possibly at school level)
	2.1.5 Life expectancy at birth	Average life expectancy (possibly available at higher levels / regional level)
2.2 Wellbeing	**2.2.1 Green space per capita**	m^2 of green space / person

	2.2.2 Urban safety – crime	Yearly number of reported crimes per 1,000 persons
	2.2.3 Urban safety – accidents	Yearly number of reported road accidents involving pedestrians and / or bicyclists
3. ECOLOGICAL AND ENVIRONMENTAL RESTORATION		
Subdomains	**Parameter**	**Description**
3.1 Land use and Vegetation	**3.1.1 % of green spaces**	% of total surface which is destined for green spaces
	3.1.2 structure of green spaces	% of tree covered areas
	3.1.3 structure of green spaces	% of shrub covered areas
	3.1.4 structure of green spaces	% of meadow covered areas
	3.1.5 % Surface of brownfields	% of total surface which is destined for brownfield areas
	3.1.6 % Surface of polluted brownfield areas	% of polluted brownfield areas
3.2 Climate / Meteorological data	**3.2.1 Precipitation**	Average annual precipitation (mm)
	3.2.2 Relative humidity	Relative humidity
	3.2.3 Air temperature	Annual mean temperature
		Winter mean temperature
		Spring mean temperature
		Summer mean temperature
		Fall mean temperature

	3.2.4 Wind strength	Wind intensity / average wind speed
	3.2.5 Wind direction	Main wind direction
3.3 Air Quality	**3.3.1 Ozone concentration**	µg/m3 / ppb
	3.3.2 NOx concentration	µg/m3 / ppb
	3.3.3 PM 2.5 concentration	µg/m3 / ppb
	3.3.4 PM10 concentration	µg/m3 / ppb
	3.3.5 VOC Concentration	µg/m3 / ppb
	3.3.6 GHG inventory	Inventory of greenhouse gases (GHG) emission at city level and LL level
4. ECONOMY AND LABOR MARKET		
Subdomains	**Parameter**	**Description**
4.1 Market labour and economy indicators	**4.1.1 GDP per capita**	GDP (PPP), Euro
	4.1.2 Businesses in the area - Industrial	Amount of Industrial companies per 1,000 inhabitants
	4.1.3 Businesses in the area - Commercial	Amount of commercial companies per 1,000 inhabitants
	4.1.4 Businesses in the area - Offices	Total amount of offices companies per 1,000 inhabitants
	4.1.3 Public jobs	- Total number of jobs in public sector
	4.1.4 Private jobs	- Total number of jobs in private sector
	4.1.5 Public green jobs	- Total number of public green jobs

	4.1.6 Private green jobs	- Total number of private green jobs
	4.1.7 Qualified jobs	- Total number of qualified jobs
	4.1.8 Non-qualified jobs	- Total number of non-qualified jobs
	4.1.9 Turnover in the green sector	Green companies' turnover in EUR
4.2 Gentrification indicators	**4.2.1 Employment rate**	the proportion of employed adults in the working age (20-64 years)
	4.2.2 Unemployment rate	the proportion of unemployed adults in the working age (20-64 years)
	4.2.3 Revenues by household	Average household disposable income
	4.2.4a Current property sale value for residential use	Property value, average, EUR/ m^2, for single- and collective housing, sale price
	4.2.4b Current property rental value for residential use	Property value, average, EUR/ m^2, for single- and collective housing, renting (monthly)
	4.2.5a Current property value for commercial/ industrial/ office use	Property value, average, EUR/ m^2, sale price
	4.2.5a Current property rental value for commercial/ industrial/ office use	Property value, average, EUR/m^2, renting (monthly)
	4.2.6 Free services	Total number of free services (parks, libraries, cycle trials, skate parks…)
	4.2.7 Basic utilities	Monthly cost of basic utilities (Electricity, water, Garbage…)
4.3 Tourism and attractiveness indicators	**4.3.1 Current number of tourists**	Measured as average number of overnight stays in tourism accommodations

	4.3.2 Number of temporary events	Trade Fairs, Congresses, Symposiums, Concerts, Parades before NBS application (in number)
	4.3.3 No. of foreign students	% of foreign students out of total enrolled higher education students
	4.3.4 Local expenses	Expenses in local retail businesses
4.4 Taxes, Investment & Financing	**4.4.1 Local taxes**	Average local taxes per capita
	4.4.2 Green investment programs/funds	Public investment programs, and investment funds

Spatial data that was not provided by WP2 but is necessary for WP4 analysis will be obtained independently. ProGIreg partner Politecnico di Torino will support in providing missing data for Turin city.

UNIBA will provide a number of geographic information system derived spatial data (GIS) by using the remote sensing satellite Sentinel-2 (European Space Agency). These will be used to calculate:

- the Normalized Difference Vegetation Index (NDVI): it provides information about the percentage of green area, at both the city and the LL district level; NDVI will be used to calculate the Greenness indicator (see D4.3[24]) and to upscale at the city level the results obtained on the carbon storage at the LL district scale.
- the Walkability Index (see D4.3[24]): it will be obtained by also using the city spatial and population data by Landscan Global population (**https://landscan.ornl.gov/**). The walkability index is an objective measure of how much a particular area is more or less likely to be walkable by people. It is a function of connectivity between places, accessibility and perceived pleasantness.

CNR will obtain air quality data of the four FRC, at both the city and LL district level, from the web sites of the local environmental agencies, where possible.

4.2. Experimental data

Experimental data will be collected by WP4 partners at both LL district and NBS level. At district level, a single survey called the General Questionnaire (GQ), will be conducted to assess benefits in the domains of social-cultural inclusiveness (Task 4.1), human health and well-being (Task 4.2) and economic and labour market (Task 4.4). ***Due to timing constrains, this survey will be conducted in the European FRC but not in Ningbo.***

At the NBS level, 10 different activities will be performed, named as “NBS monitoring tools” in the following, to characterize the benefits at the four domains level.

4.2.1. District level

General Questionnaire (GQ)

The general questionnaire (GQ) aims to collect data on social, health, and economic indicators at LL district level, where residents are likely to benefit from the NBS implemented by proGIreg. Data will be collected before and after the NBS implementation to evaluate the change in the indicators that could be attributable to the new NBS. To disentangle the change attributable to the NBS from the general temporal trend in the city, we will also conduct an identical survey in a control district. The control district, to be selected by the cities, is a district which is very similar to the LL district in terms of socioeconomic and demographic characteristics but will not have any NBS (or minimal NBS) planned to be conducted during the course of the proGIreg project.

To ensure scientific validity, the GQ is compiled of validated questionnaires/scales when available. A validated questionnaire refers to a questionnaire or scale that has been developed and administered to a representative study population. The validation process confirms that: a) the measuring instrument covers the full range of the issues being measured; b) the measuring instruments appears understandable and doable on its surface; c) the measuring instruments predicts behaviour or ability in a given area; and, most importantly, d) it measures the theoretical construct that it is designed to measure. Also, a validated measure assures a good reliability (i.e. it is consistent), reproducibility, and comparability between studies. Furthermore, validated instruments may proper, validated translations that can be applied in different countries. In case no validated questionnaire was available, we applied example questionnaires that have been successfully used in previous projects. The GQ has been reviewed and rendered suitable to FRC requirements (e.g., ethical/legal and non-intrusiveness). The finalized GQ must be translated to the local language(s) (using international validated scales when available and a skilled translator for the remaining questions).

Data collection: The GQ will be administered by the FRCs, who can involve the NGOs and other stakeholders in this task. The questionnaires will be administered through face-to-face interviews of about 30-35 minutes. Two different questionnaires have been developed for the pre-implementation and the post-implementation analysis. WP4 partners will train the interviewers for this task and will provide detailed guidebooks for the interviewers. Guidebooks are provided in Annex (Annex 1 and 2), as well as the questionnaire text (Annex 3 and 4). The guidebooks provided. The guidebooks that will be provided to the interviewers will also include further documentation (e.g. informed consent forms, questionnaire sheets, etc.), which is not included in the present document to avoid repetition. The data will be collected using the “EUSurvey” tool on a tablet or notebook. “EUSurvey” is a free, online platform for survey provided by the EC, which allows data collection, processing and upload[26]. Further

[26] https://ec.europa.eu/eusurvey/home/welcome

details will be provided in D4.2[4]. This allows for the data to be collected in electronic format directly and is optimal since there is less risk of human error and it's cheaper than hiring people to transfer GQ data from paper format to the platform. The same tablets or notebooks can also be used for the data collection at the NBS scale (see Sub-chapter 4.2.2).

Sample size: The general survey will involve 600 participants in each city (300 from the LL and 300 from the control district). The same participants will be contacted for the pre and the post analysis.

Identification and recruitment of research participants: The participants are residents of the LL district or of the control district. A random sample of persons is selected from the districts' person register. In order to reach the sample size (i.e. 300 participants in each district), the number of persons selected in each district will be over-sampled. The first contact will be made by sending an informative letter to 1000 selected persons to inform the potential participants about the study and about the probability of being visited by an interviewer. In addition, awareness of the study can be raised among the target group by involving stakeholders, using information channels such as showcase events to promote the NBS implementations, advertisements to be exhibited near LL areas, internet ads, and word of mouth.

According to the city's ethical requirements, the selected residents may be asked to respond to the invitation letter (e.g. by email or telephone) to make an appointment for the interview. A reminder letter may be sent to increase the response rate. Moreover, if the response rate is low (i.e. under 1/3), an additional sample of addresses may be selected based on the response rate of the first sample. For example, if we obtain 200 participants from the first 1000 addresses (i.e. response rate of 1/5), we may select an additional 500 addresses to obtain the remaining 100 participants.

The interviewers make appointments to visit respondents in each district (or according to convenience such as the distance between addresses). Responsive residents to the invitation letter will be asked to participate in the study. In case no appointment was made and the selected person is not at home or is not willing to participate, a different resident in the same address could be interviewed. If there is more than one resident aged 18 to 84 at home, the resident whose birthday is next is asked to participate in the study. In case this person is not present or is not willing to participate, the interviewer will proceed to ask the same question to the person who is the second in line according to the "birthday rule". This "birthday rule" ensures random selection of the participants (as the members of a household who are more likely to open the door may have certain characteristics in common). The interviewer makes up to five attempts to return to the same address in case of absence.

The inclusion criteria are

- Being 18 to 84 years old
- Being a resident of the LL district or of the control district
- Having sufficient understanding of the national language of the country where the data is collected

- Having the capacity to consent and participate
- Absence of diagnosed neuropsychiatric disorders.

If after using this strategy for a reasonable amount of time, the proposed sample size (i.e. 300 participants in the Living Lab district and 300 participants in the Control District) is not met, secondary strategies are implemented to reach a higher participation rate. The first secondary strategy is the identification of recruitment points such as community centres and marketplaces where residents of the neighbourhood can be reached and invited to participate in the study. Additional strategies can be discussed with the research partners. Informed consent is obtained before data collection. In the informed consent form, the participants give consent to be contacted again in three years to repeat the questionnaire. The informed consent forms will be provided in the D7.4.

Pseudonymisation/Anonymisation: The participant will be informed about the research methods and data protection in the informed consent form at first contact before administering the questionnaire. The participants will give consent regarding the participation in the data collection. The participant's contact details will be collected on a separate contact information sheet of paper (Annex 5). These "contact sheet data" will be stored safely and will not be shared with anyone outside of the proGIreg team of the FRC city administration. Moreover, the contact sheet data will only be used to re-contact the participant but will never be in the same file as the data collected through the GQ.

The contact sheet data will include a unique identification (ID) number for each participant. The questionnaire data is collected by tablet and includes the same ID number. The local partner will keep two datasets: one "*key file*" including the contact sheet data and the ID number that can be used to link the ID number back to the contact information (i.e. name, address, contact details) and one *anonymised file*, including the questionnaire data and the ID number (i.e. no contact sheet data such as name, address, contact details). The contact detail sheets and informed consent forms will be archived by the local partner. The anonymised database can be uploaded to the central database (and from there accessed by WP4 researchers). Further information on the anonymisation process is provided in the data management plan (D4.2[4]).

Data transfer on the platform: The local partners will collect the questionnaire data using the "EUSurvey" tool on tablets or notebooks provided with mobile data connection, thus they will be automatically digitalized. Then data have to be downloaded as .csv files and finally uploaded on the proGIreg platform, according to the Data Management Plan (D4.2[4]).

Estimated effort: Only a tentative estimation of time and monetary efforts can be provided at this stage. The realization of this survey will imply: translating questionnaires in the local languages; uploading on the "EUSurvey" platform; selection, hiring and training interviewers; selecting target persons and sending first-contact letters; sending re-contact letters after three years; data collection, storage and analysis. Many of these steps will depend on the municipality's administrative rules and by local costs, and thus monetary effort can be hardly estimated. A tentative time estimation by tasks is provided in D4.3[24], which results in about

15 PM per FRC and **between 20 and 30 PM** for three partners coordinating T4.1, T4.2 and T4.4, collectively.

4.2.2. NBS monitoring tools

A: NBS-VISITOR QUESTIONNAIRE

The aim of the NBS-visitor questionnaire is to assess the social and health benefits obtained from the different/separate NBS implementations. We aimed to develop a questionnaire to obtain NBS specific data that would be relevant to and comparable between all different NBS and to ensure comparability between cities. However, we may explore the possibility of providing additional targeted questions specific for each NBS in a later stage, when all details on the NBS implementations are available.

The NBS-visitor questionnaire will be short (interview of 15-20 minutes) and include items about the perceived social and health benefits derived from the direct contact with the implemented NBS. No personal or sensitive data will be collected. The questionnaire text is reported in the Annex (Annex 6).

The NBS-visitor evaluation will be conducted only once, post-NBS implementation. When possible (depending on the implementation timing set by the FRC), it will be administered at least 24 months after the NBS implementation, in the same season across all the cities and all the NBS (i.e., spring). Details on the monitoring timing per each NBS will be provided in D4.3[24]. The methodology for administering the questionnaire involves an interviewer going onsite and holding a face-to-face interview with the selected participants. The use of the "EUSurvey" platform for collecting the data may facilitate the data digitalization, but it is not mandatory. A detailed guidebook will be provided before data acquisition. The interviewers can be selected with help from the local proGIreg partners (e.g. the interviewers could be proGIreg partners that are responsible for the implementation of the NBS). The participants can be residents who were involved in the co-creation process or visitors of the NBS. The NBS visitor survey will be conducted on-site at strategic spots (e.g. the entrance of the NBS) targeting all adult visitors (that comply with the inclusion criteria) to participate in the study. The inclusion criteria are:

- Being 18 to 84 years old
- Having sufficient understanding of the national language of the country where the data is collected
- Having the capacity to consent and participate
- Absence of diagnosed neuropsychiatric disorders.

100 visitor interviews per NBS is the desired target. However, considering greatly varying number of visitors by NBS, we suggest a minimum number of 50 participants per NBS. This would require about **1 PM** per monitored NBS.

Vulnerable visitors/users. Some of the NBS have been designed to have an impact on vulnerable citizens, such as school children (NBS5 in Turin or Zagreb) or people with mental health problems (NBS3 in Zagreb and Turin, NBS 8 in Turin). It will be of utmost importance and scientific interest to monitor the social and health benefits induced by the implemented NBS on these target groups. However, a number of critical ethical issues arise when vulnerable population is involved. Moreover, some of the implementations are subject to the co-design process, thus implementation details are still under definition. For instance, NBS5 to be implemented in schools in Turin: as long as the school is undefined, the age of the students is also unclear, implying that it is impossible to design dedicated experiments at this stage. However, focusing on the final goal of the project, WP4 partners involved in Task 4.1 and Task 4.2 will aim at designing focused monitoring plans for vulnerable population, if feasible according to implementation timing and project ethical guidelines.

B: SOPARC

For some of the NBS, the goal is to provide (or provide access to) a space that the population can use to visit green and/or blue spaces (e.g. providing access to a river bank, re-naturing a square, etc.) and/or for physical activity. To evaluate whether this is effective we will measure either the use of a new NBS or, when possible, assess the change in the use of these spaces and in the physical activity performed after their implementation. Having information on the increase in use and physical activity is also needed to upscale the results and to be able to predict the impact of future NBS.

A valid method to quantify the use of a green/blue space (i.e. to estimate the number of users and type of physical activity) is systematic observation. We will use the validated SOPARC (System for Observing Play and Recreation in Communities)[27,28] tool. To summarise the method, trained observers (possibly including participation of stakeholders) count the number of users at the NBS site and register the users' characteristics (sex and age group) and type of activity (e.g. sedentary, walking, or very active). These observations are systematic and periodic; measurements are taken in specific periods of time (morning, lunchtime, afternoon, and evening) and specific days (within one week). These periods are defined to get an overall estimate of the use of the site.

To evaluate the change in use and physical activity, we need to quantify use of the place before and after the NBS implementation to quantify the change that may have taken place due to the NBS implementation. As a consequence, the SOPARC survey will be composed of a pre and a post implementation data collection. When possible, according to the implementation timing, the post evaluation will be performed 24 months after the pre. The surveys of the different NBS, across the different cities, will be performed in the same season (i.e., summer). More details on the monitoring timing will be provided in D4.3[24]. In the case of NBS im-

[27] McKenzie, Cohen, Sehgal, Williamson, Golinelli, (2006). System for Observing Play and Recreation in Communities (SOPARC): Reliability and Feasibility Measures. J. Phys. Act. Health 3 Suppl 1, S208-S222.
[28] https://www.rand.org/health-care/surveys_tools/soparc/user-guide.html

plementations started prior to the project, or during the first year, or located within a pre-existing public green area, a single post-implementation SOPARC assessment will allow to describe NBS users and their behaviour.

Data collection:
A detailed guidebook and specific form for data acquisition have been developed based on the guidelines provided by the developers of the method[27,28] (Annex 7 and 8). SOPARC data will be collected by pencil and then uploaded on the proGIreg platform. The SOPARC method includes four days of measurements in one week[29] and on each of these days, there are four 1h observation periods (i.e. 4 days with observing 4 times/day). An observation day missed because of bad weather or a holiday is rescheduled to take place on the same day of the next week.

To perform SOPARC for one NBS, one week of work is needed (including 1 day of training and preparations, performed by T4.2 partners, and 4 days of observations). To improve the reliability of the measurements, two observers do the same observations. Moreover, for the pre-post evaluation, two weeks of observations will be carried out: one before and one after the NBS implementation. For one pre-post evaluation, an estimation of **~1 PM** is needed.

C: ECONOMIC AND LABOUR IMPACT QUESTIONNAIRE

The economic and labour impact questionnaire will be the main tool to capture the direct and indirect economic and labour costs and benefits of the NBS implemented (see description of T4.4 above). It will be administered only post NBS implementation (after at least one year).

Target
The questionnaire will be directed to two types of stakeholders and each of these may be represented by one or more institutions/organizations. On one hand, the organizations that were in charge of constructing/implementing the NBS before its functioning and on the other hand, the organization in charge of long-term maintenance/management. If constructor/implementor and maintainer are the same organization, one interview will sufficient.

Content and number of questionnaires
The questionnaire to be provided will aim to complete data on all indicators needed to assess the direct and indirect economic and labour effects of the NBS implemented, as described in the T4.3 description above. The questionnaire will be tailored as needed to each combination of NBS+FRC+type of stakeholder and in principle a maximum of two interviews (if implementers and maintainers are different) will be necessary for each of these.

Identification and recruitment of interviews
The key persons to fill in the questionnaire will be identified by the FRC according to their experience as coordinators of the actions implemented in the NBS. The questionnaire will not ask for any personal data except name, company, job title and contact details of the person

[29] Cohen, Setodji, Evenson, Ward, Lapham, Hillier, McKenzie, 2011. How much observation is enough? Refining the administration of SOPARC. J. Phys. Act. Health. 8; 1117-1123.

interviewed. Depending on the city's ethical requirements, this contact data could be anonymised and saved in the city's file, apart from the company name.

The key persons will be contacted via email by the FRC, in local language. The project goals will be explained, as well as the importance of the and the aim of the questionnaire. If the contacted persons are willing to participate, they can choose English or local language questionnaires.

Filling in the questionnaire and data acquisition
The questionnaire will be provided in English and will be translated to the local language by the FRC, if needed. Partner responsible for T4.4 will upload both the English and the local language versions of the questionnaire on the "EUSurvey" platform. The link to access the questionnaire and instructions on how to fill it will be provided to the FRC. The FRC will send by email the questionnaire (by the corresponding link) to the relevant parties, to be filled in their own time by a given deadline. A follow-up telephone conversation can be scheduled in case there are any doubts on filling in the questionnaire although sufficient explanations will be included so that it should be manageable for the person to fill in on their own and send back once completed.
Once the questionnaire has been filled, data are downloaded by Task 4.4 partners from the "EUSurvey" platform, uploaded on the proGIreg platform, and analysed. Content processing may trigger the T4.4 team to follow up with more detail on certain aspects (for example, extracting further information on indirect economic activities happening in the NBS).

D: CARBON IMPACT

The impact of the implemented NBS on the atmospheric CO_2 concentration will be estimated by two different approaches, depending on the NBS under investigation. In both cases, it will be a post implementation analysis.

CO_2 sequestration. Vegetation of GI has the ability to sequester CO_2 that can be adsorbed and stored in several ecosystem compartments (mainly woody tissue and soil). For those NBS that might significantly increase the number of trees in the implementation area (such as NSB1 and NSB2), GI carbon storage, gross carbon sequestration and net carbon sequestration will be estimated through the use of the iTree ECO model[30] and/or the use of carbon stock changes. Calculations will be supported by a number of field data such as tree species, total height, diameter at breast height, crown base height, crown width, percent of crown missing, crown health, crown light exposure. A guidebook for field data collection, including the data recording file, is reported in Annex 9. This activity will require about **4 working days** (2 working days per 2 persons) per site.

Reduced CO_2 emission. Some NBS, such as green walls and green roofs (NBS5), can reduce energy consumption of buildings by regulating building surface temperatures. This

[30] Nowak, Crane, 2000. The Urban Forest Effects (UFORE) Model: quantifying urban forest structure and functions. In: Hansen, M., Burk, T. (Eds.), Integrated Tools for Natural Resources Inventories in the 21st Century: Proceedings of the IUFRO Conference. General Technical Report NC-212, U.S. Department of Agriculture, Forest Service, North Central Research Station, St. Paul, MN, 714–720.

effect is due to the concomitant occurrence of several mechanisms mainly related to the soil vegetation system, such as absorption of incoming heat, providing shade to building surfaces and cooling down the surfaces by evapotranspiration[31]. The kWh of energy required for heating and cooling the buildings after the NBS implementation and the average of the same data over the 5 years before the implementation will be provided by the building manager. The saved kWh saved will be obtained by a comparison of the two datasets. The saved kWh value will be translated into CO_2 equivalent using state-based conversion values of the European Environment Agency (**https://www.eea.europa.eu/data-and-maps/daviz**). Moreover, some implementations may include the installation of photovoltaic systems for energy production. The conversion of the produced kWh per year into CO_2 equivalent will provide further indication for environmental benefits.

E: AIR QUALITY

Nitrogen Oxides (NO_X) are highly reactive gases defined as the sum of Nitrogen Dioxide (NO_2) and Nitrogen Monoxide (NO). Both NO_2 and NO are pollutants mainly released into the atmosphere by fossil fuel burning. In urban environments, NO_2 is mostly related to vehicle exhaust but also other combustion processes such residential heating, combustion for industrial and residential uses. Tropospheric ozone (O_3) is a secondary pollutant mostly produced by the photochemical reactions of precursors such nitrous oxides (NO_X) and volatile organic compounds (VOC_S) under solar radiation[32]. Citizens of large cities are increasingly exposed to NO_2 and O_3 concentrations that often exceed the established standard and the phenomena is becoming global [33]

Concentration of ozone (O_3) and nitrogen dioxide (NO_2) will be discontinuously measured within the implemented NBS and in control points outside. The measurements will be carried out by means of passive diffusion tubes, recognized as a cost-effective sampling method to quantify the concentration and the dynamics of NO_2 and O_3[34]. The diffusion tubes selected for NO_2 will be acrylic tubes equipped with a thermoplastic rubber cup, with inside the adsorbent material (20% Triethanolamine/De-ionised Water). The diffusion tubes selected for O_3 will be fluorinated ethylene polymer tubes, equipped with a thermoplastic rubber cup, with inside the adsorbent material. Before the installation, both types of tubes, must be kept in dark in a cool environment (5-10 °C).

Three passive sensors for NO_2 and three for O_3 (replicates are necessary for statistical significance of the single measurement) will be co-located inside the selected NBS. In addition, an identical set will also be located in a control point outside the NBS. The diffusion tubes should be placed vertically, at a height of 2 m above the ground, and exposed unsheltered. Case-by-case analysis of probes locations will be performed together by FRC,

[31] Raji, Tenpierik, Van den Dobbelteen, (2015). The impact of greening systems on building energy performance: a literature review, Renewable and Sustainable Energy Reviews, 45 (2015) 610-623.
[32] Seinfeld, Spyros, 2016. Pandis. Atmospheric chemistry and physics: from air pollution to climate change. John Wiley & Sons.
[33] Field, ed. Climate change 2014 – Impacts, adaptation and vulnerability: Regional aspects. Cambridge University Press, 2014.
[34] Vardoulakis, Lumbreras, Solazzo, 2009. "Comparative evaluation of nitrogen oxides and ozone passive diffusion tubes for exposure studies." Atm. Environ. 43; 2509-2517.

CNR and the other possible stakeholders. After three weeks of exposure to air, sensors will be removed and sent back to the seller for analysis. After about two weeks, the results will be sent to CNR that will upload them on the proGIreg platform and will proceed with data analysis. The cost of a single passive diffusion tube, including the analysis, is about 15 Euros.

Three measurement campaigns will be performed: just before the implementation, after one year and after two years, possibly in the same season across cities and NBS (*i.e.,* summer). Details on the timing of the measurement protocol are provided in D4.3[24].

F: AIR TEMPERATURE

Urban heat island occurs when the urban environment is warmer than the surrounding countryside, especially during night-time due to the slower cooling of urban surfaces. Vegetation, thanks to evapotranspiration and shading, enhances cooling mechanisms that with a proper GI selection and management can reduce the urban heat island up to 8 °C[35.] Air temperature and relative humidity will be continuously measured within the implemented NBS and in control points outside. Low-cost battery-operated sensors with embedded data-logger will be capable to monitor and log air temperature and relative humidity day and night, at user-defined intervals, for up to a year at a time. The sensor measures air temperature with a resolution and precision of 0.5 °C, while relative humidity with a resolution of 0.5 % and a precision of 3.5%. The cost of each sensor will be approximately 80 €. The sensors will be placed sheltered at three points in the NBS (replicates are needed for statistical significance). Three sensors of the same type will be located in a control point where no NBS are implemented[36]. Data will be downloaded from the sensors every month, in order to reduce the risks that data (and/or the sensors themselves) will be lost. This can be done by using a tablet PC (no internet connection is required). Always monthly, after the downloading procedure, the data will be transferred in the proGIreg platform for analysis and storage purposes. The expected effort per FRC in terms of time will depend on the number of NBS to monitor. In case of 3 to 4 implementation sites to be monitored per FRC, data collection will require approximately 1 working day per month, along 3 years, corresponding to **36 working days** per FRC. If less sites are monitored (1 or 2), the expected FRC effort would be reduced.

G: PARTICULATE BIOMONITORING

Particulate matter abatement will be detected by monitoring particulate matter deposition on tree and shrubs leaves, at different particle size fractions (i.e., particle smaller than 10 µm and smaller than 2,5 µm, the so-called PM10 and PM2.5, will be separately studied). The use of leaves as particulate passive filters is well assessed in the literature, and the CNR unit

[35] Doick, Hutchings, 2013. Air temperature regulation by urban trees and green infrastructure', Forestry Commission Research Note 12; 1–10
[36] Fioretti, Palla, Lanza, Principi, 2010. Green roof energy and water related performance in the Mediterranean climate. Building and environment, 45; 1890-1904.

involved in proGIreg has a long-standing expertise in the field[37,38,39]). Particulate matter abatement will be measured twice during the project (few months after the NBS implementation and 2 years later), by selecting young leaves, maximum 6 months old, from trees of the same species. For NBS which already exist, a single sampling will be conducted. Attention will be paid to selecting the best tree (in case of NBS2 or NBS6) or shrub (for NBS3 and NBS5) species, based on those available on the implementation sites. Per each sampling campaign, three replicate branches will be collected per plant, and two leaves per branch will be analysed. The leaves will be collected by the FRC and sent to CNR for the analysis, closed within paper envelopes. Leaves will be studied by Scanning Electron Microscopy combined with Energy Dispersed X-Ray microanalysis, obtaining a quanti-qualitative characterization of the deposited particles, as a function of their size and elemental composition. Also, particulate matter amount per unit leaf area will be obtained, that will be further upscaled at the LL district scale and at the city scale, by using the NDVI data (GIS). By combining the obtained data with the city's wind data, efficient pollution source apportionment can be also achieved. This assessment will require 1 working day per sampling campaign to collect the leaves (in charge of the FRC) (total **2 working days** per FRC). Students can be involved in this activity, under the supervision of an expert, who should be able to identify the correct species and the youngest leaves. Leaf analysis by electron microscopy/spectroscopy will require about **1 PM** per NBS, including both sample campaigns (in charge of CNR).

H: ENVIRONMENTAL FOOTPRINT

Some NBS implemented in proGIreg have the aim to provide services and products with an environmental footprint reduction.

NBS2 will produce new soil, to be used as a replacement of agricultural soil, by regenerating soil already present within the LL. This will save soil extraction, with a valuable reduction of environmental footprint and impact on carbon cycle[40]. The amount of soil saved by NBS2 implementation will be evaluated by a substitutional approach that will account for the amount of soil that will be saved by replacing it with the regenerated soil.

Aquaponics systems (NBS4) combine hydroponic and aquaculture for the simultaneous fish and vegetable production in a close loop. When aquaponics systems are properly set up and maintained, they simulate a "natural" system but using no soil and less water, and minimizing effluent, with a significant benefit to the environment[17]. To estimate the benefits provided by the implementation of aquaponics systems and their impacts, a Life Cycle Assessment (LCA)

[37] Sgrigna, Sæbø, Gawronski, Popek, Calfapietra, 2015. Particulate Matter deposition on *Quercus ilex* leaves in an industrial city of central Italy Environ. Pollut.197; 187-194.
[38] Sgrigna, Baldacchini, Esposito, Calandrelli, Tiwary, Calfapietra, 2016. Characterization of leaf–level particulate matter for an industrial city using electron microscopy and X-ray microanalysis, Sci. Tot. Environ. 548–549; 91–99.
[39] Baldacchini et al., 2017. How does the amount and composition of PM deposited on *Platanus acerifolia* leaves change across different cities in Europe? Environ. Sci. Technol. 51; 1147-1156.
[40] Murphy et al., 2015. Benchmarking environmental impacts of peat use for electricity generation in Ireland—A Life Cycle Assessment. Sustainability; 7, 6376-6393.

approach will be used. Moreover, a comparison with several other farming techniques will be carried out.

According to recent scientific literature as well as to International Standard ISO 14044[41], the LCA will include 4 different steps: 1) Definition and scope of the study systems 2) Life Cycle Inventory (data collection) 3) Life cycle impact assessment (selection of indicators) 4) Result interpretation. For the LCA assessment calculation will be performed by mean of the extensively used SimaPro software[42]. An expert, hired by CNR, will work in synergy with all the stakeholders involved as well as with other partners of WP4.

I: BIODIVERSITY

GI contributes to enhancing biodiversity (included rare and threatened species[43,44]). Within proGIreg, NBS-tailored biodiversity monitoring protocols will be designed and adopted to monitor biodiversity enhancement. Biodiversity will be monitored in NBS3 in Turin, by studying pollinators, and in Ningbo, focusing on phytoplankton and zooplankton.

Pollinator biodiversity monitoring in Turin

Pollinators play a key role in every terrestrial ecosystem. They are pivotal not only in a biodiversity conservation point of view, but also for food production and for global economy. Monitoring this insect group is very useful to evaluate the environmental status. In Europe, pollinators are primarily insects like bees, hoverflies, butterflies, moths, beetles and other fly species (EU Pollinators Initiative, 2017).[45]

Pollinator biodiversity monitoring in Turin will be on charge of different groups of research from UNITO and other stakeholders. Biodiversity monitoring will account for bee, floral and butterfly surveys, in agreement with the EU Pollinator Initiative[46,47,48,49]. However, suitable biomonitoring protocols will be adopted, based on the NBS type, size, and on the stakeholders involved. In particular, three different biomonitoring actions will take place: in a large park (NBS3 - Gardens in Cascina Piemonte), on a green roof (NBS5 – New green roof on a public building), and within the context of a citizen science project involving people with mental diseases (NBS8).

[41] Forchino, Lourguioui, Brigolin, Pastres, 2017. Aquaponics and sustainability: The comparison of two different aquaponic techniques using the Life Cycle Assessment (LCA). Aquacultural Engineering; 77, 80-88.
[42] https://simapro.com/
[43] Bonelli, et al., 2018, The first red list of Italian butterflies. Insect Conservation and Diversity.
[44] Nieto, et al., 2014. European Red List of bees. Luxembourg: Publication Office of the European Union.
[45] Underwood, Darwin, Gerritsen, 2017. Pollinator initiatives in EU Member States: Success factors and gaps. Report for European Commission under contract for provision of technical support related to Target 2 of the EU Biodiversity Strategy to 2020 – maintaining and restoring ecosystems and their services. ENV.B.2/SER/2016/0018. Institute for European Environmental Policy, Brussels.
[46] Quaranta, et al., 2004. Wild bees in agroecosystems and semi-natural landscapes. 1997–2000 collection period in Italy. Bulletin of Insectology 57;11–61.
[47] Dafni, Kevan, Husband, editors, 2005. Practical pollination ecology. Enviroquest, Cambridge, Ontario, Canada.
[48] Westphal et al., 2008. Measuring bee biodiversity in different European habitats and biogeographical regions. Ecol. Monogr. 78; 653–671.
[49] Nielsen et al., 2011. Assessing bee species richness in two Mediterranean communities: importance of habitat type and sampling techniques. Ecol. Res. 26; 969–983.

- **Large park protocol.** It will account for bees, flowers and butterflies survey, according to the following procedure.
  Bee surveys: Each bee survey comprises 250m long linear transects walked in 50 min. Each transect start point and direction walked were randomly determined. All bees unambiguously identifiable are recorded and all others that could not be identified in the field are caught with a hand net and retained for later identification. Bee richness and abundance are determined. The honey bee is identified to species level (*Apis mellifera*) while other bees are identified to genus level. Observation sets are made at least one per month, from April to September to cover the main flowering period and bee activity in Turin (Italy). The observations are conducted between 9:00 am and 5:00 pm. Windy and rainy days are avoided for all observations and samplings.
  Flower surveys: Larval food plants and adult nectar sources of butterflies as well as flower surveys are carried out in parallel to the bee and butterfly surveys along the transects.
  Butterfly surveys: At the focus area of Cascina Piemonte, semi-quantitative surveys will be performed by experts walking along fixed-route 300-500 m transects depending on the investigated area (known as "Pollard walk") [50]. Butterfly species are identified, and individuals of each species counted. Observation sets are made, every two weeks, from April to September to cover the main flowering period and butterfly activity in Turin. The observations are conducted between 10:00 am and 3:00 pm for butterflies. Windy and rainy days are avoided for all observations and samplings.
  Total estimated time required: 2 PM/year (**10 PM**/5 years)
  The transect walks allow the recording of associations between flowers and bees (essential in studies focusing on pollination ecology and ES) despite to the passive sampling methods (e.g. pan traps). Transect walks offer possibilities to evaluate the success of NBS implemented by combining butterfly and bee responses at community level. By sharing monitoring scheme methodologies results are easily comparable.

- **Green Roof protocol.**
  The protocol developed for the Large Park area will be adapted to the Green Roof, as soon as the size of this latter will be defined, during the co-design process.

- **Butterfly surveys with Citizen Scientists'.** This activity contributes to NBS8 and will take place in Mental Health Centre gardens close to Cascina Piemonte, following the protocols implemented by Farfalle in Tour (http://www.farfalleintour.it/). In brief, users of Mental Health Centre are directly involved in butterfly monitoring, in collaboration with any other citizen that would join the initiative. Before surveys start, the experts must train a group of users about butterfly species morphology (identification) and ecology. This group will become the "scientific committee" that during the project will transfer the knowledge by teaching to other citizens. Trained *Citizen Scientists* will monitor butterfly species and send photos to the experts through a website (an app will be implemented) for validation. Observation sets are made twice per month from April to September. According to the extension of the green area users could monitor butterflies through Pollard walk (described above) or fixed observation point survey, carrying out 10 minutes of observation interspersed with 10 minutes of rest, for one hour in total.

Phytoplankton biodiversity monitoring in Ningbo

Surface water plankton biodiversity monitoring will be conducted in Ningbo by IUE-CAS and SME, taking place in the Moon Lake, within the LL. Plankton plays an important role in fisheries, water pollution prevention and environmental impacts of water conservancy

[50] Pollard, Yates, 1993. Monitoring butterflies for ecology and conservation. Chapman & Hall, NY.

projects[51]. Water samples will be collected once a week, and 3 sampling points will be set at the inlet, outlet and centre of the lake. Different protocols will be adopted for phytoplankton and zooplankton.

- **Phytoplankton.** Ten litres (10 l) of water will be separately collected from the three aquifers (surface layer, 1 time and 2 times transparency depth layer) and mixed. Then, 5‰Lugol solution will be add to the sample. Then, the sample will be brought back to the laboratory and left standing for 48h. The supernatant will be aspirated by siphoning, and approximately 50 ml of the remaining solution will be transferred to a 100 ml vial and add water to 100 m. The processed samples will be then stored in a 4 ° C refrigerator. Then, observation and counting under the microscope will be conducted.
- **Zooplankton.** Ten litres (10 l) of water will be separately collected from the three aquifers (surface layer, 1 time and 2 times transparency depth layer) and mixed. The water sample will be filtered using a plankton net (64 μm), the concentrate will be placed in a 100 ml bottle, and the plankton net will be washed three times or more with raw water. The washed concentrate will be also poured into the 100 ml bottle. Then, 5 ml of Bonn solution will be added and bring up to 100 ml with water. The processed samples will be then stored in a 4 ° C refrigerator. Then, observation and counting under the microscope will be conducted.

Total estimated time required: 3 PM/year (**9 PM**/3 years).

J: WATER QUALITY

Water pollution directly or indirectly endangers human health and restricts urban sustainable development. Therefore, it is necessary to conduct long-term monitoring of urban water bodies and provide data support for water quality security[52]. The monitoring method that will be implemented in proGIreg is as follows.

Sampling sites will be set by considering the water surface area and shape, and surrounding environment. The frequency of water collection will be once a week. Water samples will be collected with a water collector at a distance of 0.5 m from the water surface and stored in a 2.5 l polyethylene bottle. At the same time, the temperature of the water, dissolved oxygen, pH, and salinity will be measured on-site, using a portable detector, and the transparency of the water will be measured using a transparency plate. The collected water samples will be transported back to the laboratory and filtered through a 0.45 μm filter. They will be stored in a refrigerator at 4 ° C and various parameters will be measured within two weeks, as listed in Table 2.

[51] Sun, Wang, Gao, et al. 2018. Distribution and Influencing Factors of Plankton in an Artificial Lagoon in Ningbo. Asian Journal of Ecotoxicology,
[52] Tang, Li, Cao, et al. 2019. Compositional variety of dissolved organic matter and its correlation with water quality in peri-urban and urban river watersheds. Ecological Indicators,

Table 2 – Water parameters to be collected for Water Quality assessment, with specific detection methods, units and detection limits.

Parameter	Detection method	Unit	Detection limit
Transparency	"Water and Wastewater Monitoring and Analysis Methods" (Fourth Edition) China Environmental Science Press	m	/
Water temperature	Thermometer method GB 13195-91	°C	0.1 °C
pH	Glass electrode method GB 6920-86	/	0.01
Dissolved oxygen	Electrochemical probe method GB 11913-89	mg/l	0.01 mg/l
Total suspended solids	"Water and Wastewater Monitoring and Analysis Methods" (Fourth Edition) China Environmental Science Press	mg/l	/
Chemistry oxygen demand	Dichromate method GB 11914-89	mg/l	0.7 mg/l
Total phosphorus	Ammonium molybdate spectrophotometric method GB 11893-89	mg/l	0.01 mg/l
Total nitrogen	Alkaline persulfate elimination message UV spectrophotometry HJ 636-2012	mg/l	0.01 mg/l
Chlorophyll-a	"Water and Wastewater Monitoring and Analysis Methods" (Fourth Edition) China Environmental Science Press	μg/l	/
Ammonia nitrogen	Lowing salicylic acid spectrophotometry HJ 665-2013	mg/l	0.01 mg/l

4.2.3. Potential applicability of NBS monitoring tools

The present document is intended not only as presenting the monitoring and assessment plan to be conducted in the proGIreg FRC, but also as a guidebook describing possible monitoring tools to be applied by other cities (for instance, by the Follower Cities - FC - in proGIreg) to monitor the benefit provided by analogous NBS types. Table 3 presents the potential application of the NBS monitoring tools described above in monitoring the eight different NBS types implemented in proGIreg.

Table 3 - Applicability of the different NBS monitoring tools per NBS type

Tool code	Tool description	NBS 1	NBS 2	NBS 3	NBS 4	NBS 5	NBS 6	NBS 7	NBS 8
A	NBS-visitors questionnaire	Y	Y	Y	Y	Y	Y	N	N
B	SOPARC	Y	Y	Y	N	Y	Y	N	N
C	Economic and labour impact questionnaire	Y	Y	Y	Y	Y	Y	Y	Y
D	Carbon impact	Y	Y	Y	N	Y	Y	N	N
E	Air quality	Y	Y	Y	N	Y	Y	N	N
F	Air temperature	Y	Y	Y	Y	Y	Y	N	N
G	Particulate biomonitoring	Y	Y	Y	N	Y	Y	N	N
H	Environmental footprint	N	Y	N	Y	N	N	N	N
I	Biodiversity	Y	Y	Y	Y	Y	Y	N	Y
J	Water quality	N	N	Y	N	N	N	N	N

These NBS monitoring tools enable, in principle, providing a full description of the benefits assessed according to the four domains described in Chapter 2, for almost all the NBS types that will be studied in proGIreg. However, real applicability of these tools in the LL of the FRC is strongly limited due to a number of factors, listed below.

- **Implementation timing.** According to the data provided by the FRC (better described in D4.3[24]), very few implementations will allow to perform both the pre-implementation evaluation and the post-implementation evaluation (which should be 24 months after, as stated in the GA), in time to analyse the collected data within the end of proGIreg (May 2023). As a consequence, implementations already started, or that will start later than 2020, should be excluded by the monitoring and assessment activity. This is partially due to the fact that the innovation part of the project (e.g.co-designing and co-implementing the NBS with citizens) also require time within the 5 years research period. Thus, the research goals have to be a compromise in balance with these other aspects, and this will be particularly important in the case of Turin city.
- **Small size of the intervention.** According to the FRC's suggestions, all the implementations that are too small to obtain a considerable effect have been excluded from the analysis.
- **Presence in the surrounding of a more important GI**. This is the case, for instance, of the Mirafiori Castle Garden in Turin, which will be implemented within a pre-existing park.
- **Unavailability of trained staff.** This is the main limitation we have encountered in replicating the biodiversity monitoring in Dortmund and Zagreb.
- **Limitations in amount of funding**.

Given these limitations, the number of NBS that will be monitored during proGIreg is considerably reduced. However, by introducing some flexibility with respect to the required 24 months-assessment, at least one implementation per NBS type per FRC has been selected to be studied, ensuring cross-city analysis, when possible (not all the NBS types are implemented in all the FRCs).

5. ProGIreg implementations

In this Chapter, the implementation plans of the FRC will be presented separately. Since some of the NBS will be implemented as a consequence of a co-design process, many details such as the implementation timing and the location are still under elaboration. Further changes in the presented implementation plans could also occur in the future due to the results of the feasibility studies required prior to the implementations.

Per each FRC, a map showing the LL district is presented: this will be the area in which district level analysis will be performed.

A list of the implementations that are planned to be performed is provided including information/criteria used to select the implementation sites that will be monitored. Per each implementation site, it is specified if it will be a "case study" for benefit assessment or not. If the site will be monitored, details on the monitoring plan are provided. Otherwise, reasons why a site has been excluded from the monitoring activity are explained. For the

implementations which are still under definition, this will be communicated later, mainly based on timing (see Sub-chapter 4.2.3).

5.1. Dortmund

Dortmund Living Lab (215 ha, see Figure 3) comprises an area along the Emscher river. It is situated about 2 km west of downtown Dortmund. At its longest north-south-extension it is 4.8 km long, at its broadest extension in the northern part it is 1.25 km wide, at its narrowest part it is only 40 m wide. As the LL will not give opportunity to realize all NBS, the adjacent areas in a 500 to 2,000 m wide buffer around the LL are also places in which NBS may be realized ("Analysis Area", 2,275 ha). The effects of realized NBS may have a direct impact on the Analysis Area as numerous inhabitants are living here in several settlement areas directly adjacent to the Living Lab: Huckarde in the North-West, Deusen in the North-East, Dorstfeld in the South-West, the Rheinische Straße quarter respectively the Union quarter in the South. The total number of residents in the analysis area is 56,812. The borders of the analysis area are highlighted in Figure 3, and this is the area in which district level analysis and assessment will be performed. Further details on the Dortmund LL and on the implemented NBS can be found in the D2.2[23] and in D3.2 ("Four Implementation Plans: Dortmund, Turin, Zagreb, Ningbo").

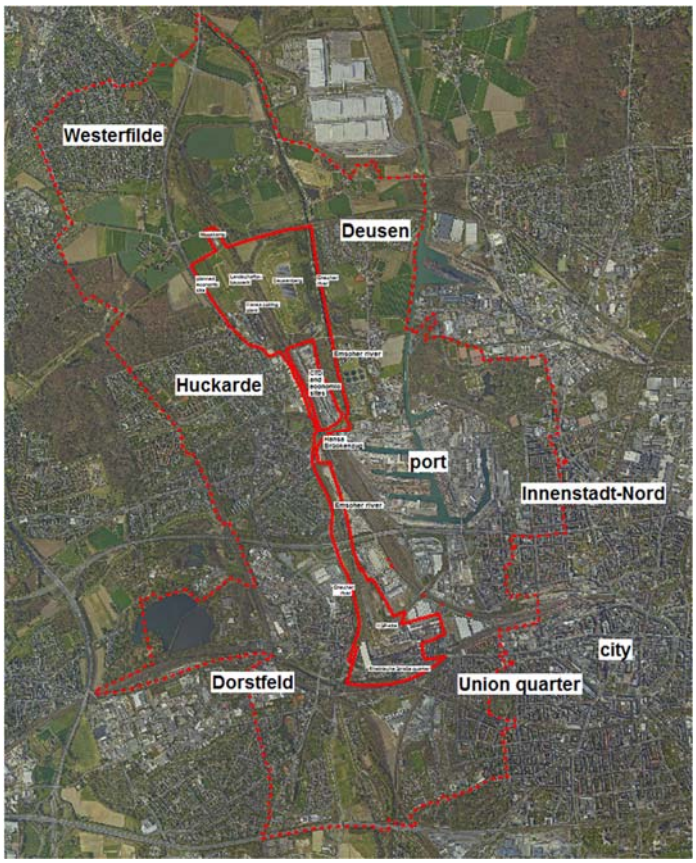


Figure 3 – Dortmund Living Lab (continuous line) and Analysis Area (LL district; dashed line) (Source: City of Dortmund)

The NBS to be implemented in Dortmund are listed in Table 4. Per each implementation, it is specified if it will be monitored and how. The two different activities in NBS1 have been split in the table because they will be separately assessed.

Table 4 – NBS to be implemented in Dortmund and monitoring tools to be used. When the implementation is still under definition, possible monitoring tools are indicated within brackets.

DORTMUND						
NBS name/ description	**NBS type**	**Size**	**Involved stakeholders**	**Implementation timing**	**Estimated number of users per year**	**NBS monitoring tools**
New forest planted on the renatured Deusenberg landfill	NBS1	4 ha	City of Dortmund	Already existent	The whole area will be object of further implementation due to the International Garden Exhibition. It is impossible to decouple effects of the proGIreg implementations on the number of users	D, G
Solar energy production (40,000 m², 3.6 MWp) on the renatured Deusenberg landfill		4 ha	City of Dortmund	Already existent		C, D
Sport activities on 2 ha of the renatured Deusenberg landfill		To be defined	City of Dortmund	To be defined		(A, B, C)
Food forests and gardening in Huckarde	NBS3	2,000 m²	City of Dortmund, DieUrbanisten, St. Urbanus church council, SWUAS	09/2019 – 09/2020	To be defined	A, B, C, E, F, G

Community managed aquaponics system	NBS4	400 m², location still undefined	DieUrbanisten, SWUAS	To be defined	Trained people: 60; visitors: 400; consumers: 800	C, H
Connecting the isolated Huckarde borough with the renatured Emscher river and Deusenberg sites	NBS6	To be defined	City of Dortmund	To be defined	To be defined	B, C
Improving and monitoring pollinator biodiversity in conjunction with NBS 3	NBS8	1 ha	Die Urbanisten, SWUAS	To be defined	Trained people: 10	

5.2. Turin

Turin will introduce NBS including collaborative vegetable gardens, pollinator-friendly areas, green roofs and walls to the post-industrial 'Mirafiori Sud' area, which is the LL in its whole (in this case, LL and LL district are the same area, shown in Figure 4). Turin will experiment with the use of 'new soil,' produced by combining compost and special fungi with poor-quality, but uncontaminated soil. This project works on different sectoral policies, including urban regeneration, social and active inclusion, environment and green planning and economic development and support to innovation. The number of inhabitants in Mirafiori Sud is 34,659. Further details on the Turin LL and on the implemented NBS can be found in the D2.2[23] and in D3.2 ("Four Implementation Plans: Dortmund, Turin, Zagreb, Ningbo").

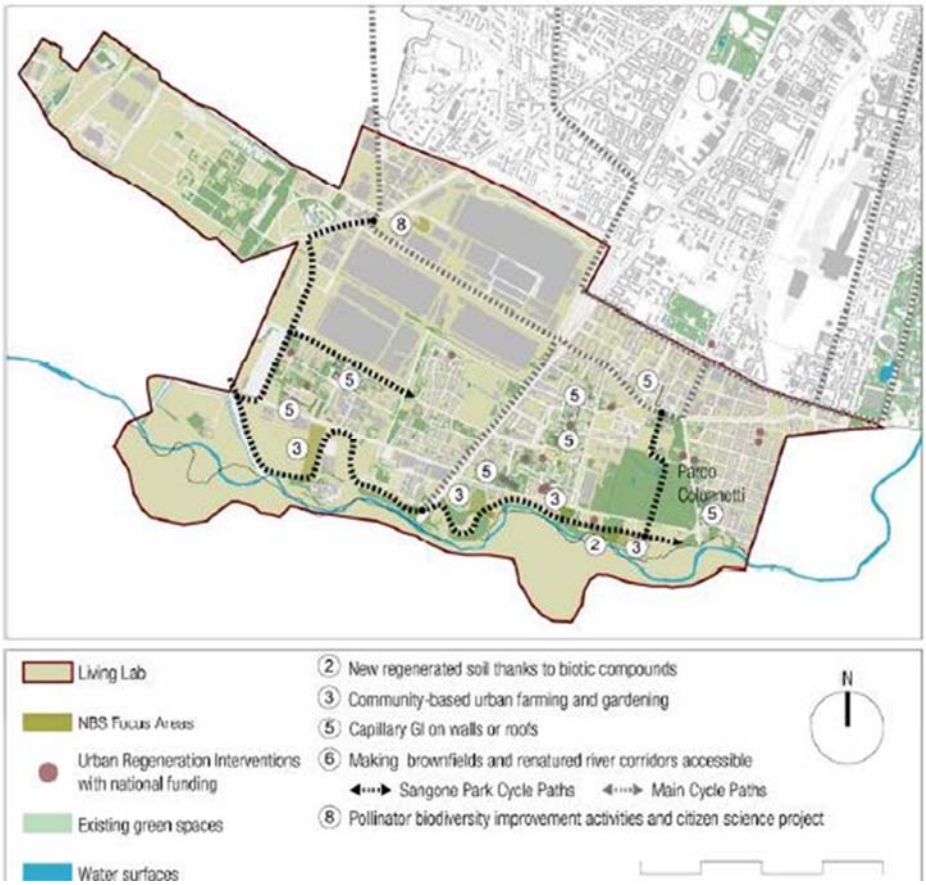


Figure 4 – Turin LL and LL district: Mirafiori Sud (Source: RWTH)

The NBS to be implemented in Turin are listed in Table 5. Per each implementation, it is specified if it will be monitored and how. The two different activities in NBS2 have been split in the table because they will be assessed separately.

Table 5 – NBS to be implemented in Turin and monitoring tools to be used. When the implementation is still under definition, possible monitoring tools are indicated within brackets.

TURIN						
NBS name/ description	**NBS type**	**Size**	**Involved stakeholders**	**Implementation timing**	**Estimated number of users per year**	**NBS monitoring tools**
New Soil production in Sangone Park	NBS2	2,000 m^2	Dual, UNITO, Envipark	10/2019 – 04/2020	Workers:10 trained people: 50 visitors: 100	C, H
New Forest in the Sangone Park						A, B, D, E, F, G
Castello di Mirafiori ruins recovery and new planting	NBS3	2,000 m^2	Associazione Clorofilla	09/2018-03/2020	Workers:10 consumers: no visitors: 500	It will not be monitored, since it is a small intervention in an already existing park.
Gardens in Cascina Piemonte		12,000 m^2	Associazione Clorofilla	02/2019 - 07/2020	Workers: 20 consumers: 300 visitors: 500	A, B, C, E, F, G, I
Pollinator friendly garden		60 boxes	OrtiAlti	03/2020-09/2020	Workers:10 consumers: 50 visitors: 50	Too late implementation
School gardens		10-12 boxes in each of the 7 different schools	Fondazione Mirafiori	01/2019 – 10/2019	Around 500 students around 20 teachers around 1,000 visitors (families)	Small implementations

Gardens in courtyards of social housing buildings		10-20 boxes	Fondazione Mirafiori Miravolante	To be co-designed	15-20 community gardeners (inhabitants) around 500 visitors	Small implementation
Aquaponic test system	NBS4	1 m^3	City of Turin	To be defined	Workers:10 consumers: 50 visitors: 50	Small implementation
Green roof on Casa nel Parco	NBS5	400 m^2	City of Turin	10/2018-04/2019	Workers:10 consumers: 50 visitors: 50	Renewal of an existing GI
Green wall outdoor on a homeless asylum		To be defined	City of Turin	To be defined	TBD	A, C, D, G
Green wall indoor in a school		To be defined	City of Turin	To be defined	To be defined	A
New green roof on public building		100 m^2	OrtiAlti	12/2020-02/2021	Workers:10 consumers:50 visitors: 50	C, D, E, F, G, I
Local natural heritage enhancement	NBS6	To be co-designed	Miravolante	To be co-designed	Workers:10 consumers:50 visitors: 50	(B, C)
ICT tools for regulations and plans	NBS7	/	City of Turin	To be defined	To be defined	(C)
Citizen science and disadvantaged people	NBS8	All LL	UNITO	Already in progress	Workers (disadvantaged people + Unito researchers): 5	C, I

5.3. Zagreb

The City of Zagreb and its local partners will implement five NBS. This will include the elaboration of the necessary technical and construction plans, obtaining of the construction permits, the contracting of all necessary works and services and the management and supervision of the construction works and sites.

The Zagreb LL is located in the eastern neighbourhood of Sesvete (see Figure 5), 10.2 km from the city centre. The whole district of Sesvete will be considered for the assessment at the LL district level. The surface of Sesvete is ca 165 km² (1/4 of overall surface area of the city), with 70,000 inhabitants (9% of the city population) and lowest average population age (37.8 years). Sesvete is a traditional and closely-knit community which has never developed a clear urban form or clear identity in the past. However, thanks to the activities of a local NGO in recent years it is now developing an increased sense of confidence with people demanding better connected public spaces and parks, bike lanes, more public facilities and a hub for start-up businesses and culture, to create a new urban identity.

The core of the LL will be the 13-ha brownfield site of the former meat processing factory Sljeme which is now owned by the Zagreb Holding Company, and transferral of ownership to the City of Zagreb is underway. The LL is located by the railway line, south to the present centre of Sesvete. It is connected to the railway and is part of the economic zone which now lies between the older centre of Sesvete and the new neighbourhood development to the South in Novi Jelkovec with 11,000 inhabitants.

Further details on the Zagreb LL and on the implemented NBS can be found in the D2.2[23] and in D3.2 (“Four Implementation Plans: Dortmund, Turin, Zagreb, Ningbo”).

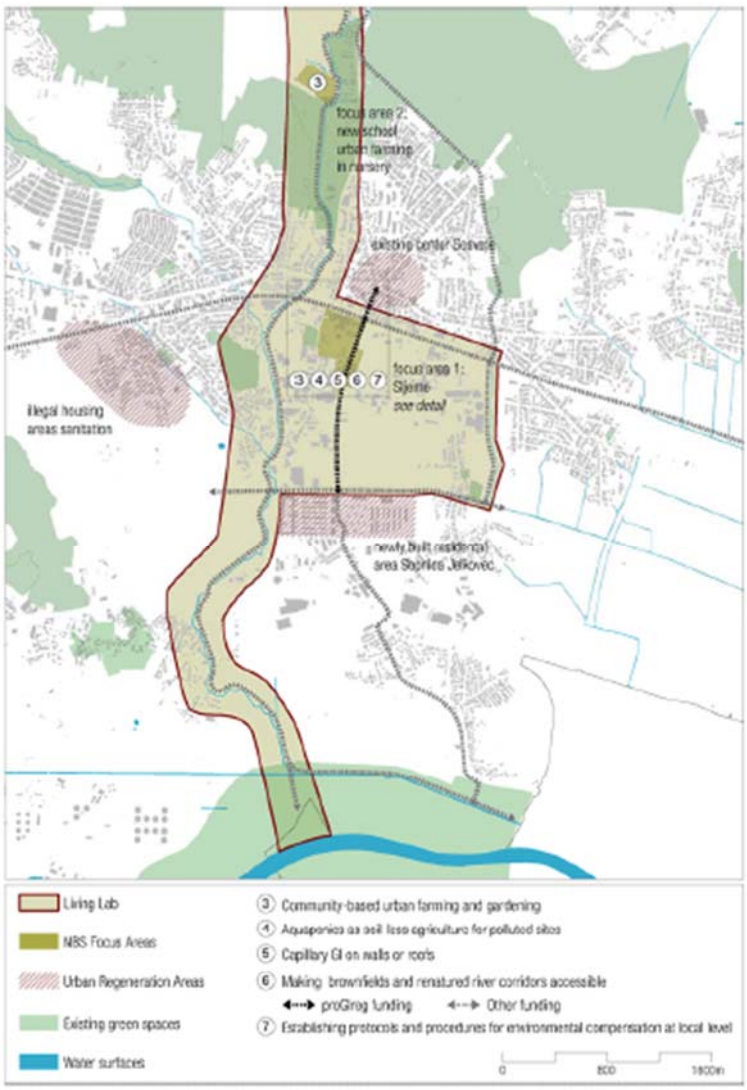


Figure 5 – Zagreb LL and LL district: Sesvete (Source: RWTH)

The NBS to be implemented in Zagreb are listed in Table 6. It is specified if and how each implementation will be monitored.

Table 6 – NBS to be implemented in Zagreb and monitoring tools to be used. When the implementation is still under definition, possible monitoring tools are indicated within brackets.

ZAGREB						
NBS name/ description	**NBS type**	**Size**	**Involved stakeholders**	**Implementation timing**	**Estimated number of users per year**	**NBS monitoring tools**
The Sesvete City Garden – upgrading of the existing garden	NBS3	10,732 m^2	Zagreb Municipality	9/2019-6/2021	102 users of city gardens, ca 1,000 consumers of fruits and vegetables grown in the gardens	A, B, C, E, F, G
The Sesvete City Garden – new therapy garden		8,700 m^2	Zagreb Municipality, "Mali dom" rehabilitation centre, City Office of Physical Planning	9/2019-6/2021	46 children with disabilities, 100 other users, 500 visitors a year	A, B, C, E, F, G
Info point		242 m^2	Green and Blue Sesvete, Zagreb Municipality	1/2020-6/2021	1,500 visitors a year	Not monitored because it not involves GI
Aquaponics testing installation	NBS4	50 m^2	Komfor Klima Grupa Zagreb Municipality	12/2019-6/2020	500 visitors a year	C, H
Roof on building to be designed	NBS5	700 m^2	Faculty of Architecture, Zagreb Municipality, Komfor Klima Grupa	2/2020-6/2021	To be evaluated	C, D, E, F, G

Photovoltaic cells		150 m^2		2/2020-6/2021		C, D
Green wall	NBS5	To be defined	To be defined	To be defined	To be defined	A, C, D, G
New cycling path	NBS6	850 m	City Office of Physical Planning, Zagreb Municipality, Local Council	1/2020-12/2020	5,000 users (10% of ca 50,000 inhabitants of Sesvete)	B, C
New protocols and make changes to its planning procedures and policy development processes	NBS7	/	Zagreb Municipality, City Office of Physical Planning	Start on 2021		C

5.4. Ningbo

Ningbo Living Lab (28 ha, see Figure 6) is mainly located in Moon Lake Park. Moon Lake is a shallow lake in the centre of Ningbo City. The Lake has the ecological functions of storing and purifying water, providing habitats for animals and plants, and regulating the nearby climate to reduce the urban heat island effect. As a cultural landmark of Ningbo, Moon Lake Park retains a lot of historical monuments, which has well inherited local culture. At present, it provides a place for people to relax and entertain. In the future, cultural industries (based on characteristic towns) will be developed around the park to promote tourism development and economic growth. However, in recent years, water blooms have occurred frequently, and seasonal polluted and malodorous water has appeared locally. The water quality has gradually deteriorated, greatly reducing the ecological and social benefits of the urban lake. In order to analyse the impact of implementing NBS in Moon Lake, the analysis area was extended to the entire Moon Lake Street. Located in Haishu District, Moon Lake Street has seven communities (a community consists of multiple residential quarters and it is managed by a residents committee led by the sub-district office), with Jiefang South Road in the east, Changchun Road in the west, Nanyuan Hotel in the south and Zhongshan Road in the north. The area of the jurisdiction is 2.07 km^2 and the registered population is 28,900.

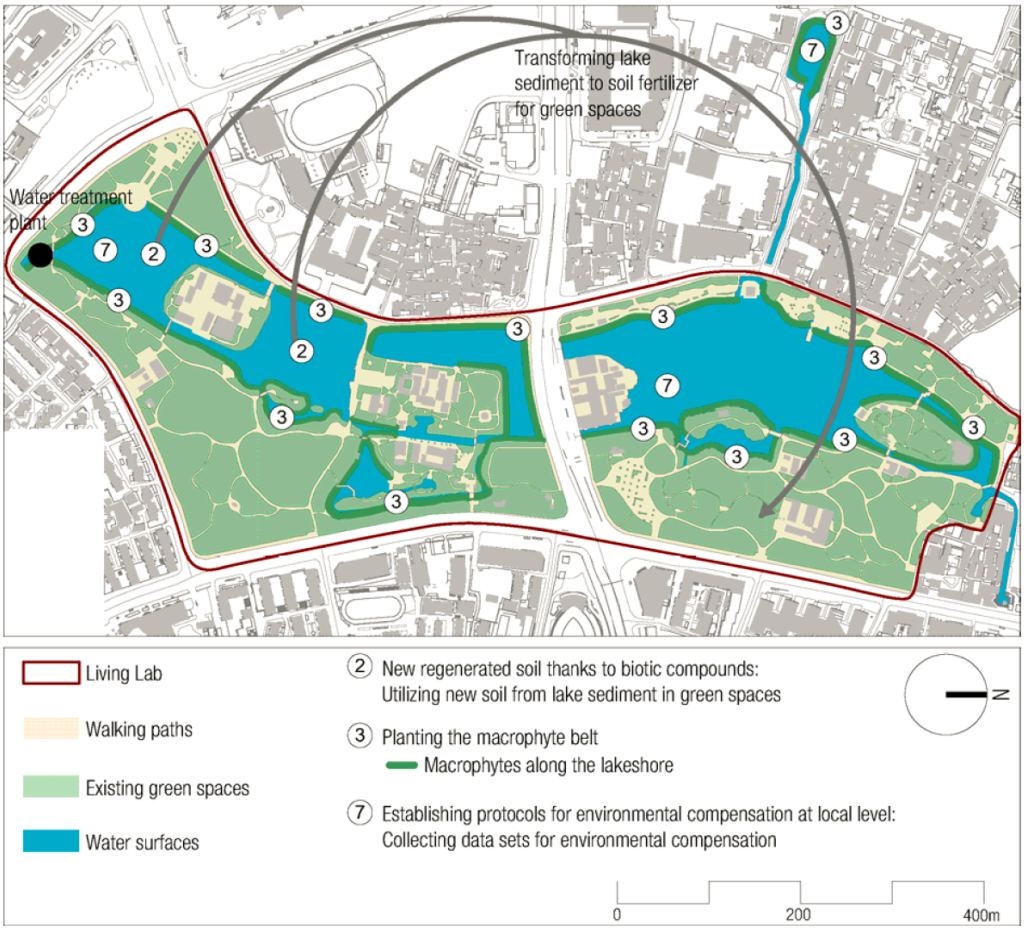


Figure 6 - Living Lab (continuous line) of Ningbo. (Source: proGIreg)

The NBS to be implemented in Ningbo are listed in Table 7. Per each implementation, it is specified how it will be monitored.

Table 7 - NBS to be implemented in Ningbo and monitoring tools to be used.

NINGBO						
NBS name/ description	**NBS type**	**Size**	**Involved stakeholders**	**Implementation timing**	**Estimated number of users**	**NBS monitoring tools**
Transforming lake sediment to soil fertilizer	NBS2	50,000 m^3 of lake sediment	Ningbo government, residents, IUE-CAS	01/2019 - 12/2020	Laboratory staff and other workers: 20 per year	C, H
Planting aquatic plants along the shore of the lake	NBS3	21,641m^2 (Including 1,918 m^2 of emergent plants and floating plants, and 19,723 m^2 of submerged plants)	Ningbo Forestry Bureau, residents	01/2019 - 06/2020	Workers:10 visitors: 5,000 per day	A, B, G, I, J
Procedures for environmental compensation	NBS7	3 observation sites	Ningbo government, residents, IUE-CAS	From 01/2021	Workers:10 per year	C

Annex 1: General Questionnaire guidebook (pre)

Interviewer guidebook

General Population Questionnaire

(pre-evaluation)

1. Information & preparation

In this study, interviewers are asked to administer a questionnaire to selected participants. We use an interview administered questionnaire to obtain the highest number of accurate answers. Please read this guidebook carefully before starting the data collection. In addition, please get familiar with the questionnaire and clarifications provided in this guidebook.

This guidebook consists of three main sections. This first section contains general information about the work we will be doing. Section 2 will describe how to recruit, approach and obtain the consent of the participant to collaborate with us. Section 3 contains all the explanations and clarifications you should need to guide the participant through the actual answering of the questions contained in the questionnaire.

The idea is that you (the interviewer) fill in the questionnaire together with the participant in an interview setting so the participant has the opportunity to ask for clarification if a question is not clear to him/her. You should read the questions out loud and register the answers of the participant in a program (especially designed for proGIreg) on a tablet. The participant will receive a paper version of the questionnaire, so he/she can read along with you. He/she may also choose to read along with you on the tablet. The interview takes place at or near the residence of the participant. If both the participant and interviewer agree and feel comfortable, the interview may take place in the home of the participant (i.e. if the interviewer is invited in or if the interviewer asks permission to come in). The interview may also take place at the door or on a bench outside, as long as regarded safe. **If you are uncomfortable in a situation or you have any feelings of unsafety, apologize and go to the next address.**

The participants are residents in two neighbourhoods in the city. You will be provided with a list of addresses and are asked to pass by the houses one by one, according to appointments with the participant or according to convenience (e.g. based on proximity between the addresses). The time period to go by the addresses is mainly from 9 am to 6 pm to ensure that the majority of the residents are at home (i.e. we will not find enough persons for interviews at late afternoon/early evening hours).

Before starting to recruit participants, please equip yourself with the following items:

- Tablet with loaded battery (every O.S. with standard browser will work).
- Sufficient material:
    - Paper copies of the informed consent form
    - Pen(s)
    - Paper copies of the participant sheet (questionnaire in paper format)
    - Printed copy of this guidebook

2. Recruitment of participants

2.1. Introduction

In case you visit an address *without* appointment.

When a potential participant (i.e. adult) opens the door, please introduce yourself and the project in the following manner:

i. *If the person who opened the door is a child, please ask if there is an adult present.*

Interviewer: **I am ..., an interviewer from the proGIreg project. As part of this project, we are doing a research study to evaluate the social, health, and economic benefits of providing nature in cities. You have received an informative letter from us about the possibility of this visit. We would like to ask you, or someone of this household, if you would like to take part in an interview for our research study.**

Interviewer: **Are you the only adult at home?**
If more adults are at home: **Of all adults that are at home now, who will be the first to have a birthday?**

ii. *If another resident has his/her birthday earlier in the year than the person who opened the door, please ask if you could talk to this resident.*

iii. *If the resident with the first birthday does not want to participate, ask if another adult would like to participate.*

In case you visit an address *with* appointment:

Interviewer: **I am ..., an interviewer from the proGIreg project. As part of this project, we are doing a research study to evaluate the social, health, and economic benefits of providing nature in cities. You have received an informative letter from us about the possibility of this visit and <<*name participant*>> has made an appointment with us to take part in an interview for our research study. Could I please speak to <<*name participant*>>?**

In any case, make sure that:

- The potential participant is 18 years old or older
- The potential participant lives at the address

Interviewer: **Before you decide if you would like to take part in our study, we would like to explain the study to you.**

2.2. Informed consent

To obtain informed consent, we use the “informed consent forms”. Please give a copy to the participant. The first pages of the informed consent form include an explanation of the study’s purpose and methods. It is very important that the potential participant understands the information included in this form. Please reassure the potential participant that he/she can ask you questions if any information is not clear. The table below lists some questions that might come up and how to address them.

Possible question	**Possible answer**
What are nature-based solutions? (*Or any related questions to the explanation of nature-based solutions*)	Nature-based solutions are actions in which we use nature to obtain certain benefits. For example, we could plant trees and provide places for cleaner, cooler air.
Why would nature-based solutions affect our health, our social circumstances, or our economic circumstances?	Nature-based solutions can provide many benefits to residents living near them. They can improve your health and sense of wellbeing by providing a place where you can do physical activity, where you can relax, and where you can socialize with your family, friends, and neighbours. Also, nature-based solutions help to save on energy costs in the community and at home. For instance, vegetation can reduce air temperature in summer time, which could lead to lower need to use the air conditioning.
How do I withdraw from the study?	The participation is absolutely voluntary. You can withdraw from the study at any time without any explanation.
How will you contact me to do the questionnaire again?	We ask you to indicate your email and your telephone number, so we can call or email you to contact you again. These data will be held by the City of <city name> and will not be made public to anyone else.
Data collection/processing/protection...	Your contact details are collected on a separate sheet. We will anonymise the information we collect from you and remove all identifying data (i.e. name, address, contact details). Publications or other results from this study will not identify you.

When the participant understands the information and is willing to participate, he/she is asked to sign the informed consent form. Reassure the potential participant that participation is absolutely voluntary.

If the participant does not want to sign the informed consent form, he/she cannot be a participant in the study. If none of the adult residents at the address wants to participate, thank them for their time and go to the next address.

2.3. Participant contact information sheet

At the start of the interview, please fill in the contact information sheet (**provided in paper format**). Reassure the participant that this information will be safely stored by the city and will be used only to contact him/her again. This information is not shared and will not be linked with the questionnaire that will be filled in on the tablet.

It is extremely important that the Respondent number (ID) on the contact information sheet is the same as the Respondent number (ID) given on the questionnaire on the tablet. Please review this thoroughly.

3. Interview (pre-evaluation)

When you have obtained the informed consent and have filled out the contact information sheet, you can start the interview. First, you give the participant their copy of the questionnaire sheet (in paper format) so they can read along when you read the questions and possible answers to them. The questions will be clearly read aloud by the interviewer. The interviewee will be asked to respond verbally and the interviewer will report the answer on the Tablet. Instead of reading along with their paper version of the questionnaire, the participant may also read along on the tablet, which would also allow them to see the answers that are filled in, based on their response. Please invite the participant to do how he/she prefers.

In the text below, you will find in **bold** the text that you are supposed to read out loud to introduce a section of questions. In the tables, you will find further clarifications and instructions for specific questions. Giving any of the clarifications to the participant is optional; if you see that the participant could use some more information, please give it to them.

Section 1: About you

Interviewer: **First, we will ask some background information about yourself and your household. The questions are not meant to be intrusive but will help us a lot in our study. Remember that all the information you provide is confidential.**

Question	Further instructions/clarifications
1	Please give the tablet to the participant, saying: "Please, choose the option concerning the gender to which you feel you belong". After the participant has selected the answer, take back the tablet and continue with the interview.
4	For the years of education, please start with the years in primary school, i.e. do not include any education received before primary school. If someone is a student and did not finish their studies yet, these years are not included.
6	With detached house, also called stand-alone house, we mean a free-standing residential building. Sometimes referred to as a single-family home, as opposed to a multi-family residential dwelling. With semi-detached house, we mean a single-family dwelling house built as one of a pair that share one common wall. Often, each house's layout is a mirror image of the other. To help assessing the number of flats in a building, you can ask the number of floors the building has and the number of flats/front doors per floor (and then calculate if this would add up to more than 10 flats in total). Or alternatively, if he/she thinks that more than 10 separate households live in the building.
7	Please select all answers that apply; i.e. a person can have both a private garden and a balcony.

Section 2: Visits to and satisfaction with green and blue spaces

Interviewer: **In this section, we will ask you about green and blue spaces.**
Green spaces are areas of grass, trees, or other vegetation. These include, for example, parks, playgrounds and playing fields in urban areas, and forests or woodlands, family gardens, agricultural fields, and mountains in more rural areas.
Blue spaces are visible areas of water in a city. These include inland areas like lakes, ponds, canals, rivers, fountains, and (outdoor) pools, and coastal areas such as beaches, harbours, piers, cliffs, and headlands.

These spaces do not include:
- Indoor locations
- Places which you visit as part of your job
- Private locations such as your own garden, land, pond, or swimming pool

We will ask about the green and blue spaces you visit in your leisure time. "Leisure time" means involving recreation (for fun) but not work.

Question	Further clarification
10.	With spending time, we mean if you visit such a green or blue space to enjoy the place or to do an activity there, or if you do activities (e.g. walking, biking, swimming, etc.) in green or blue spaces. If the participant did not use that particular green space in a normal week in these seasons, please write down a 0. If a participant reports to use the space in one of the two seasons (for example, summer but not in spring) please report the average. *Example: "I spent 14 hours a week at the pool in summer, but not in spring", please report: **7** hours a week.* **10a.** We refer only to public gardens, not private gardens.**10b.** natural green spaces include mountains, forests, natural parks, etc.
12.a	With quality, we refer to whether you think the green/blue environment is usable, attractive, or beautiful.
12.b	Here we ask if you are satisfied with the amount of green/blue space in your neighbourhood, i.e. if you think there are enough parks, gardens, playgrounds, trees, etc.
12.c	With maintenance, we mean if you think the green and blue spaces in your neighbourhood are well taken care of; i.e. they are cleaned, broken things are repaired, etc.
12.d	With safety, we refer to your feelings of safety when you are in the space, which could be affected by e.g. traffic or perception of crime.
13	Further explanation of the categories: - No green space/no window: No green means that the whole view from the window is filled with built-up area (i.e. buildings, parking places, roads, etc.) - A little bit of the view: You can see a little bit of nature (plants, trees, grass, etc) from your window. If you would put all the nature together, it could fill up maybe one fourth of your window. - Some of the view: You can see quite a bit of nature (plants, trees, grass, etc) from your window. If you would put all the nature together, it could fill up roughly half of your window. - Most of the view: You can see a lot of nature (plants, trees, grass, etc) from your window. If you would put all the vegetation together, it would fill up over half of your window. There would still be a bit of built-up area.

- All of the view: The whole view from the window is filled with natural elements; there is almost no built up area.

Section 3: Connectedness to nature

Interviewer: **Please answer each of these questions in terms of the way you generally feel. There are no right or wrong answers. On a scale from 1 to 5, with 1 being strongly disagree and 5 strongly agree, simply state as honestly as you can what you are presently experiencing. If you neither agree nor disagree, please select "neutral".**

Question	Further clarification
17.e	Cyclical process = actions that move in a circle
17.f	Kinship = a family relationship, or the state of feeling very close to someone or something
17.k	Embedded = fit into, inserted

Section 4: General health

Interviewer: **Now we will continue with questions regarding your health. We are interested in your health, so we can explore any links between spending time in nature and health.**

Question	Further clarification
22	Asthma attacks or episodes refer to periods of worsening asthma symptoms that make you limit your usual activity, or make you seek medical care. An attack of shortness of breath does not include breathlessness after exercise.

Section 5: Mental health & wellbeing

Interviewer: **Now we will continue with some questions about your wellbeing. We are interested in your wellbeing so we can explore any links between spending time in nature and, for example, stress.**

Question	Further clarification
25.	Major life events are defined as discrete experiences that disrupt an individual's usual activities, causing a substantial change and readjustment. Examples of life events include marriage, divorce, illness or injury, and changing or losing a job. They are not necessarily negative but can also be a positive change.
28.	Interviewer, please stress that these items no longer refer to feelings of the past **4** weeks, but to the past **2** (so a bit more recent).
29.	Interviewer, please stress that these items no longer refer to the past **2** weeks but to feelings of the past **1**.

Section 6: Social support and cohesion

Interviewer: **The following questions concern your relationships with people around you and in your neighbourhood, so we can explore any links between spending time in nature and, for example, social ties of the neighbourhood.**

Question	Further clarification
30.	"Other people" refers to whoever you know, including, family, friends, neighbours, acquaintances, people from associations or religious groups, etc ...)

Section 7: Physical activity

Interviewer: **This section includes questions on physical activity to investigate the relationship between nature and green spaces and physical activity. You will be asked about the time you spent being physically active in the last 7 days. Think about the activities you do at your job, as part of your house and yard work, to get from place to place, and in your spare time for leisure, recreation, exercise, or sport.**

Question	Further clarification
35.b	We ask about the amount of time a participant would spend on vigorous activities in one day. We look for ***accumulative*** physical activity on one of those days; so if someone usually does vigorous physical activities *twice* in a day, we want the sum of the time of both activities. If the participant has difficulty with responding to question 35.b: An average time for one of the days on which you do vigorous activity is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day you would spend 3 hours, but on another day only 30 min), ask: *How much time in total did you spend over the last 7 days doing vigorous physical activities?* ____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* Only fill in this question if the participant cannot answer question 35.b.
36.b	We ask about the amount of time a participant would spend on moderate activities in one day. We look for ***accumulative*** physical activity on one of those days; so if someone usually does moderate physical activities *twice* in a day, we want the sum of the time of both activities. If the participant has difficulty with responding to question 36.b: An average time for one of the days on which you do moderate activity is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day you would spend 3 hours, but on another day only 30 min), ask: *How much time in total did you spend over the last 7 days doing moderate physical activities?* ____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* Only fill in this question if the participant cannot answer question 36.b.
37.b	We ask about the amount of time a participant would spend walking in one day. We look for ***accumulative*** physical activity on one of those days;

	so if someone usually walks *twice* in a day, we want the sum of the time of both activities. <u>If the participant has difficulty with responding to question 37.b:</u> An average time for one of the days on which you walk is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day you would spend 5 hours walking and on another day only 30 minutes), ask: *What is the total amount of time you spent walking over the last 7 days?* *____Hours per week [Range: 0-112]* *____Minutes per week [Range: 0-6720]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* <u>Only fill in this question if the participant cannot answer question 37.b.</u>
38.	We ask about the amount of time a participant would spend sitting in one day. We look for ***<u>accumulative</u>*** time (i.e. the sum) on one of those days. <u>If the participant has difficulty with responding to question 38:</u> An average time per day spent sitting is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day, you would sit 5 hours, and on another day 15 hours), ask*:* *"What is the total amount of time you spent sitting last Wednesday?".* *___ Hours on Wednesday [Range: 0-16]* *___ Minutes on Wednesday [Range: 0-960]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* <u>Only fill in this question if the participant cannot answer question 38.</u>

Section 8: Mindfulness

Interviewer: **The following section is about mindfulness, which is a concept that describes a variety of ways of relating to your thoughts and feelings. We are interested in the relationship between contact with nature and mindfulness. For each of the items below, rate how much these ways apply to you.**

Question	Further clarification
39.	This item does not have a time reference. If the participant asks what period he should refer to, please answer this way: "Think about how you are and feel in general".

Section 9: Labour market and economy

Interviewer: **Now we would like to as you some questions about your personal economy, labour status and living conditions. The questions are not meant to be intrusive but will help us a lot in our study. Remember that all the information you provide us is completely confidential.**

Question	Further clarification
41.	Green jobs are those related to environmental protection (i.e. preventing, reducing and eliminating pollution and any other degradation of the environment) and resource management, such as maintaining the stock of natural resources and preventing them from being used up.
44-54	If the participant does not know and offers to ask the answer from another household member, this can be accepted.
45	Net income means their income after labour taxes have been discounted. This amount would general coincide with the paycheck that gets transferred/deposited monthly in the participant's account. If the participant is self-employed, you could ask them to calculate their approximate average monthly earnings after taxes.

Section 10: Quality of the interview

Interviewer: **Now one last question before saying goodbye. We kindly ask you to evaluate the interview we just did.**

(NB: After answering this last question, the interviewer can fill in section 11 on the subjective assessment of the interview by himself).

4. Finishing the interview

Interviewer: **This is the end of the questionnaire! Thank you very much for helping us with this study and for participating in this interview. As we told you at the beginning of the interview, we will contact you again in about three years to participate in the second round of interviews. But, please remember that your positive answer now does not mean that you will be obliged to participate when we contact you. Participation is always voluntary, and you can withdraw from the study at any time.**

5. Last steps

Make sure the interview is saved in the program. Furthermore, please store the contact information sheet carefully and drop it off at the local responsible person as soon as possible.

Annex 2: General Questionnaire guidebook (post)

Interviewer guidebook

General Population Questionnaire

(post-evaluation)

1. Information & preparation

In this study, interviewers are asked to administer a questionnaire to participants who have already participated in the baseline assessment. In case you have not administered the previous questionnaire, this guidebook will provide all the information you need for this second interview. The post-evaluation questionnaire is very similar to the previous one, but not identical. So, also in case you have already administered the pre-evaluation questionnaire, please read this guidebook carefully before starting this second data collection.

This guidebook has been divided in three main sections. This first section contains general information about the work we are doing. Section 2 is on the steps taken before the actual interview (inviting the participant and making an appointment for the interview, reminding the participant of the details of the research, and encouraging him/her to collaborate with us again). Lastly, section 3 contains all the explanations and clarifications you should need to guide the participant through the actual answering of the questions of the questionnaire.

The idea is that you (the interviewer) fill in the questionnaire together with the participant in an interview setting. You should read the questions out loud and register the answers of the participant in a program (especially designed for proGIreg) on a tablet. The participant will receive a paper version of the questionnaire, so he/she can read along with you. In this manner, the participant has the opportunity to ask for clarification if a question is not clear to him/her. Before the data collection starts, please get familiar with the questionnaire and clarifications.

2. Before the interview

2.1. Invitation for the second interview

The participant has agreed to be contacted for participation in the second interview. You call the participant on the telephone to invite him/her to participate in the second interview and to make an appointment. You will be provided with the contact details of the participant (name, address, and telephone number). This is confidential information; you should store this information very carefully and protect the privacy of the participant. This information should also include who interviewed the participant at baseline. If possible, it is preferable to have the same interviewer for the same participant.

Please call the participant in the following manner:

Interviewer: **Good morning <name of the selected participant>! I am <name of the interviewer>, an interviewer from the proGIreg project. In 2019, you completed an**

interview for our research study and agreed to be contacted again for a second interview. Would you be willing to participate in this second interview?

- *If the participant is hesitant to participate, offer to explain the proGIreg project and the study; please tell the participant it is important for us to have a second interview because with two measurements, we are able to see how the health, social, and economic indicators change over time. Participation would take around half an hour. Reassure the participant that he/she can ask questions about anything that is unclear.*

Interviewer: **I will come to your home to do the interview. Would you be available on <<day and date>> at <<time>>?**

2.2. Preparation

Before going to the participant's house, please equip yourself with the following items:

- Tablet with loaded battery
- Sufficient material:
  - Information sheet
  - Informed (and previously signed) consent form
  - Pen(s)
  - Participant sheet (questionnaire in paper format)
  - Print version of this guidebook

2.3. Home visit

On the day of the appointment, you go by the participant's house. When someone opens the door, please introduce yourself and the project in the following manner:

Interviewer: **Good morning!**
I am <name of the interviewer> from the proGIreg project. I talked on the phone with <name of the selected participant>. Could I speak to him/her?

- If the participant is not present at the address, the interviewer should call the next day to make another appointment. The interviewer can return to the same address at another moment up to five attempts.

Interviewer: **In 2019, you completed an interview for our research study and we talked on the phone about doing another interview today. It will take you away about thirty minutes.**

- *If the participant is not willing to complete the questionnaire now, but is willing to do so another day, please arrange an appointment with him/her.*

Interviewer: **Before we begin, we would like to remind you of what our study is about and why your participation is important to us.**

First, we summarize what the study is about, what it entails, and details on the information sheet and informed consent that he/she already signed before the first assessment. Please reassure the participant that he/she can ask you questions if any information is not clear. The table below lists some questions that might come up and how to address them.

For example: **The research study is part of the European proGIreg project that aims to evaluate the benefits of nature-based solutions. Nature-based solutions are natural and semi-natural areas within the city that may provide environmental, social, and economic benefits. Examples of nature-based solutions are green and blue spaces such as parks, public gardens, and rivers.**

As in the first interview, we ask you to respond to a questionnaire that will take about half an hour of your time. We will treat all the information that you provide us with confidentiality. Most importantly, any information that could identify you (such as your name, address, or telephone number) will not be shared with anyone and will be safely stored only by the city's administration. In addition, the information that is collected in this interview will not be linked to this personal information (name, address, or telephone number).

Possible question	**Possible answer**
What are nature-based solutions? (*Or any related questions to the explanation of nature-based solutions*)	Nature-based solutions are actions in which we use nature to obtain certain benefits. For example, we could plant trees and provide lakes for cleaner, cooler air.
Why would nature-based solutions affect our health, our social circumstances, or our economic circumstances?	Nature-based solutions could provide many benefits to residents living near them. They would improve your health and sense of wellbeing by providing a place where you can do physical activity, where you can relax, and where you can socialize with your family, friends, and neighbours. Also, nature-based solutions help to save on energy costs in the community and at home.
How do I withdraw from the study?	The participation is absolutely voluntary. You can withdraw from the study at any time without any explanation.
Data collection/processing/protection...	Your contact details are stored separately from the first questionnaire you have completed. This interview does not include further questions on personal information.

Reassure the potential participant that participation is absolutely voluntary, and that he/she can withdraw from the study at any time without any explanation.

2.4. Respondent number

In a separate file, you have the contact information of the participant. Each participant is given a unique Respondent number (ID). **It is extremely important that the Respondent number (ID) given in the contact information is the same as the Respondent number (ID) given on the questionnaire on the tablet.** Please review this thoroughly.

3. Interview (follow-up)

First, you give the participant their copy of the questionnaire sheet (in paper format) so they can read along when you read the questions and possible answers to them. The questions will be clearly read aloud by the interviewer. The interviewee will be asked to respond verbally, and the interviewer will report the answer on the Tablet. Instead of reading along with their paper version of the questionnaire, the participant may also read along on the tablet, which would also allow them to see the answers that are filled in, based on their response. Please invite the participant to do how he/she prefers.

In the text below, you will find in **bold** the text that you are supposed to read out loud to introduce a section of questions. In the tables, you will find further clarifications and instructions for specific questions. Giving any of the clarifications to the participant is optional; if you see that the participant could use some more information, please give it to them.

3.1. Section 1: About you

Interviewer: **First, we will ask some background information about yourself and your household. The questions are not meant to be intrusive but will help us a lot in our study. Remember that all the information you provide is confidential.**

Question	Further instructions/clarifications
4.	With detached house, also called stand-alone house, we mean a free-standing residential building. Sometimes referred to as a single-family home, as opposed to a multi-family residential dwelling. With semi-detached house, we mean a single-family dwelling house built as one of a pair that share one common wall. Often, each house's layout is a mirror image of the other. To help assessing the number of flats in a building, you can ask the number of floors the building has and the number of flats/front doors per floor (and then calculate if this would add up to more than 10 flats in total). Or alternatively, if he/she thinks that more than 10 separate households live in the building.
5.	Please select all answers that apply; i.e. a person can have both a private garden and a balcony.

3.2. Section 2: Visits to and satisfaction with green and blue spaces

Interviewer: **In this section, we will ask you about green and blue spaces.**
Green spaces are areas of grass, trees, or other vegetation. These include, for example, parks, playgrounds and playing fields in urban areas, and forests or woodlands, family gardens, agricultural fields, and mountains in more rural areas.
Blue spaces are visible areas of water in a city. These include inland areas like lakes, ponds, canals, rivers, fountains, and (outdoor) pools, and coastal areas such as beaches, harbours, piers, cliffs, and headlands.

These spaces do not include:
- Indoor locations
- Places which you visit as part of your job
- Private locations such as your own garden, land, pond, or swimming pool

We will ask about the green and blue spaces you visit in your leisure time. "Leisure time" means involving recreation (for fun) but not work.

Question	Further clarification
7.	With spending time, we mean if you visit such a green or blue space to enjoy the place or to do an activity there, or if you do activities (e.g. walking, biking, swimming, etc.) in green or blue spaces. If the participant did not use that particular green space in a normal week in these seasons, please write down a 0. If a participant reports to use the space in one of the two seasons (for example, summer but not in spring) please report the average.

	*Example: "I spent 14 hours a week at the pool in summer, but not in spring", please report: **7** hours a week.* **7a.** We refer only to public gardens, not private gardens. **7b.** natural green spaces include mountains, forests, natural parks, etc.
9.a	With quality, we refer to whether you think the green/blue environment is usable, attractive, or beautiful.
9.b	Here we ask if you are satisfied with the amount of green/blue space in your neighbourhood, i.e. if you think there are enough parks, gardens, playgrounds, trees, etc.
9.c	With maintenance, we mean if you think the green and blue spaces in your neighbourhood are well taken care of; i.e. they are cleaned, broken things are repaired, etc.
9.d	With safety, we refer to your feelings of safety when you are in the space, which could be affected by e.g. traffic or perception of crime.
10.	Further explanation of the categories: - No green space/no window: No green means that the whole view from the window is filled with built-up area (i.e. buildings, parking places, roads, etc.) - A little bit of the view: You can see a little bit of nature (plants, trees, grass, etc) from your window. If you would put all the nature together, it could fill up maybe one fourth of your window. - Some of the view: You can see quite a bit of nature (plants, trees, grass, etc) from your window. If you would put all the nature together, it could fill up roughly half of your window. - Most of the view: You can see a lot of nature (plants, trees, grass, etc) from your window. If you would put all the vegetation together, it would fill up over half of your window. There would still be a bit of built-up area. - All of the view: The whole view from the window is filled with natural elements; there is almost no built up area.

3.3. Section 3: Connectedness to nature

Interviewer: **Please answer each of these questions in terms of the way you generally feel. There are no right or wrong answers. On a scale from 1 to 5, with 1 being strongly disagree and 5 strongly agree, simply state as honestly as you can what you are presently experiencing. If you neither agree nor disagree, please select "neutral".**

Question	Further clarification
13.e	Cyclical process = actions that move in a circle
13.f	Kinship = a family relationship, or the state of feeling very close to someone or something
13.k	Embedded = fit into, inserted

3.4. Section 4: General health

Interviewer: **Now we will continue with questions regarding your health. We are interested in your health, so we can explore any links between spending time in nature and health.**

Question	Further clarification
17.	Asthma attacks or episodes refer to periods of worsening asthma symptoms that make you limit your usual activity, or make you seek medical care. An attack of shortness of breath does not include breathlessness after exercise.

3.5. Section 5: Mental health & wellbeing

Interviewer: **Now we will continue with some questions about your wellbeing. We are interested in your wellbeing so we can explore any links between spending time in nature and, for example, stress.**

Question	Further clarification
21.	Major life events are defined as discrete experiences that disrupt an individual's usual activities, causing a substantial change and readjustment. Examples of life events include marriage, divorce, illness or injury, and changing or losing a job. They are not necessarily negative but can also be a positive change.
24.	Interviewer, please stress that these items no longer refer to feelings of the past **4** weeks, but to the past **2** (so a bit more recent).
25.	Interviewer, please stress that these items no longer refer to feelings of the past **2** weeks but to the past **1**.

3.6. Section 6: Social support and cohesion

Interviewer: **The following questions concern your relationships with people around you and in your neighbourhood, so we can explore any links between spending time in nature and, for example, social ties of the neighbourhood.**

Question	Further clarification
26.	"Other people" refers to whoever you know, including, family, friends, neighbours, acquaintances, people from associations or religious groups, etc ...)

3.7. Section 7: Physical activity

Interviewer: **This section includes questions on physical activity to investigate the relationship between nature and green spaces and physical activity. You will be asked about the time you spent being physically active in the last 7 days. Think about the activities you do at your job, as part of your house and yard work, to get from place to place, and in your spare time for leisure, recreation, exercise, or sport.**

Question	Further clarification
31.b	We ask about the amount of time a participant would spend on vigorous activities in one day. We look for *accumulative* physical activity on one of those days; so, if someone usually does vigorous physical activities *twice* in a day, we want the sum of the time of both activities. If the participant has difficulty with responding to question 31.b: An average time for one of the days on which you do vigorous activity is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day you would spend 3 hours, but on another day only 30 min), ask: *How much time in total did you spend over the last 7 days doing vigorous physical activities?* ____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* Only fill in this question if the participant cannot answer question 31.b.
32.b	We ask about the amount of time a participant would spend on moderate activities in one day. We look for *accumulative* physical activity on one of

	those days; so if someone usually does moderate physical activities *twice* in a day, we want the sum of the time of both activities. <u>If the participant has difficulty with responding to question 32.b:</u> An average time for one of the days on which you do moderate activity is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day you would spend 3 hours, but on another day only 30 min), ask: *How much time in total did you spend over the last 7 days doing moderate physical activities?* ____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* <u>Only fill in this question if the participant cannot answer question 32.b.</u>
33.b	We ask about the amount of time a participant would spend walking in one day. We look for ***<u>accumulative</u>*** physical activity on one of those days; so if someone usually walks *twice* in a day, we want the sum of the time of both activities. <u>If the participant has difficulty with responding to question 33.b:</u> An average time for one of the days on which you walk is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day you would spend 5 hours walking and, on another day, only 30 minutes), ask: *What is the total amount of time you spent walking over the last 7 days?* ____*Hours per week [Range: 0-112]* ____*Minutes per week [Range: 0-6720]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer* <u>Only fill in this question if the participant cannot answer question 33.b.</u>
34.	We ask about the amount of time a participant would spend sitting in one day. We look for ***<u>accumulative</u>*** time (i.e. the sum) on one of those days. <u>If the participant has difficulty with responding to question 34:</u> An average time per day spent sitting is being sought. If the respondent cannot answer because the pattern of time spent varies widely from day to day (e.g. on one day, you would sit 5 hours, and on another day 15 hours), ask*:* *"What is the total amount of time you spent sitting last Wednesday?".*

___ *Hours on Wednesday [Range: 0-16]*
___ *Minutes on Wednesday [Range: 0-960]*
❑ *Don't know/Not sure*
❑ *Prefer not to answer*

Only fill in this question if the participant cannot answer question 34.

3.8. Section 8: Mindfulness

Interviewer: **The following section is about mindfulness, which is a concept that describes the variety of ways of relating to your thoughts and feelings. We are interested in the relationship between contact with nature and mindfulness. For each of the items below, rate how much these ways apply to you.**

Question	Further clarification
35.	This item does not have a time reference. If the participant asks what period he should refer to, please answer this way: "Think about how you are and feel in general".

3.9. Section 9: Labour market and economy

Interviewer: **Now wewould like to ask you some questions about your personal economy, labour status and living conditions. The questions are not meant to be intrusive but will help us a lot in our study. Remember that all the information you provide us is completely confidential.**

Question	Further clarification
38.	Green jobs are those related to environmental protection (i.e. preventing, reducing and eliminating pollution and any other degradation of the environment) and resource management, such as maintaining the stock of natural resources and preventing them from being used up.
41-51	If the participant does not know and offers to ask the answer from another household member, this can be accepted.

42.	Net income means their income after labour taxes have been discounted. This amount would general coincide with the paycheck that gets transferred/deposited monthly in the participant's account. If the participant is self-employed, you could ask them to calculate their approximate average monthly earnings after taxes.

3.10. Section 10: Perceived quality of implemented NBS

Section 10 includes questions about the NBS that are implemented in the city as part of the proGIreg project. Please get familiar with the different NBS (i.e. knowing what has been done, where it was implemented, and when it was done) so you can answer any potential questions of the participant.

Interviewer: **Now we'd like to ask you some specific questions concerning the NBS implementations which has been built in your city. The following NBS have been introduced:**

A: _____
B: _____
C: _____
D: _____
E: _____
F: _____

Etc.

Question	Further clarification
52.a	Nature-based solutions are actions in which we use nature to obtain certain benefits. For example, we could plant trees and provide lakes for cleaner, cooler air, or we could provide nature in an open space to create a pleasant place for leisure activities.
52.b	Please select all answers that you know
55	**This is the last question for participants that did not visit any of the NBS** **>> Please skip to section 11 *after* completion of this question**
56	Please select all NBSs that you have visited
59.	This includes visits of a few minutes to visits of all day. Please provide the total sum, thus count all visits to each NBS (i.e. including repeated visits to the same NBS) and sum up all visits to the different NBS.
65.n	"Sense of oneness" is defined as a strong feeling of closeness or affinity with something or someone

3.11. Section 11: Quality of the interview

Interviewer: **Now one last question before saying goodbye. We kindly ask you to evaluate the interview we just did.**

- *NB: After answering this last question, please fill in section 12 on the subjective assessment of the interview by yourself.*

4. Finishing the interview

Interviewer: **<u>This is the end of the questionnaire!</u> Thank you very much for helping us with this study and for participating in this interview. Your collaboration is very helpful for our research.**

5. Last steps

Make sure the interview is saved in the program. Furthermore, please store the contact information carefully and bring it back at the local responsible person as soon as possible.

Annex 3: General Questionnaire (pre)

General Questionnaire (pre)

SECTION 1: ABOUT YOU

1. *[INTERVIEWER: Please, choose the option concerning the gender to which you feel you belong]*	❑ *Male* ❑ *Female* ❑ *Third gender*
2. How old are you?	_____ years old
3. What is your current civil status?	❑ Single ❑ Married/registered partnership ❑ Living together ❑ Living apart together (LAT) ❑ Divorced/separated ❑ Widowed
4. Please, indicate your years of education beginning with primary school (considering only the years successfully passed)	_____ years
5. What is your current employment status?	❑ Employee ❑ Self-employed with employees ❑ Self-employed/Freelance without employees ❑ Unemployed ❑ Student (without any studentship) ❑ Stay-at-home parent ❑ Rehabilitation/Disabled ❑ Retired ❑ Other, specify: _____
6. What kind of home do you live in?	❑ Detached house ❑ Semi-detached house ❑ Flat in a building with less than 10 flats ❑ Flat in a building with more than 10 flats ❑ Other, specify: _____
7. Do you have access to the following private outdoor green/blue environments at home? ***[More than one answer is possible]***	❑ Private garden/yard ❑ Private communal garden/space ❑ Balcony, patio area, rooftop terrace or similar ❑ No access to a private garden or outdoor space ❑ A private agricultural field ❑ Other; please specify _____
8. How many persons (adults or children) live in your household including yourself?	adults children
9.a Were you born in <country>?	❑ Yes (**1**) **[>>> skip to 9.c]** ❑ No (**0**)

9.b Since when do you live in <country>?	|___||___||___||___| year
9.c What is your nationality?	a. <nationality> b. Other: _____

SECTION 2: VISITS TO AND SATISFACTION WITH GREEN AND BLUE SPACES

10. In a normal week during the last 12 months, on average, how many hours did you spend in the following green or blue spaces? Please report the number of hours per week in spring-summer and the number of hours per week in autumn-winter, separately.

	[If you use the space in only one of the seasons, please report the average.]	Spring-Summer (hours per week)	Autumn-Winter (hours per week)
a.	Parks/public gardens		
b.	Woods/other natural green spaces		
c.	Agricultural field		
d.	Blue spaces		

11. Is there any green or blue space within a 10-minute walk from your home?

❑ Yes ❑ No ❑ Don't know

12. Overall, in your neighbourhood, how satisfied are you with the following aspects?

		1 Very dissatisfied	**2** Dissatisfied	**3** Neutral	**4** Satisfied	**5** Very satisfied
a.	The quality of the green/blue environment	❑	❑	❑	❑	❑
b.	The amount of the green/blue environment	❑	❑	❑	❑	❑
c.	The maintenance of the green/blue environment	❑	❑	❑	❑	❑
d.	The safety of the green/blue environment with regard to traffic as well as people (e.g. perceived crime)	❑	❑	❑	❑	❑

13. At home, how much green space (trees, grasses, flowers, etc.) can you see through the following window(s)? Please rate the amount of the view that is filled by greenspace on a scale from 0 (no green space/no window) to 4 (all of the view completely filled green space)

		0 No green space/ no window	**1** A little bit of the view	**2** Some of the view	**3** Most of the view	**4** All of the view
a.	Bedroom (your bedroom, not others)	❑	❑	❑	❑	❑
b.	Kitchen	❑	❑	❑	❑	❑
c.	Living room	❑	❑	❑	❑	❑

14. How often (during the day) do you look out through the following window(s)?

		0 No window	**1** Rarely	**2** Sometimes	**3** Often
a.	Bedroom (your bedroom, not others)	❑	❑	❑	❑

b.	Kitchen	❑	❑	❑	❑
c.	Living room	❑	❑	❑	❑

15. Do you keep indoor plants in your home?	❑ Yes (**1**) ❑ No (**0**) **[>>> skip to Q17]**
16. How many indoor plant pots do you have at home?	|___||___| plant pots

SECTION 3: CONNECTEDNESS TO NATURE

17. Please tell us what is closest to your situation, on a scale from 1 to 5, with:

		1 Strongly disa-gree	**2** Disa-gree	**3** Neu-tral	**4** Agree	**5** Strongly agree
a.	I often feel a sense of oneness with the natural world around me.	❑	❑	❑	❑	❑
b.	I think of the natural world as a community to which I belong.	❑	❑	❑	❑	❑
c.	I recognise and appreciate the intelligence of other living or-ganisms.	❑	❑	❑	❑	❑
d.	I often feel disconnected from nature.	❑	❑	❑	❑	❑
e.	When I think of my life, I imagine myself to be part of a larger cyclical process of living.	❑	❑	❑	❑	❑
f.	I often feel a kinship with animals and plants.	❑	❑	❑	❑	❑
g.	I feel as though I belong to the Earth as equally as it belongs to me.	❑	❑	❑	❑	❑
h.	I have a deep understanding of how my actions affect the natural world.	❑	❑	❑	❑	❑
i.	I often feel part of the web of life.	❑	❑	❑	❑	❑
j.	I feel that all inhabitants of the Earth, human and nonhuman, share a common 'life force'.	❑	❑	❑	❑	❑
k.	Like a tree can be part of a forest, I feel embedded within the broader natural world.	❑	❑	❑	❑	❑
l.	When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.	❑	❑	❑	❑	❑
m.	I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.	❑	❑	❑	❑	❑
n.	My personal welfare is independent of the welfare of the nat-ural world.	❑	❑	❑	❑	❑

SECTION 4: GENERAL HEALTH

18. In general, how would you say your health is?	❑ Excellent ❑ Very good ❑ Good ❑ Fair ❑ Poor

19.	What is your height? ***[Please give your best estimate.]***	|___|___|___| centimeters			
20.	What is your weight? ***[Please give your best estimate.]***	|___|___|___| kilograms			
21.	During the past four weeks, did you suffer from:	**0** No	**1** Sometimes	**2** Regularly/Often	**3** Very often or constantly
	a. Dizziness or feeling light-headed?	❑	❑	❑	❑
	b. Muscle pain?	❑	❑	❑	❑
	c. Fainting?	❑	❑	❑	❑
	d. Neck pain?	❑	❑	❑	❑
	e. Back pain?	❑	❑	❑	❑
	f. Excessive perspiration (i.e. sweating)?	❑	❑	❑	❑
	g. Palpitations (i.e. heart racing or pounding)?	❑	❑	❑	❑
	h. Headache?	❑	❑	❑	❑
	i. A bloated feeling in the abdomen?	❑	❑	❑	❑
	j. Blurred vision or spots in front of your eyes?	❑	❑	❑	❑
	k. Shortness of breath?	❑	❑	❑	❑
	l. Nausea or upset stomach?	❑	❑	❑	❑
	m. Pain in the abdomen or stomach area?	❑	❑	❑	❑
	n. Tingling in the fingers?	❑	❑	❑	❑
	o. Pressure or a tight feeling in the chest?	❑	❑	❑	❑
	p. Chest pain?	❑	❑	❑	❑
22.	During the past 6 months, have you had any of the following?	❑ An episode of asthma or an asthma attack ❑ An attack of shortness of breath with wheezing ❑ "Hay fever" or other allergic nasal symptoms (sneezing, or itchy, runny nose) as from pollen ❑ None of the above			
23.	Which of the following best describes your smoking habit?	❑ I have never been a smoker ❑ Daily smoker ❑ Smoker, but not daily ❑ Non-smoker, but previously smoked daily ❑ Non-smoker, but previously smoked although not daily			
24.	In the last year, how often did you usually have any kind of drink containing alcohol? *By a drink, we mean, for example, a can or bottle of beer, a glass of wine, or a drink containing 1 shot of liquor.*	❑ Never ❑ On special occasions/a few times a month ❑ Once or twice a week ❑ 3-5 times a week ❑ (Almost) daily			

SECTION 5: MENTAL HEALTH & WELLBEING

25.	In the <u>past four weeks</u>, was your life affected by any major event? For example, starting a new job, having a medical procedure (operation), giving birth, passing away of a family member or close friend	❑ Yes ❑ No ❑ Prefer not to answer

26. The following questions concern how you feel and have felt in the past four weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks…	**6** None of the time	**5** A bit of the time	**4** Some of the time	**3** A good bit of the time	**2** Most of the time	**1** All of the time
a. Did you feel full of pep (energy/full of life)?	❑	❑	❑	❑	❑	❑
b. Have you been a very nervous person?	❑	❑	❑	❑	❑	❑
c. Have you felt so down in the dumps that nothing could cheer you up?	❑	❑	❑	❑	❑	❑
d. Have you felt calm and peaceful?	❑	❑	❑	❑	❑	❑
e. Did you have a lot of energy?	❑	❑	❑	❑	❑	❑
f. Have you felt downhearted and blue?	❑	❑	❑	❑	❑	❑
g. Did you feel worn out?	❑	❑	❑	❑	❑	❑
h. Have you been a happy person?	❑	❑	❑	❑	❑	❑
i. Did you feel tired?	❑	❑	❑	❑	❑	❑

27. The questions in this section ask you about your feelings and thoughts during the past four weeks. In each case, you will be asked to indicate *how often* you felt or thought a certain way.

In the last month, how often ...	**0** Never	**1** Almost never	**2** Some-times	**3** Fairly often	**4** Very of-ten
a. Have you felt that you were unable to control the important things in your life?	❑	❑	❑	❑	❑
b. Have you felt confident about your ability to handle your personal problems?	❑	❑	❑	❑	❑
c. Have you felt that things were going your way?	❑	❑	❑	❑	❑
d. Have you felt difficulties were piling up so high that you could not overcome them?	❑	❑	❑	❑	❑

28. Over the last 2 weeks, how often have you been bothered by the following problems?

	0 Not at all	**1** Several days	**2** More than half the days	**3** Nearly every day
a. Feeling nervous, anxious, or on edge	❑	❑	❑	❑
b. Not being able to stop or control worrying	❑	❑	❑	❑
c. Worrying too much about different things	❑	❑	❑	❑
d. Trouble relaxing	❑	❑	❑	❑
e. Being so restless that it's hard to sit still	❑	❑	❑	❑
f. Becoming easily annoyed or irritable	❑	❑	❑	❑
g. Feeling afraid as if something awful might happen	❑	❑	❑	❑

29. Choose the best answer for how you have felt over the past week

	Yes (**1**)	No (**0**)
a. Are you basically satisfied with your life?	❑	❑
b. Do you often get bored?	❑	❑
c. Do you often feel helpless?	❑	❑
d. Do you prefer to stay at home rather than going out and doing new things?	❑	❑
e. Do you feel pretty worthless the way you are now?	❑	❑

SECTION 6: SOCIAL SUPPORT AND COHESION

30. Below is a list of some things that other people do for us or give us that may be helpful or supportive. Please tell us what is closest to your situation, on a scale from 1 to 5, with:

	1 Much less than I would like	2 Less than I would like	3 Some, but would like more	4 Almost as much as I would like	5 As much as I would like
1. I have people who care about what happens to me.	❑	❑	❑	❑	❑
2. I get love and affection.	❑	❑	❑	❑	❑
3. I get chances to talk to someone about problems at work or with my housework.	❑	❑	❑	❑	❑
4. I get chances to talk to someone I trust about my personal or family problems.	❑	❑	❑	❑	❑
5. I get chances to talk about money matters.	❑	❑	❑	❑	❑
6. I get invitations to go out and do things with other people.	❑	❑	❑	❑	❑
7. I get useful advice about important things in life.	❑	❑	❑	❑	❑
8. I get help when I am sick in bed.	❑	❑	❑	❑	❑

31. How strongly do you agree or disagree with the following statements **about your neighbourhood?**

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
a) People are willing to help their neighbours.	❑	❑	❑	❑	❑
b) People in this neighbourhood can be trusted.	❑	❑	❑	❑	❑
c) People in this neighbourhood generally do not get along with each other.	❑	❑	❑	❑	❑
d) People in this neighbourhood do not share the same values.	❑	❑	❑	❑	❑
e) I feel attached to (or at home in) this neighbourhood.	❑	❑	❑	❑	❑
f) I live in a nice neighbourhood where people have a sense of belonging.	❑	❑	❑	❑	❑

32. How often do you have contact **with your neighbours**?

- ❑ (almost) Daily
- ❑ At least once a week
- ❑ 1-3 times per month
- ❑ Less than once a month
- ❑ Seldom or never

33. How important is it for you to have frequent contact with your neighbours?

- ❑ Very important
- ❑ Important
- ❑ Somewhat important
- ❑ Not important
- ❑ Not important at all

34. How often do you meet your neighbours in...?

	1 Never/Rarely	2 Sometimes	3 Often
a. Public indoor spaces (e.g. schools, civic centres, shopping centres, bars/restaurants, etc.)	❑	❑	❑
b. Public outdoor spaces (e.g. green spaces, plazas/squares, etc.)	❑	❑	❑

SECTION 7: PHYSICAL ACTIVITY

35.	The first questions are about **vigorous activities** which make you breathe much harder than normal and may include running, heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for **at least 10 minutes at a time**.	
	a. During **the last 7 days**, on how many days did you do vigorous physical activities?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you spend doing **vigorous** physical activities on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	*>>**IF DON'T KNOW**: How much time in total did you spend over the last 7 days doing vigorous physical activities?*	____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]*
36.	Now think about activities which take **moderate physical effort** that you did in the last 7 days. Moderate physical activities make you breath somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking. Again, think about only those physical activities that you did for **at least 10 minutes at a time**.	
	a. During **the last 7 days**, on how many days did you do **moderate** physical activities?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you usually spend doing **moderate** physical activities on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	*>>**IF DON'T KNOW**: How much time in total did you spend over the last 7 days doing moderate physical activities?*	____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]*
37.	Now think about the time you spent **walking** in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.	
	a. During **the last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you spend **walking** on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	*>>**IF DON'T KNOW**: What is the total amount of time you spent walking over the last 7 days?*	____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]*

38.	Now think about the time you spent **sitting** on weekdays during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time, visiting friends, reading, sitting at a desk, or sitting or lying down to watch television.	
	During **the last 7 days**, how much time did you spend **sitting** on a weekday? *>>**IF DON'T KNOW**: What is the total amount of time you spent sitting last Wednesday?*	____ Hours per weekday *[Range: 0-16]* ____ Minutes per weekday *[Range: 0- 960]* ❑ Don't know/Not sure ❑ Prefer not to answer ____ *Hours on Wednesday [Range: 0-16]* ____ *Minutes on Wednesday [Range: 0-960]*

SECTION 8: MINDFULNESS

39. Please tell us what is the closest to your situation, on a scale from 1 to 4, with:	**1** Rarely/ Not at all	**2** Sometimes	**3** Often	**4** Almost always
a. It is easy for me to concentrate on what I am doing.	❑	❑	❑	❑
b. I am preoccupied by the future.	❑	❑	❑	❑
c. I can tolerate emotional pain.	❑	❑	❑	❑
d. I can accept things I cannot change.	❑	❑	❑	❑
e. I can usually describe how I feel at the moment in considerable detail.	❑	❑	❑	❑
f. I am easily distracted.	❑	❑	❑	❑
g. I am preoccupied by the past.	❑	❑	❑	❑
h. It's easy for me to keep track of my thoughts and feelings.	❑	❑	❑	❑
i. I try to notice my thoughts without judging them.	❑	❑	❑	❑
j. I am able to accept the thoughts and feelings I have.	❑	❑	❑	❑
k. I am able to focus on the present moment.	❑	❑	❑	❑
l. I am able to pay close attention to one thing for a long period of time.	❑	❑	❑	❑

SECTION 9: LABOUR MARKET AND ECONOMY

40. If you are employed, what sector do you work in?

❑ Agriculture, forestry and fishing	❑ Professional, scientific, and technical activities
❑ Mining and quarrying	❑ Administrative and support service activities
❑ Electricity, gas, steam and air conditioning supply	❑ Public administration and defence; compulsory social security
❑ Manufacturing	❑ Education
❑ Water supply; sewerage, waste management and remediation activities	❑ Human health and social work activities
❑ Construction	❑ Arts, entertainment and recreation
❑ Transportation and storage	❑ Other service activities
❑ Wholesale and retail trade; repair of motor vehicles and motorcycles	❑ Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
❑ Accommodation and food service activities	❑ Activities of extraterritorial organisations and bodies
❑ Information and communication	❑ Real estate activities
❑ Financial and insurance activities	

41.	Do you have a job that is considered in the **environmental economy (a green job)?**	❑ Yes (**1**) ❑ No (**0**) **[>>> skip to Q44]**
42	When did you begin working in the **environmental economy**?	|__|__|__|__| year

43. If you do have a green job, which **sector** of the ones below is it in?
[More than one answer is possible]

- ❑ Protection of ambient air and climate, of which:
  - ❑ Protection of climate and ozone layer
- ❑ Wastewater management
- ❑ Waste management
- ❑ Protection and remediation of soil, groundwater and surface water
- ❑ Noise and vibration abatement
- ❑ Protection of biodiversity and landscapes
- ❑ Protection against radiation
- ❑ Environmental research and development
- ❑ Other environmental protection activities
- ❑ Management of water
- ❑ Management of forest resources, of which:
  - ❑ Management of forest areas
  - ❑ Minimisation of the intake of forest resources
- ❑ Management of wild flora and fauna
- ❑ Management of energy resources, of which:
  - ❑ Production of energy from renewable resources
  - ❑ Heat/energy savings and management
  - ❑ Minimisation of the use of fossil energy as raw materials
- ❑ Management of minerals
- ❑ Research and development activities for resource management
- ❑ Other resource management activities: _____
- ❑ Others, please briefly describe: _____

44.	How many members of your household make an income?	|__|__| person/s
45.	What is the net income per month of all members of your household together?	❑ Less than €851 ❑ €851 to €1150 ❑ €1151 to €1750 ❑ €1751 to €3050 ❑ €3051 to €3500 ❑ €3501 or more ❑ Don't know/prefer not to answer
46.	How well would you say you or your household is managing financially these days? Would you say you are…	❑ Living comfortably ❑ Doing alright ❑ Just about getting by ❑ Finding it quite difficult ❑ Finding it very difficult ❑ Prefer not to answer
47.	Compared to a year ago, how would you say you or your household is doing financially now?	❑ Better off ❑ Worse off ❑ About the same ❑ Prefer not to answer

48. At the moment, how difficult do you find it to afford these items?	**1** Very difficult	**2** Fairly difficult	**3** Slightly difficult	**4** Not difficult
Food	❑	❑	❑	❑
Clothing	❑	❑	❑	❑
Heating	❑	❑	❑	❑
Rent/mortgage	❑	❑	❑	❑

49.	Which answer best describes you or your household's **living situation?**	❑ I (we) own the home where I (we) live and I (we) have a loan or mortgage **[>>> skip to Q51]** ❑ I (we) own the home where I (we) live and I (we) have no loan or mortgage **[>>> skip to Q51]** ❑ I (we) pay rent at market price ❑ I (we) pay rent at reduced price or free ❑ Other, please explain: _____
50.	If you **rent**, how much do you pay per month?	€|__|__|__|__|__|__| ❑ Don't know/Not sure ❑ Prefer not to answer
51.	In what year did you last move?	|__|__|__|__| year
52.	Why did you move?	❑ Change in family circumstances (new baby, got married, divorced, older children moved away, etc.) ❑ Our/my rent was raised more than we/I could pay ❑ We/I wanted to move to this area ❑ Change in working location required us/me to move ❑ Other, please explain
53.	Do you believe it is easy to find good housing at a reasonable price in your city?	❑ Very easy ❑ Easy ❑ Difficult ❑ Very difficult ❑ Don't know
54.	What is the size of your current home in m^2?	|__|__|__|__|__|__| m^2 ❑ Don't know/Not sure ❑ Prefer not to answer

END OF THE QUESTIONNAIRE

SECTION 10

QUALITY OF THE INTERVIEW

55. How would you rate the questions in this interview?

❑ Easy
❑ Neither easy nor difficult
❑ Difficult
❑ I don't know

SECTION 11

TO BE FILLED OUT BY THE INTERVIEWER

56. Evaluation of the quality of the interview:

❑ Very good
❑ Good
❑ Moderate
❑ Poor
❑ Very poor

Annex 4: General Questionnaire (post)

General Questionnaire (post)

SECTION 1: ABOUT YOU

1. How old are you?	_____ years old
2. What is your current civil status?	❑ Single ❑ Married/registered partnership ❑ Living together ❑ Living apart together (LAT) ❑ Divorced/separated ❑ Widowed
3. What is your current employment status?	❑ Employee ❑ Self-employed with employees ❑ Self-employed/Freelance without employees ❑ Unemployed ❑ Student (without any studentship) ❑ Stay-at-home parent ❑ Rehabilitation/Disabled ❑ Retired ❑ Other, specify: _____
4. What kind of home do you live in?	❑ Detached house ❑ Semi-detached house ❑ Flat in a building with less than 10 flats ❑ Flat in a building with more than 10 flats ❑ Other, specify: _____
5. Do you have access to the following private out-door green/blue environments at home? ***[More than one answer is possible]***	❑ Private garden/yard ❑ Private communal garden/space ❑ Balcony, patio area, rooftop terrace or similar ❑ No access to a private garden or outdoor space ❑ A private agricultural field ❑ Other; please specify _____
6. How many persons (adults or children) live in your household including yourself?	adults children

SECTION 2: VISITS TO AND SATISFACTION WITH GREEN AND BLUE SPACES

7. In a normal week during the last 12 months, on average, how many hours did you spend in the following green or blue spaces? Please report the number of hours per week in spring-summer and the number of hours per week in autumn-winter, separately.

	[If you use the space in only one of the seasons, please report the average.]	Spring-Summer (hours per week)	Autumn-Winter (hours per week)
a.	Parks/public gardens		
b.	Woods/other natural green spaces		
c.	Agricultural field		
d.	Blue spaces		

8. Is there any green or blue space within a 10-minute walk from your home?

❑ Yes ❑ No ❑ Don't know

9. Overall, in your neighbourhood, how satisfied are you with the following aspects?

		1 Very dissatisfied	**2** Dissatisfied	**3** Neutral	**4** Satisfied	**5** Very satisfied
a.	The quality of the green/blue environment	❑	❑	❑	❑	❑
b.	The amount of the green/blue environment	❑	❑	❑	❑	❑
c.	The maintenance of the green/blue environment	❑	❑	❑	❑	❑
d.	The safety of the green/blue environment with regard to traffic as well as people (e.g. perceived crime)	❑	❑	❑	❑	❑

10. At home, how much green space (trees, grasses, flowers, etc.) can you see through the following window(s)? Please rate the amount of the view that is filled by greenspace on a scale from 0 (no green space/no window) to 4 (all of the view completely filled green space)

		0 No green space/ no window	**1** A little bit of the view	**2** Some of the view	**3** Most of the view	**4** All of the view
a.	Bedroom (your bedroom, not others)	❑	❑	❑	❑	❑
b.	Kitchen	❑	❑	❑	❑	❑
c.	Living room	❑	❑	❑	❑	❑

11. How often (during the day) do you look out through the following window(s)?

		0 No window	**1** Rarely	**2** Sometimes	**3** Often
a.	Bedroom (your bedroom, not others)	❑	❑	❑	❑
b.	Kitchen	❑	❑	❑	❑
c.	Living room	❑	❑	❑	❑

12a. Do you keep indoor plants in your home?

❑ Yes (**1**)
❑ No (**0**) **[>>> skip to Q13]**

12b. How many indoor plant pots do you have at home?

|___||___| plant pots

SECTION 3: CONNECTEDNESS TO NATURE

13. Please tell us what is closest to your situation, on a scale from 1 to 5, with:

		1 Strongly disa-gree	2 Disa-gree	3 Neu-tral	4 Agree	5 Strongly agree
a.	I often feel a sense of oneness with the natural world around me.	❑	❑	❑	❑	❑
b.	I think of the natural world as a community to which I belong.	❑	❑	❑	❑	❑
c.	I recognise and appreciate the intelligence of other living organisms.	❑	❑	❑	❑	❑
d.	I often feel disconnected from nature.	❑	❑	❑	❑	❑
e.	When I think of my life, I imagine myself to be part of a larger cyclical process of living.	❑	❑	❑	❑	❑
f.	I often feel a kinship with animals and plants.	❑	❑	❑	❑	❑
g.	I feel as though I belong to the Earth as equally as it belongs to me.	❑	❑	❑	❑	❑
h.	I have a deep understanding of how my actions affect the natural world.	❑	❑	❑	❑	❑
i.	I often feel part of the web of life.	❑	❑	❑	❑	❑
j.	I feel that all inhabitants of the Earth, human and nonhuman, share a common 'life force'.	❑	❑	❑	❑	❑
k.	Like a tree can be part of a forest, I feel embedded within the broader natural world.	❑	❑	❑	❑	❑
l.	When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.	❑	❑	❑	❑	❑
m.	I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.	❑	❑	❑	❑	❑
n.	My personal welfare is independent of the welfare of the natural world.	❑	❑	❑	❑	❑

SECTION 4: GENERAL HEALTH

14. In general, how would you say your health is?	❑ Excellent ❑ Very good ❑ Good ❑ Fair ❑ Poor
15. What is your height? ***[Please give your best estimate.]***	|___|___|___| centimeters
16. What is your weight? ***[Please give your best estimate.]***	|___|___|___| kilograms

17. During the past four weeks, did you suffer from:	0 No	1 Sometimes	2 Regularly/Often	3 Very often or constantly
a. Dizziness or feeling light-headed?	❑	❑	❑	❑
b. Muscle pain?	❑	❑	❑	❑
c. Fainting?	❑	❑	❑	❑
d. Neck pain?	❑	❑	❑	❑
e. Back pain?	❑	❑	❑	❑
f. Excessive perspiration (i.e. sweating)?	❑	❑	❑	❑
g. Palpitations (i.e. heart racing or pounding)?	❑	❑	❑	❑
h. Headache?	❑	❑	❑	❑
i. A bloated feeling in the abdomen?	❑	❑	❑	❑
j. Blurred vision or spots in front of your eyes?	❑	❑	❑	❑
k. Shortness of breath?	❑	❑	❑	❑
l. Nausea or upset stomach?	❑	❑	❑	❑
m. Pain in the abdomen or stomach area?	❑	❑	❑	❑
n. Tingling in the fingers?	❑	❑	❑	❑
o. Pressure or a tight feeling in the chest?	❑	❑	❑	❑
p. Chest pain?	❑	❑	❑	❑

18. During the past 6 months, have you had any of the following?	❑ An episode of asthma or an asthma attack ❑ An attack of shortness of breath with wheezing ❑ "Hay fever" or other allergic nasal symptoms (sneezing, or itchy, runny nose) as from pollen ❑ None of the above
19. Which of the following best describes your smoking habit?	❑ I have never been a smoker ❑ Daily smoker ❑ Smoker, but not daily ❑ Non-smoker, but previously smoked daily ❑ Non-smoker, but previously smoked although not daily
20. In the last year, how often did you usually have any kind of drink containing alcohol? *By a drink, we mean, for example, a can or bottle of beer, a glass of wine, or a drink containing 1 shot of liquor.*	❑ Never ❑ On special occasions/a few times a month ❑ Once or twice a week ❑ 3-5 times a week ❑ (Almost) daily

SECTION 5: MENTAL HEALTH & WELLBEING

21. In the past four weeks, was your life affected by any major event? For example, starting a new job, having a medical procedure (operation), giving birth, passing away of a family member or close friend	❑ Yes ❑ No ❑ Prefer not to answer

22. The following questions concern how you feel and have felt in the past four weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks…	6 None of the time	5 A bit of the time	4 Some of the time	3 A good bit of the time	2 Most of the time	1 All of the time
a. Did you feel full of pep (energy/full of life)?	❑	❑	❑	❑	❑	❑
b. Have you been a very nervous person?	❑	❑	❑	❑	❑	❑
c. Have you felt so down in the dumps that nothing could cheer you up?	❑	❑	❑	❑	❑	❑
d. Have you felt calm and peaceful?	❑	❑	❑	❑	❑	❑
e. Did you have a lot of energy?	❑	❑	❑	❑	❑	❑
f. Have you felt downhearted and blue?	❑	❑	❑	❑	❑	❑
g. Did you feel worn out?	❑	❑	❑	❑	❑	❑
h. Have you been a happy person?	❑	❑	❑	❑	❑	❑
i. Did you feel tired?	❑	❑	❑	❑	❑	❑

23. The questions in this section ask you about your feelings and thoughts during the past four weeks. In each case, you will be asked to indicate *how often* you felt or thought a certain way.

In the last month, how often ...	0 Never	1 Almost never	2 Some-times	3 Fairly often	4 Very of-ten
a. Have you felt that you were unable to control the important things in your life?	❑	❑	❑	❑	❑
b. Have you felt confident about your ability to handle your personal problems?	❑	❑	❑	❑	❑
c. Have you felt that things were going your way?	❑	❑	❑	❑	❑
d. Have you felt difficulties were piling up so high that you could not overcome them?	❑	❑	❑	❑	❑

24. Over the last 2 weeks, how often have you been bothered by the following problems?

	0 Not at all	1 Several days	2 More than half the days	3 Nearly every day
a. Feeling nervous, anxious, or on edge	❑	❑	❑	❑
b. Not being able to stop or control worrying	❑	❑	❑	❑
c. Worrying too much about different things	❑	❑	❑	❑
d. Trouble relaxing	❑	❑	❑	❑
e. Being so restless that it's hard to sit still	❑	❑	❑	❑
f. Becoming easily annoyed or irritable	❑	❑	❑	❑
g. Feeling afraid as if something awful might happen	❑	❑	❑	❑

25. Choose the best answer for how you have felt over the past week

	Yes (1)	No (0)
a. Are you basically satisfied with your life?	❑	❑
b. Do you often get bored?	❑	❑
c. Do you often feel helpless?	❑	❑
d. Do you prefer to stay at home rather than going out and doing new things?	❑	❑
e. Do you feel pretty worthless the way you are now?	❑	❑

SECTION 6: SOCIAL SUPPORT AND COHESION

26. Below is a list of some things that other people do for us or give us that may be helpful or supportive. Please tell us what is closest to your situation, on a scale from 1 to 5, with:

	1 Much less than I would like	2 Less than I would like	3 Some, but would like more	4 Almost as much as I would like	5 As much as I would like
9. I have people who care about what happens to me.	❑	❑	❑	❑	❑
10. I get love and affection.	❑	❑	❑	❑	❑
11. I get chances to talk to someone about problems at work or with my housework.	❑	❑	❑	❑	❑
12. I get chances to talk to someone I trust about my personal or family problems.	❑	❑	❑	❑	❑
13. I get chances to talk about money matters.	❑	❑	❑	❑	❑
14. I get invitations to go out and do things with other people.	❑	❑	❑	❑	❑
15. I get useful advice about important things in life.	❑	❑	❑	❑	❑
16. I get help when I am sick in bed.	❑	❑	❑	❑	❑

27. How strongly do you agree or disagree with the following statements **about your neighbourhood?**

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
g) People are willing to help their neighbours.	❑	❑	❑	❑	❑
h) People in this neighbourhood can be trusted.	❑	❑	❑	❑	❑
i) People in this neighbourhood generally don't get along with each other.	❑	❑	❑	❑	❑
j) People in this neighbourhood do not share the same values.	❑	❑	❑	❑	❑
k) I feel attached to (or at home in) this neighbourhood.	❑	❑	❑	❑	❑
l) I live in a nice neighbourhood where people have a sense of belonging.	❑	❑	❑	❑	❑

28. How often do you have contact **with your neighbours**?

- ❑ (almost) Daily
- ❑ At least once a week
- ❑ 1-3 times per month
- ❑ Less than once a month
- ❑ Seldom or never

29. How important is it for you to have frequent contact with your neighbours?

- ❑ Very important
- ❑ Important
- ❑ Somewhat important
- ❑ Not important
- ❑ Not important at all

30. How often do you meet your neighbours in...?

	1 Never/Rarely	2 Sometimes	3 Often
a. Public indoor spaces (e.g. schools, civic centres, shopping centres, bars/restaurants, etc.)	❑	❑	❑
b. Public outdoor spaces (e.g. green spaces, plazas/squares, etc.)	❑	❑	❑

SECTION 7: PHYSICAL ACTIVITY

31.	The first questions are about **vigorous activities** which make you breathe much harder than normal and may include running, heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for **at least 10 minutes at a time**.	
	a. During **the last 7 days**, on how many days did you do vigorous physical activities?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you spend doing **vigorous** physical activities on one of those days?	_____ Hours per day *[Range: 0-16]* _____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	*>>**IF DON'T KNOW**: How much time in total did you spend over the last 7 days doing vigorous physical activities?*	____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]*
32.	Now think about activities which take **moderate physical effort** that you did in the last 7 days. Moderate physical activities make you breath somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking. Again, think about only those physical activities that you did for **at least 10 minutes at a time**.	
	a. During **the last 7 days**, on how many days did you do **moderate** physical activities?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you usually spend doing **moderate** physical activities on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	*>>**IF DON'T KNOW**: How much time in total did you spend over the last 7 days doing moderate physical activities?*	____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]*
33.	Now think about the time you spent **walking** in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.	
	a. During **the last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you spend **walking** on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	*>>**IF DON'T KNOW**: What is the total amount of time you spent walking over the last 7 days?*	____ *Hours per week [Range: 0-112]* ____ *Minutes per week [Range: 0-6720]*

34.	Now think about the time you spent **sitting** on weekdays during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time, visiting friends, reading, sitting at a desk, or sitting or lying down to watch television.	
	During **the last 7 days**, how much time did you spend **sitting** on a weekday? *>>**IF DON'T KNOW**: What is the total amount of time you spent sitting last Wednesday?*	____ Hours per weekday *[Range: 0-16]* ____ Minutes per weekday *[Range: 0- 960]* ❑ Don't know/Not sure ❑ Prefer not to answer ____ *Hours on Wednesday [Range: 0-16]* ____ *Minutes on Wednesday [Range: 0-960]*

SECTION 8: MINDFULNESS

35. Please tell us what is the closest to your situation, on a scale from 1 to 4, with:	1 Rarely/ Not at all	2 Sometimes	3 Often	4 Almost always
a. It is easy for me to concentrate on what I am doing.	❑	❑	❑	❑
b. I am preoccupied by the future.	❑	❑	❑	❑
c. I can tolerate emotional pain.	❑	❑	❑	❑
d. I can accept things I cannot change.	❑	❑	❑	❑
e. I can usually describe how I feel at the moment in considerable detail.	❑	❑	❑	❑
f. I am easily distracted.	❑	❑	❑	❑
g. I am preoccupied by the past.	❑	❑	❑	❑
h. It's easy for me to keep track of my thoughts and feelings.	❑	❑	❑	❑
i. I try to notice my thoughts without judging them.	❑	❑	❑	❑
j. I am able to accept the thoughts and feelings I have.	❑	❑	❑	❑
k. I am able to focus on the present moment.	❑	❑	❑	❑
l. I am able to pay close attention to one thing for a long period of time.	❑	❑	❑	❑

SECTION 9: LABOUR MARKET AND ECONOMY

36.	Have you changed job since the last interview?	❑ Yes, I changed job or started a new job ❑ No, I still have the same job as during the last interview **[>> skip to Q41]** ❑
37.	If you are employed, what sector do you work in now?	

❑ Agriculture, forestry and fishing	❑ Professional, scientific, and technical activities
❑ Mining and quarrying	❑ Administrative and support service activities
❑ Electricity, gas, steam and air conditioning supply	❑ Public administration and defence; compulsory social security
❑ Manufacturing	❑ Education
❑ Water supply; sewerage, waste management and remediation activities	❑ Human health and social work activities
❑ Construction	❑ Arts, entertainment and recreation
❑ Transportation and storage	❑ Other service activities
❑ Wholesale and retail trade; repair of motor vehicles and motorcycles	❑ Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
❑ Accommodation and food service activities	❑ Activities of extraterritorial organisations and bodies
❑ Information and communication	❑ Real estate activities
❑ Financial and insurance activities	

38.	Do you have a job that is considered in the **environmental economy (a green job)?**	❑ Yes (**1**) ❑ No (**0**) **[>>> skip to Q41]**
39	When did you begin working in the **environmental economy**?	|__||__||__||__| year
40.	If you do have a green job, which **sector** of the ones below is it in? **[More than one answer is possible]**	

- ❑ Protection of ambient air and climate, of which:
  - ❑ Protection of climate and ozone layer
- ❑ Wastewater management
- ❑ Waste management
- ❑ Protection and remediation of soil, groundwater and surface water
- ❑ Noise and vibration abatement
- ❑ Protection of biodiversity and landscapes
- ❑ Protection against radiation
- ❑ Environmental research and development
- ❑ Other environmental protection activities
- ❑ Management of water
- ❑ Management of forest resources, of which:
  - ❑ Management of forest areas
  - ❑ Minimisation of the intake of forest resources
- ❑ Management of wild flora and fauna
- ❑ Management of energy resources, of which:
  - ❑ Production of energy from renewable resources
  - ❑ Heat/energy savings and management
  - ❑ Minimisation of the use of fossil energy as raw materials
- ❑ Management of minerals
- ❑ Research and development activities for resource management
- ❑ Other resource management activities: _____
- ❑ Others, please briefly describe: _____

41.	How many members of your household make an income?	|__||__| person/s
42.	What is the net income per month of all members of your household together?	❑ Less than €851 ❑ €851 to €1150 ❑ €1151 to €1750 ❑ €1751 to €3050 ❑ €3051 to €3500 ❑ €3501 or more ❑ Don't know/prefer not to answer
43.	How well would you say you or your household is managing financially these days? Would you say you are…	❑ Living comfortably ❑ Doing alright ❑ Just about getting by ❑ Finding it quite difficult ❑ Finding it very difficult ❑ Prefer not to answer
44.	Compared to a year ago, how would you say you or your household is doing financially now?	❑ Better off ❑ Worse off ❑ About the same ❑ Prefer not to answer

45. At the moment, how difficult do you find it to afford these items?	**1** Very difficult	**2** Fairly difficult	**3** Slightly difficult	**4** Not difficult
Food	❑	❑	❑	❑
Clothing	❑	❑	❑	❑
Heating	❑	❑	❑	❑
Rent/mortgage	❑	❑	❑	❑

46.	Have you moved since the last interview?	❑ Yes ❑ ❑ Don't know/Not sure ❑ Prefer not to answer **[>>> skip to Q45]**
47.	Why did you move?	❑ ❑ ❑ ❑ ❑
48.	Which answer best describes you or your household's **living situation?**	❑ I (we) own the home where I (we) live and I (we) have a loan or mortgage **[>>> skip to Q50]** ❑ I (we) own the home where I (we) live and I (we) have no loan or mortgage **[>>> skip to Q50]** ❑ I (we) pay rent at market price ❑ I (we) pay rent at reduced price or free ❑ Other, please explain: _____
49.	If you **rent**, how much do you pay per month?	€|__|__|__|__|__| ❑ Don't know/Not sure ❑ Prefer not to answer
50.	Do you believe it is easy to find good housing at a reasonable price in your city?	❑ Very easy ❑ Easy ❑ Difficult ❑ Very difficult ❑ Don't know
51.	What is the size of your current home in m^2?	|__|__|__|__|__|__| m^2 ❑ Don't know/Not sure ❑ Prefer not to answer

SECTION 10

PERCEIVED QUALITY OF IMPLEMENTED NBS

In your city, the following NBS were introduced:

[Provide a list of proGIreg's NBS in the city]

A: _____
B: _____
C: _____
Etc.

52a.	Did you know that any of these NBS have been built or organised?	❑ Yes ❑ No **[>>> skip to Q53]**
52b.	Which one?	❑ A ❑ B ❑ C ❑ ...
53.	Is (any of) the NBS within a 10 to 15 minute walk from your home?	❑ Yes ❑ No ❑ Don't know

54.	Have you visited any of the NBS?	❑ Yes **[>>> go to Q56]** ❑ No
55.	What is the reason you did not visit any of the NBSs? (please select all options that apply)	❑ I am not interested in visiting them ❑ I did not know about them ❑ I live in another neighbourhood (too far away) ❑ I don't have time ❑ I am not able to visit (e.g. due to disability or other physical barriers) ❑ The place does not seem safe to me ❑ Never got a chance, but I am planning to go there ❑ Other _____ [>>>SKIP TO SECTION 11]
56.	Which NBS(s) have you visited?	❑ A ❑ B ❑ C ❑ ...
57.	Which NBS did you visit most often? (If you have visited only one, please just report that one)	❑ A ❑ B ❑ C ❑ ...
58.	In the past four weeks, approximately how many times have you visited any of these new NBS during your leisure time? This could be anything from a few minutes to all day. Please provide the total sum, thus include all visits to all different NBS (including repeated visits to the same NBS).	|__||__| times
59.	In the past four weeks how much time, on average, did these visits last? (if you have attended different NBSs, please report an overall average for all these NBSs)	|__||__|.|__| hours
60.	On these visits, what was the main activity you performed? Please select the **one** activity that you did for **most** of your time:	❑ Walking ❑ Running ❑ Cycling ❑ Gardening ❑ Informal games and sport(s) (e.g. frisbee, beach ball) ❑ Sunbathing ❑ Quiet activities (e.g. reading, relaxing) ❑ Socialising with friends, family, or neighbours ❑ Other activity, please specify: _____
61.	Do you think the neighbourhoods surrounding the NBSs have improved due to the presence of the NBSs?	❑ Yes ❑ No ❑ Don't know

62.	Have you used any of these NBS to socialise with your neighbours?	❑ Yes ❑ No
63.	Have you used any of these NBS to socialise with your friends (not neighbours) and relatives?	❑ Yes ❑ No
64.	To what extent do you think that these NBS have contributed to improving and increasing relations with your neighbours?	❑ A lot ❑ Quite a bit ❑ A little ❑ Not at all

65. **Below are some statements regarding the NBS you visited most often.** Please indicate how much each statement fits your experience of the given setting, on a scale from 0 to 6; 0 means you do not agree at all, and 6 means you completely agree.

	0	1	2	3	4	5	6
- a. It is an escape experience	❑	❑	❑	❑	❑	❑	❑
- b. Spending time here gives me a good break from my day-to-day routine	❑	❑	❑	❑	❑	❑	❑
- c. The setting has fascinating qualities	❑	❑	❑	❑	❑	❑	❑
- d. My attention is drawn to many interesting things	❑	❑	❑	❑	❑	❑	❑
- e. I would like to get to know this place better	❑	❑	❑	❑	❑	❑	❑
- f. There is much to explore and discover here	❑	❑	❑	❑	❑	❑	❑
- g. I would like to spend more time looking at the surroundings	❑	❑	❑	❑	❑	❑	❑
- h. There is too much going on	❑	❑	❑	❑	❑	❑	❑
- i. It is a confusing place	❑	❑	❑	❑	❑	❑	❑
- j. There is a great deal of distraction	❑	❑	❑	❑	❑	❑	❑
- k. It is chaotic here	❑	❑	❑	❑	❑	❑	❑
- l. I can do things I like here	❑	❑	❑	❑	❑	❑	❑
- m. I have a sense that I belong here	❑	❑	❑	❑	❑	❑	❑
- n. I have a sense of oneness with this setting	❑	❑	❑	❑	❑	❑	❑
- o. Being here suits my personality	❑	❑	❑	❑	❑	❑	❑
- p. I could find ways to enjoy myself in a place like this	❑	❑	❑	❑	❑	❑	❑

END OF THE QUESTIONNAIRE

SECTION 11

QUALITY OF THE INTERVIEW
63. How would you rate the questions in this interview? ❑ Easy ❑ Neither easy nor difficult ❑ Difficult ❑ I don't know

SECTION 12

TO BE FILLED OUT BY THE INTERVIEWER
64. Evaluation of the quality of the interview: ❑ Very good ❑ Good ❑ Moderate ❑ Poor ❑ Very poor

Annex 5: General Questionnaire - Contact Information Sheet

General questionnaire

CONTACT INFORMATION SHEET	
Date completion questionnaire	|__|__| / |__|__| / |__|__|__|__| *(day/month/year)*
Name of the interviewer	_____
Respondent number (ID)	☐☐☐☐☐☐☐☐
City	☐ *Zagreb* ☐ *Dortmund* ☐ *Turin* ☐ *Ningbo*
Name	_____
Surname	_____
Home address	_____
Postal / ZIP Code	_____
Date of birth	|__|__| / |__|__| / |__|__|__|__| (day/month/year)
Contact information	
Telephone	National code:_____ Number:_____
Email	_____@_____

Annex 6: NBS-visitor questionnaire

Date:	**|___| day |___| month |_____|year**
Start time:	**|___||___| hours |___||___| minutes**
NBS name:	_____
City:	_____
Interviewer name:	_____

SECTION 1
VISITS TO AND SATISFACTION WITH THE NATURE-BASED SOLUTION

You have been asked to participate in this study, because you are a visitor of <<name NBS>>. The first section is about your use of <<name NBS>> and about your opinion about the place.

1.	Have you collaborated in the NBS co-creation or implementation?	❑ Yes ❑ No
2.	If yes, how?	_____
3.	How long have you been here today?	|___||___| hours |___||___| minutes
4.	Is <<name NBS>> within a 10-15 minute walk from your home?	❑ Yes ❑ No
5.	In the past four weeks, approximately how many times have you visited <<name NBS>>? This could be anything from a few minutes to all day. Please provide the total sum, thus include all visits to <<name NBS>> during your leisure time or by passing through.	|__|__| times
6.	On average, how long did these visits last?	|__|__|.|__| hours
7.	On these visits, what was the main activity you performed? Please select the **one** activity that you did for **most** of your time:	❑ Walking ❑ Running ❑ Cycling ❑ Gardening ❑ Informal games and sport(s) (e.g. frisbee, beach ball) ❑ Sunbathing ❑ Quiet activities (e.g. reading, relaxing) ❑ Socialising with friends, family, or neighbours ❑ Other activity not in the list. Please specify: _____

8.	Since a year or two, this place (<<name NBS>>) has been improved as part of the ProGIreg project, for example, by planning activities, by planting more green, or by providing a garden. Do you visit this place more often now than before these improvements were made?	❑ Yes, I visit more often now than before (or I did not visit this place before) ❑ This is my first visit to this place ❑ No, I visit as often now as before ❑ No, I visit less often now than before ❑ I just started visiting this place, but because of other reasons than the improvements (e.g. moving, new dog) ❑ I don't know

9. **Below are some statements regarding <<name NBS>>.** Please indicate how much each statement fits your experience of the given setting, on a scale from 1 to 5; 1 means you do not agree at all, and 5 means you completely agree.

	1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree
a. There are opportunities for physical exercise	❑	❑	❑	❑	❑
b. There are opportunities for meeting people	❑	❑	❑	❑	❑
c. I have easy access to the place on foot or by bike	❑	❑	❑	❑	❑
d. There is a sufficient variety in terms of plants, water, view, etc.	❑	❑	❑	❑	❑
e. I like the sounds	❑	❑	❑	❑	❑
f. I like the colours	❑	❑	❑	❑	❑
g. I like the view	❑	❑	❑	❑	❑
h. I feel safe	❑	❑	❑	❑	❑
i. The area is free from litter/vandalism	❑	❑	❑	❑	❑
j. I felt part of nature	❑	❑	❑	❑	❑

SECTION 2
SOCIAL ACTIVITIES

In the following section, we ask you about any social activities you might have done <<name NBS>> and about the impact of <<name NBS>> on your neighbourhood

10.	Did you come here alone today?	❑ Yes ❑ No
11.	Did you have any interaction with someone you met at the NBS spot? (If you were already with someone, please, consider only other people whom you met in the NBS spot)	❑ Yes ❑ No
12.	How many?	|___|___|___| persons
13.	How much time did you spend with this/these person/s?	|___|___| hours |___|___| minutes

14.	What activities did you do together?	❑ Chatting ❑ Walking ❑ Doing sports ❑ Other, please specify: _____ _____
15.	When you visit <<name NBS>>, do you usually socialise with your neighbours?	❑ Never ❑ Sometimes ❑ Often ❑ Always
16.	When you visit <<name NBS>>, do you usually socialise with your friends (not neighbours) and relatives?	❑ Never ❑ Sometimes ❑ Often ❑ Always

17.	Do you think the neighbourhood(s) surrounding the NBSs have improved due to the presence of the NBSs, in terms of…	Not at all	A little bit	Quite a bit	A lot
	a. Social relations?	❑	❑	❑	❑
	b. Identification with the social entity?	❑	❑	❑	❑
	c. Orientation toward the common good?	❑	❑	❑	❑
	d. Shared values?	❑	❑	❑	❑
	e. Degree of equality between individuals and groups?	❑	❑	❑	❑
	f. Quality of life?	❑	❑	❑	❑
18.	To what extent do you think that this NBS have contributed to improving and increasing relations with your neighbours?	❑ A lot ❑ Quite a bit ❑ A little ❑ Not at all			
19.	When you visit the NBS, do you make eye contact with the people you encounter?	❑ A lot ❑ Quite a bit ❑ A little ❑ Not at all			

SECTION 3
PHYSICAL ACTIVITY

In this section, you will be asked about the physical activities you have done in <<name NBS>>.

20.	The first questions are about **vigorous activities** which make you breathe much harder than normal and may include running, heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for **at least 10 minutes at a time**.	
	a. During **the last 7 days**, on how many days did you do vigorous physical activities in <<name NBS>>? *If this is the only day that you visited, only consider today*	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you spend doing **vigorous** physical activities in <<name NBS>> on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer

	If this is the only day that you visited, please report the time you spend doing vigorous physical activities here today **c.** How much time in total did you spend over the last 7 days doing vigorous physical activities in <<name NBS>>?	____ Hours per week *[Range: 0-112]* ____ Minutes per week *[Range: 0-6720]* ❑ Don't know/Not sure ❑ Prefer not to answer
21.	Now think about activities which take **moderate physical effort** that you did in the last 7 days in <<name NBS>>. Moderate physical activities make you breath somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking. Again, think about only those physical activities that you did for **at least 10 minutes at a time**.	
	a. During **the last 7 days**, on how many days did you do **moderate** physical activities in <<name NBS>>?	____ Days per week *[Range: 0-7]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you spend doing **moderate** physical activities in <<name NBS>> on one of those days?	____ Hours per day *[Range: 0-16]* ____ Minutes per day *[Range: 0-960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	c.How much time in total did you spend over the last 7 days doing moderate physical activities in <<name NBS>>?"	____ Hours per week *[Range: 0-112]* ____ Minutes per week *[Range: 0-6720]* ❑ Don't know/Not sure ❑ Prefer not to answer
22.	Now think about the time you spent **walking** in <<name NBS>> in the last 7 days.	
	a. During **the last 7 days**, on how many days did you do **walk** for at least 10 minutes at a time in <<name NBS>>?	____ Hours per weekday *[Range: 0-16]* ____ Minutes per weekday *[Range: 0- 960]* ❑ Don't know/Not sure ❑ Prefer not to answer
	b. How much time did you usually spend **walking** in <<name NBS>> on one of those days?	____ *Hours on Wednesday [Range: 0-16]* ____ *Minutes on Wednesday [Range: 0-960]* ❑ *Don't know/Not sure* ❑ *Prefer not to answer*
	c. What is the total amount of time you spent walking in <<name NBS>> over the last 7 days?	____ Hours per week *[Range: 0-112]* ____ Minutes per week *[Range: 0-6720]* ❑ Don't know/Not sure ❑ Prefer not to answer

SECTION 4

SELF-PERCEIVED RESTORATION AND NBS

We will continue with some questions about your health and well-being after a visit to <<name NBS>>.

23. Please indicate how the following statements apply to what you experience during or after you visit <<name NBS>>.						
During or after visiting here:	**1** Not at all	**2** A Little	**3** Some-what	**4** Much	**5** Very much
1. I feel calmer.	❑	❑	❑	❑	❑
2. My concentration and alertness clearly increase.	❑	❑	❑	❑	❑
3. I get new enthusiasm and energy for my everyday routines.	❑	❑	❑	❑	❑
4. I feel restored and relaxed.	❑	❑	❑	❑	❑
5. I forget everyday worries.	❑	❑	❑	❑	❑
6. My thoughts are cleared and clarified.	❑	❑	❑	❑	❑
7. My self-confidence improves.	❑	❑	❑	❑	❑
8. I gain vitality.	❑	❑	❑	❑	❑
9. I get confidence for each new day.	❑	❑	❑	❑	❑
24. Did any of the following happen to you while you were at <<name NBS>>? **[More than one option possible]**	❑ I got an allergic reaction ❑ I got injured in an accident ❑ harassed, was attacked, or had an argument with a stranger ❑ I got sunburn or sunstroke/dehydration ❑ Other, namely, _____					

SECTION 5
ABOUT YOU

Now, we will ask some background information about you. The questions are not meant to be intrusive but will help us a lot in our study. Remember that all the information you provide is confidential and anonymous.

25.	*[Please assess: respondent is male or female]*	❑ *Male* ❑ *Female* ❑ *Third gender*
26.	How old are you?	_____ years old
27.	Please, indicate your years of education beginning with primary school (considering only the years successfully passed)	_____ years

28.	What is your current employment status?	❑ Employed ❑ Unemployed ❑ Student (without any studentship) ❑ Stay-at-home parent ❑ Rehabilitation/Disabled ❑ Retired ❑ Other, specify:_____
29.a	Were you born in this country?	❑ Yes ❑ No
29.b	What nationality do you have?	1) <nationality> 2) Other _____
30.	How many years have you been living in the current address?	__|__| years
31.	Which of the following best describes your smoking habit?	❑ I have never been a smoker ❑ Daily smoker ❑ Smoker, but not daily ❑ Non-smoker, but I used to smoke daily ❑ Non-smoker, but I used to smoke, although not daily
32.	In the last year, how often did you usually have any kind of drink containing alcohol? *By a drink, we mean, for example, a can or bottle of beer, a glass of wine, or a drink containing 1 shot of liquor.*	❑ Never ❑ On special occasions/a few times a month ❑ Once or twice a week ❑ 3-5 times a week ❑ (Almost) daily ❑

END OF THE QUESTIONNAIRE

SECTION 6

QUALITY OF THE INTERVIEW

33. How would you rate the questions in this interview?
❑ Easy
❑ Neither easy nor difficult
❑ Difficult
❑ I don't know

SECTION 7

TO BE FILLED OUT BY THE INTERVIEWER

34. Evaluation of the quality of the interview:
❑ Very good
❑ Good
❑ Moderate
❑ Poor
❑ Very poor

35. Have you been directly involved in the NBS implementation?
❑ Yes
❑ No

36. If yes, what role did you play? _____

SOPARC guidebook

1. Purpose and rationale

This study is part of the European **proGIreg** project that is funded by the European Union's Horizon 2020 research and innovation programme (www.progireg.eu). In this project, new nature-based solutions (NBS) are implemented in Dortmund, Turin, Zagreb and Ningbo. Nature-based solutions are natural and semi-natural areas within the city that may provide environmental, social, and economic benefits and help build resilience in the city. Examples of nature-based solutions are green and blue spaces such as parks, public gardens, and river corridors.

For some of the NBS implemented in the context of the ProGIreg project, the goal is to provide (or provide access to) a space that the population can use for visits to green and/or blue spaces (e.g. providing access to a river bank, renaturing a square, etc.) and for physical activities. To evaluate whether this is effective, it is important to measure whether the implementation of the NBS increases the use of these spaces and whether there is an increase in the physical activity performed in the space. Therefore, we need to estimate the use before the NBS is implemented and estimate the use after the NBS is implemented.

We will use the System of Observing Play and Recreation in Communities (SOPARC) to obtain information on the use of the NBS. SOPARC uses direct observation to estimate the number of visitors and provides an assessment of the visitors' physical activity levels, gender, activity modes/types, and estimated age and race/ethnicity. Additionally, it provides information on the quality of the NBS such as levels of accessibility, usability, supervision, and organization.

This guidebook has been developed to be used by observers of the NBS within the ProGIreg project. **Most of the information is retrieved from articles by the developers of the method[53,54,55] and the SOPARC Online App User Guide[56]. Some information may be directly taken from these sources or only slightly adjusted to fit our project. Please do not copy any of the information in this booklet for any, for example, scientific publications.**

[53] McKenzie et al. (2006) System for Observing Play and Recreation in Communities (SOPARC): Reliability and Feasibility Measures
[54] Evenson et al. (2016) Park characteristics, use, and physical activity: A review of studies using SOPARC (System for Observing Play and Recreation in Communities)
[55] Cohen et al. (2011) How much observation is enough? Refining the administration of SOPARC.
[56] https://www.rand.org/health-care/surveys_tools/soparc/user-guide.html

2. Summary of procedures

To give a short summary of the method, trained observers go to the NBS site to observe and count the number of users, and register the users' characteristics (sex, ethnicity, and age group) and type of activity that they are doing at the site (e.g. sedentary, walking, or very active). These observations are systematic and periodic; measurements are taken in specific periods of time (morning, lunchtime, afternoon, and evening) and specific days (within one week; two weekdays and two weekend-days).

This procedure is repeated twice; once before the NBS is implemented and once after the NBS is implemented.

3. Training and preparation (day 1)

3.1. Observation by scanning

Observations of the NBS area are done by performing a scan. How these scans are performed is explained in the training videos that are available on the Youtube channel of Thomas McKenzie:

https://www.youtube.com/channel/UCCLTwiGV7rfoPcMNOXigjbw

Please watch the three videos to familiarize with the method:

1. SOPLAY/SOPARC PART 1-INTRODUCTION (15:26)
2. SOPLAY/SOPARC PART 2-CODING PRACTICE (5:47)
3. SOPLAY/SOPARC PART 3-ASSESSMENT (4:54)

3.2 Target Areas

3.2.1. Introduction

Some NBS may be too large to be observed from one spot. In such a case, the NBS area can be divided into smaller, observable sections (hereafter named "Target Areas"). It is important to choose the Target Areas well to obtain reliable measurements.

A well-defined Target Area is one that can be scanned from left to right without encountering visual obstructions. They should be a size that makes it possible to count all individuals within the area accurately. The Target Areas should include all locations that can provide opportunities for visiting and/or being physically active, or that are expected to provide these opportunities after the NBS is implemented. In this chapter, we will explain how to choose the Target Areas.

3.2.2. Preparation

1. Collect a map of the NBS site:

   The proGIreg project will provide you with a description of the NBS and a map that outlines the area where the NBS will be implemented. As the NBS is not implemented yet in the before observations, you should also collect a satellite image of the area (in its current state) from Google Maps to get a current outline and general layout of the NBS area. When you print the image, all areas that will be affected by the NBS should be visible.

2. Get a feel for the layout of the NBS and how it is used.

3. Make an exploratory visit to the NBS. Walk around the site and note the visitors, how the space is used, and the general layout and major features. In addition, imagine how the area may be affected by the planned NBS.

4. Look around to see if there are obvious sections or dividers that can help to define Target Areas.

5. Note which parts of the NBS are the most and least used.

6. Make note of any unique NBS features that may need to be considered for data collection.

3.2.3. Defining Target Areas

In general, apply the following guidelines to choose the Target Areas.

1. A target area is a space in which activities may occur (i.e. you expect visitors there, before **and/or** after the NBS implementation). A target area should be large enough to accommodate activity, but small enough to accurately count everyone who may be using the area.

2. Areas of the park that are open to the public for use should be observed. Areas not intended for public use or that would be inappropriate for observation (e.g., storage space, staff offices, and restrooms) should not be included in SOPARC observations.

3. There is no established minimum or maximum number of Target Areas, nor is there a defined size limit for a Target Area. If one of the NBS in your city requires a large number of Target Areas, we might need to double the observers working simultaneously (i.e. four observers, working in pairs).

4. Observers need to be able to move efficiently (i.e. easily and quickly) from area to area during an observation rotation.

5. Observers should be able to observe the entire Target Area from one spot on the ground, and be able to scan from left to right without visual obstruction.

6. The area will be affected by the NBS; select Target Areas that are most likely to function both before and after the NBS implementation. The Target Areas need to be the same before and after the NBS implementation as much as possible.

7. If possible, each Target Area should be made up of one primary feature (e.g., Lawn, Sidewalk, Garden, Play area). This permits the aggregation of data for similar Target Areas within the same park or across parks. However, this may not always be possible, and some areas may have mixed characteristics (e.g., Lawn and Sidewalk).

8. Existing boundaries (e.g., chalk lines on fields, tree lines, fences) can help determine a Target Area.
    - Keep in mind that Target Areas need to remain the same throughout the observation week and need to stay the same as much as possible as after the NBS implementation; e.g. chalk lines may be temporary.

9. Activity types can also be used to help define Target Areas. For example, a tree-shaded section of a large green space could be divided into a separate Target Area since one might expect to observe people having picnics or being involved in some other sedentary activity, rather than running around or playing a sport as in the open space.

For lawns and other undefined green spaces, please keep the following in mind:

People can use green space for diverse purposes (from sleeping to running) and in varying numbers (i.e. ranging from a few visitors to large groups of people). Since these areas are of mixed use it can be difficult to obtain an accurate count if they are too large. It is generally best to divide them into smaller, more manageable Target Areas, even though they may be vacant frequently.

1. Use natural boundaries to delineate these Target Areas as much as possible.

2. In the absence of obvious boundaries (e.g., fence), use trees, bushes, light posts, tables, and other immovable objects to help create boundaries.
    - In addition to defining Target Area boundaries, these objects can help an observer to determine where he/she is on the map, but can also clutter the map unnecessarily. Consider carefully about what is included on the map.

3. If the area is hilly, it may be necessary to further divide it so that the space can be observed without (visual) obstruction.

4. Use shade to help define Target Areas.
    - If one section of a large green space often is shaded and another is not, try to keep them separate as the amount of shade available often affects usage.

For sidewalks, please keep the following in mind:

Sidewalks generally are used for traveling from point A to B. Keeping these areas separate from a typically sedentary area such as a lawn or picnic area will help to more accurately count how many individuals are involved in the primary activity and at what activity level. You may find sidewalks that encircle a play area, basketball court, or other area designed for a specific activity. These sidewalks can be their own Target Area or may be included with the

sport or activity specific area. Some things to consider in making this decision is whether a Target Area including the sidewalk would be too large to accurately observe, and whether the sidewalk might be an expected spectator area (remember that spectators only exist during organized activities, so this most often would not apply to play areas).

1. Decide if there is a route that often is used as a walking or jogging path. If so, consider doing a walking path scan for this Target Area.
    - If you choose to do a walking path observation using sidewalks as the walking path, do not include these sidewalks as additional Target Areas.
2. As sidewalks are normally well-defined, simply divide them into manageable sections so that they can be observed accurately.
3. When deciding how much of a sidewalk to include in a Target Area, keep in mind that people often will be moving in two different directions.

3.2.4. Ordering Target Areas

1. Order Target Areas such that the observer can move clockwise through the area efficiently.
2. It may be possible to observe multiple Target Areas from a single point – order them accordingly.
3. Begin observation rotations with the most prominent outdoor area (e.g. garden, picnic area, etc.)
4. Avoid having observers go into dangerous areas (if these areas are to be observed, do this from a safe distance).

3.2.5. Drawing the Map

These directions assume you have a map printed from a mapping website (e.g. as provided by proGIreg or from Google Maps).

1. Begin with the most prominent outdoor park feature.
2. Proceed from the first outdoor Target Area in a clockwise fashion and continue to add Target Areas until all of the area that will be affected by the NBS has been included in a Target Area.
3. Include areas where you do not suggest any activity (or visitors) to help the observer locate Target Areas.
4. Number all Target Areas in order.
5. Mark a walking path or trail as a single Target Area, not divided and included as a part of other Target Areas. Choose a single point from which the walking path will be observed during every observation. It should be unobstructed, shaded if possible, and in a spot from which you will likely see all individuals using the walking path.

3.3. SOPARC forms

Make sure you are familiar with the coding forms (please find them in the Annex). The text below further explains and defines different parts of the forms:

Target Area Conditions
Check "Yes" or "No" to describe specific conditions for each scan area:

Accessible = Code "YES" if area is accessible to the public (e.g., area is not locked or rented to a private party). Code "NO" when the area is not accessible to the public. Also code the area as NOT accessible if people have inappropriately entered the space (e.g., kids crawling through a hole in the fence when gate is locked).

Usable = Code "YES" if area is usable for physical activity (e.g., is not excessively wet or roped off for repair). For example, code "YES" when the space is usable, even though it may be locked. Code "NO" when there is insufficient lighting to use the space (e.g., no outdoor lights permitting play after sunset).

Equipped = Code "YES" if equipment (e.g., balls, jump ropes) provided by the park is present during the scan. Code "NO" if the only equipment available is permanent (e.g., basketball hoops and climbing apparatus) or owned by park users themselves (e.g., frisbee, ball, or bicycle brought by a family).

Supervised = Code "YES" if area is supervised by designated park or adjunct personnel (e.g., park rangers, playground supervisors, volunteers, sport officials, teachers). The supervisor must be in or adjacent to that specific area (e.g., available to direct park users and respond to emergencies), but does not have to be instructing, officiating, or organizing activities.

Activity Organized = Code "YES" if an organized physical activity is occurring in the scan area (e.g., a scheduled sporting event or exercise class is being led by park staff or adjunct personnel).

Dark = Code "YES" to indicate the area has insufficient lighting to permit active play. Observers should not enter a Target Area unless there is sufficient lighting.

Empty = Code "YES" when there are no individuals present during the scan. Also, code "YES" when the area is dark.

Comments
Enter relevant additional information about the condition, people, or activities within the Target Area.

Activity
Write in the most prominent physical activity that females and males are doing in the area. During scans of the Target Area, all people should be accounted for as either participating in the primary activity or as a spectator.

Age group
Determine age according to the following criteria:

Child = pre-pubescent children. As a general rule, code children from infancy to 12 years of age as children.

Teen = As a general rule, code youths from 13 to 20 years of age as teens.

Adults = As a general rule, code people from 21 to 59 years of age as adults.

Senior = As a general rule, code people 60 years of age and older as seniors.

Ethnicity

Code whether the primary race/ethnicity for each individual is Caucasian (C), Latino (L), Black (B), Asian (A), or Other (O).

However, the recording of the ethnicity of the visitors is not a requirement and should be considered while taking into account the local circumstances and ethical issues. Also, the ethnicity categories can be adapted to be nationally/culturally appropriate.

Activity level

Sedentary (S) = Individual is lying down, sitting, or standing in place.

Walking (W) = Individual is walking at a casual pace

Vigorous activity (V) = Individual is engaged in an activity more vigorous than an ordinary walk (e.g., increasing rate causing them to sweat, such as jogging, biking, etc.).

Activity (specify)

Please specify the activity the individual is doing using the following codes:

Codes	Physical activity mode
GD	Gardening
BC	Bicycling
JG	Jogging
RU	Running
FN	Fitness related activities, including aerobics, fitness, strengthening exercises (e.g. pull ups, sit-ups)
SP	Sport related activities, including football, soccer, handball, basketball, baseball/softball, volleyball, archery, dance, gymnastics, material arts, skating/skateboarding, swimming, and tennis/racquetball.

GA	Game related codes, including catch, climbing, frisbee, jumping (rope, hop scotch), manipulatives/racquet activities, playground activities, and tag/chasing games.

If the activity does not fit any of the categories in the table, please write down a keyword to describe the activity, and after the observation period, describe the activity in full in the comments/notes section.

4. Data collection (observations)

Observations are performed on Tuesday, Thursday, Saturday, and Sunday. On each day, there are four observation periods; morning, lunchtime/midday, afternoon, and evening. The timing ofeach observation period depends on the time that is most representative of that period considering cultural considerations.

4.1. Preparations

Before you go to the NBS site, be sure to bring sufficient paper forms for the full scan and a working writing utensil. Before printing the forms, keep in mind that you may need to adjust the paper form to accommodate a larger number of Target Areas. Also, be sure to print out a copy of the park Target Area map.

Arrive at the NBS site at least 20 minutes prior to the official start of observation. Review the sequence for observing Target Areas. As we ask two observers to do the same observations, visit each Target Area in order together and review if you both know on which spot to stand and how to scan. Mentally rehearse by scanning each area a few times.

4.2. Scans

Now perform the scans, as explained in the training video, to collect the data. Scan each Target Area in the selected order and fill in the forms.

4.3. Last steps

After you have scanned all Target Areas, make sure you have filled in all forms correctly. Write down comments where necessary. The forms of all target areas of one NBS should be carefully placed in a folder and safely stored. Moreover, the collected data must be transferred from the paper forms to electronic format to upload the data to the project's platform. The data manager of the project will provide a program to transcribe the results.

Please also store detailed information on the Target Areas together with the maps to enable the repetition of the observations after the NBS implementation.

Annex 8: SOPARC observation and summary forms

SOPARC observation form

Date: __/__/20__ **NBS:** _____ **Observer:** _____

Period: _____ **Target area:** A (…) B (…) C (…) **Start time:** __ : __

Temperature and weather: _____ **End time:** __ : __

N	Gender		Age group				Ethnicity	Activity level			Activity (specify)	Notes
1	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
2	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
3	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
4	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
5	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
6	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
7	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
8	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
9	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
10	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
11	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
12	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
13	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
14	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
15	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
16	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
17	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
18	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
19	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
20	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		
21	F	M	Child	Teen	Adult	Senior	C LA B A O	S	W	V		

N	Gender		Age group				Ethnicity					Activity level			Activity (specify)	Notes
22	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
23	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
24	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
25	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
26	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
27	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
28	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
29	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
30	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
31	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
32	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
33	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
34	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
35	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
36	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
37	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
38	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
39	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		
…	F	M	Child	Teen	Adult	Senior	C	LA	B	A	O	S	W	V		

NOTES:

Note: Please indicate any events or observations of interest (e.g., unlawful behavior), or any other information that may affect your count, or observed behaviors such as significant events or background information.

SOPARC summary form

Date: __/__/20__	**NBS:** _____	**Observer:** _____
Period: _____	**Target area:** _____	**Start time:** __ : __

CONDITIONS OF TARGET AREA

Accessible	*(e.g., not locked or rented to others)*	☐ yes ☐ no	**Comments:**
Usable	*(e.g., is not excessively wet or windy)*	☐ yes ☐ no	
Equipped	*(e.g. removable balls available)*	☐ yes ☐ no	
Supervised	*(e.g., not locked or rented to others)*	☐ yes ☐ no	
Organized	*(e.g., team sporting event)*	☐ yes ☐ no	
Dark	*(e.g., insufficiently lit)*	☐ yes ☐ no	
Empty	*(e.g., scan area is empty)*	☐ yes ☐ no	

PEOPLE	**ACTIVITY**	**AGE GROUP**				**ETHNICITY**					**ACTIVITY**		
		Child	Teen	Adults	Senior	C	LA	B	A	O	S	W	L
Participants	**Primary activity**												
Female													
Male													
Participants	**Secondary activity**												
Female													
Male													
Spectators	**Organized activity**												
Female													
Male													

Annex 9: Guidebook for field data collection

NBS MONITORING TOOL D – CARBON IMPACT

The iTree ECO model (https://www.itreetools.org/eco/) will be used to estimate CO_2 sequestration by newly planted trees in proGIreg NBS. To be run, i-Tree ECO model requires a number of field data to be collected, concerning the NBS site. Such data accounts for the variables listed below. A short explanation and the indication of the measurement tool are also present, when required. **i-Tree ECO model variables are listed below.**

Tree species;

Total tree height - the height from the ground to the top of the tree - hypsometer or clysimeter or metric tape;

Tree diameter at breast height (DBH) – tree diameter at approximately 1.3 m above the ground - caliper or metric tape;

Crown base height - height from the ground to the base of the live crown; the live crown base is the point on the main trunk perpendicular to the lowest live foliage on the last branch that is included in the live crown - hypsometer or clysimeter or metric tape;

Crown width - the width of the crown in two directions: north-south and east-west - metric tape;

Percent of crown missing - percent of the crown volume that is not occupied by branches and leaves – human eye: 1) visualize the expected “typical crown outline” as a silhouette created by the live crown width, total height, and height to base of live crown measurements; 2) imagine this silhouette as a symmetrical crown formed around the centre point of the measured width of the tree and filled with leaves as if it were a healthy tree in excellent condition; 3) estimate the percent foliage that is absent due to pruning, dieback, defoliation, uneven crown, or dwarf or sparse leaves (do not include normal interior crown voids due to leaf shading) 4) record percent canopy missing as 0%-100% (100% for dead trees);

Crown health – health status of the tree – human eye: visual assessment of the number of dead branches (i.e., dieback) in a tree’s crown and can be estimated as dieback; to record dieback, users will enter the percent of the crown that is composed of dead branches;

Crown light exposure - number of sides of the tree’s crown receiving light from above or the side (from 0 to 5; 0 means fully shaded, 5 is for open growth tree).

Field data should be collected by compiling the following template and then uploaded on the proGIreg platform, to be processed. The above-mentioned data should be collected for all the trees in the site.

DATA	LOCATION	Species	Height (m)	DBH (cm)	Crown base height (m)	Crown width (m)	Crown missing (%)	Crown health	Crown light exposure
dd.mm.yyyy HH:MM	Lat & Lon								

Passive diffusion tubes for NO_2 and O_3 monitoring (here after probes) will be purchased and installed in three different years (Pre-Post-Post design), in the same month (possibly June). The years will be chosen according with the implementation timing of the selected NBS. The same type of tubes will be used in all the NBS to be monitored.

Which probes?

The diffusion tubes selected for NO_2 will be acrylic tubes equipped with a thermoplastic rubber cup, with inside the adsorbent material (20% Triethanolamine/De-ionised Water). The diffusion tubes selected for O_3 will be fluorinated ethylene polymer tubes, equipped with a thermoplastic rubber cup, with inside the adsorbent material. Analysis of the sensors after use is in charge of the seller and is included in the price.
CNR will buy the first set of sensors, for all the FRC (pre-implementation campaign) and will provide instructions to the cities for the following purchases.

Before the installation

The probes have a limited shelf life (typically 12 weeks), thus they have to be bought yearly, according to the needing, and must be exposed and returned for analysis within this period. Before the installation, both types of tubes must be kept in dark, at 5-10 °C.

Installation

One set of passive diffusion tubes (3 for NO_2 e 3 for O_3) will be located inside the implemented NBS and another one in a control point outside the NBS.
The exact locations will be defined by CNR together with the responsible person identified by the stakeholders involved in the NBS implementation and maintenance, during the first installation (pre-implementation).
In any case, the diffusion tubes will be placed vertically at a height of 2 m above the ground and exposed unsheltered. The end of the tube must be positioned in an area with a free circulation of air. Tubes should not be mounted directly onto a surface: ideally a spacer of at least 5 cm should be used between the surface and the tube) and neither on the corner of a building (to avoid high turbulence) nor exposed in intense direct sunlight.
After installation, the screw top container must be removed and kept in a safe place (after the installation it must be used back to close the tube).
The tube must be clearly labelled with a provided barcode (provided together with the tubes)
The exposure length in the field will be of a period of 3 weeks (21 days).

After the installation

After the exposure period, the probes must be removed, screwed up, stored in a sealed container (as a plastic bag), and returned to the seller that will analyse it and should provide the results within 2 weeks after receiving the probes.
Together with the tubes, an exposure sheet (provided together with the tube), where the exact exposure time is reported, must be filled.

NBS MONITORING TOOL F – AIR TEMPERATURE

Temperature/relative humidity sensors will be purchased and installed in the LL, to continuously monitor the effect of the NBS from before the implementation up to two years after.

Which probes?

The temperature/relative humidity sensors will be battery operated and equipped with an embedded datalogger. Data download to a tablet or a laptop will be done by the USB port. The sensor will measure air temperature with a resolution and precision of 0.5 °C, while relative humidity with a resolution of 0.5 % and a precision of 3.5%. It will be used a 10-minute time interval for data recording. The logging rate and star-time can be defined by plugging the module into a Windows PC and used the purpose designed software under Windows environment.

CNR will assists the FRC in buying the most suitable sensors.

Before the installation

Sensors can be stored at ambient temperature, without particular precautions.

Installation

Per each NBS to be monitored, a set of six temperature/relative humidity sensors that continuously measure the before mentioned variables will used: three sensors will be placed inside the implemented NBS and three more in control point outside the NBS.
The exact location will be defined by CNR together with the responsible person identified by the stakeholder involved in the NBS implementation and maintenance, during the installation of the first set of air quality sensors (see above). In any case, the sensors must be installed avoiding direct sunlight (shaded or better sheltered).
Data downloading will occur monthly, by using a PC Windows equipped with a USB A female port and the purpose designed software under Windows environment. The data will be afterword uploaded to the project platform for analysis and storage.
Battery status check will be performed monthly. The data logger is supplied complete with a long-life lithium battery, which can typically allow logging for a year. Status indication via flashing red and green LEDs. Once the battery is empty the data logger will not lose prior recorded data, but it will not record new data until the battery is changed.

After the installation

After the completion of the monitoring activity within proGIreg, the temperature/relative humidity sensors can be used for other projects/activities.

NBS MONITORING TOOL G – PARTICULATE BIOMONITORING

Particulate matter biomonitoring will be performed by collecting leaves from trees or shrubs in the NBS at two times: just after the implementation and two years later. Leaves should be collected always in the same period (i.e., late July) and after a rainless period of 10-15 days.

The youngest leaves of the crown should be collected, i.e. those at the apex of the branches.

The involved stakeholders will collect leaves. CNR will provide assistance with respect to plant species choice and side of the crown on which leaves should be collected.

Leaves from trees (NBS1 and NBS2) should be collected at 3 m height, if possible. If this will not be possible, they will be collected at 2 m height, taking care to avoid possible contamination due to the surroundings.

Leaves from shrubs (NBS3 and NBS5) should be collected far from possible contamination sources. Also, to improve cross-city analysis, the same shrub species should be collected in this case, if it will be possible to have at least one common species in the different implementations.

Leaves should be collected wearing single use gloves, and touching the leaves only on their edges, in order to avoid possible contamination. Five leaves should be collected per each replicate, and temporary stored in clean plastic bags (one bag per replicate), in fridge.

Not later than the day after, always wearing single use gloves and touching them only on their edges, leaves should be placed in a paper envelop (one paper per each replicate), between two sheets of clean paper, and sent to CNR for analysis, possibly in a single box per each city.