URBAN GreenUP

D1.3: City and area diagnosis procedure

WP , T1.3

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[1] PU = Public

PP = Restricted to other programme participants (including the Commission Services)

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0 Abstract

The aim of this report is to provide cities with a useful guide to the diagnosis process for re-naturing of cities and/or its areas. It explains with more detail the diagnosis procedure, an initial and important part of the URBAN GreenUP re-naturing urban planning concept and process (RUP). It supports the direct implementation of one or a set of NBS in a specific area of the city to address also specific challenges in a more effective way.

The document explains the importance of the diagnosis procedure like the procedures directly linked to. It indicates the objectives and outlines the supporting tools to cross the process. The diagnosis process is the important starting point that enable cities to meet the main objective, which is Re-Naturing urban areas with NBS.

The URBAN GreenUP Methodology procedures described, as a base guide to analyse this process, includes:

- The definition of the procedure that allows a detailed city diagnosis, of the city/area since the climate change challenge, including KPIs allowing evaluation of the current situation of the city/area. The analysis takes into account the categorization of the KPIs developed in the Project.
- The definition of the procedure to identify the baseline of city/area, where takes into account the KPIs developed. The procedure allows not only to get a baseline, but also, to take into account the diagnosis for the current situation, which allow detect the NBS that could be able to solve or mitigate the problems identified, and generate RUPs. This procedure also allows the comparison of the baseline with different RUP scenarios or the introduction of a specific NBS letting know the impact of each of them.

1 Definition of concepts

Re-naturing City Methodology – methodology for supporting the Re-naturing of the cities and/or areas, that will include new concepts as Re-naturing Urban Plans RUPs that will let embrace the climate change challenges.

NBS – Nature-Based Solutions - can provide a multitude of benefits that influence human health, lifestyle and well-being, can improve air quality, reduce local temperatures on a small scale, act as carbon stores, help on mitigation of climate change, reduce flooding disasters overcoming the adaptation to climate change and be an important habitat for wildlife.

RUP – Re-naturing Urban Plans – which incorporates the urban planning aspects directly related with nature-based solutions as major strategy to fight against climate change. It will be part of the Sustainable Urban Planning and totally integrated with the urban strategy for dealing with the main city challenges.

Methodology Component – All the components needed for methodology developments, those could be activities, but also, catalogues, guides, decisions, etc.

Methodology Processes – methodology activities that analyse/ define/ evaluate the methodology concept, and create corresponding outputs, in many cases, basing also on inputs from different activities.

Methodology Procedure – methodology output related to the systemized step-by-step activity for Re-naturing Methodology Implementation.

Input – Information coming from other Project processes, or external, not developed in the Project but needed for methodology definition.

Output – Information created in a Project process, could be an input to other Project process.

Work Flow – relation among different Project processes and components. It also indicates the correct direction to implement the methodology.

Diagnosis – as a process refers to identification of the main characteristics of the city and to determine its particular capacity for adoption of the NBS solution or/and scenario. It follows the specific city targets defined in advanced.

Scaling up – The term “scaling up” in its pure definition it is to make something larger in size, amount etc. In this document the term “scaling up” referring, the set of processes, methodology based, providing a larger scale of implementation of NBS strategies. The viability of the scaling up, will be identified according to how, “Credible, Relevant, Relative advantage over existing practices have, Easy to adopt, Compatible and Able to be tested” the methodology is.

2 Background

To support re-naturing journey of the cities, URBAN GreenUP developed a systematic strategy to reach high level of impacts through the use of NBS. It aims to provide an integrated methodology to support the Urban Planning of NBS at the local city level, as a powerful strategy to contribute to increase sustainability, addressing a range of societal challenges.

URBAN GreenUP introduces the concept of Renaturing Urban Planning, which incorporates NBS alongside the traditional urban planning aspects to generate a more sustainable approach to Urban Planning. In parallel to traditional planning processes, the methodology supports cities in the direct implementation of one or more NBS in a specific area or across the city to address specific societal challenges in a more effective and ecologically sustainable way.

The social aspects are considered one of the main key elements, and the economic issues complementing the environmental one, fostering the creation of good business cases to solve the general lack of budget of the public administration. To achieve good outcomes, a co-creation approach is adopted in the definition of the methodology, from the definition and design of the technical solutions to the final assessment. This ensures that NBS are adapted to the local context, that they address local priorities and needs of stakeholders, and work within the opportunities and constraints of the local context.

The method produces a RUP, which should be fully integrated in the city's urban planning and land use planning processes. The method also enables cities to specify a set of NBS to mitigate one or several societal challenges, ready to the tendering process.

This holistic approach to the methodology builds in part on the experience of the cities involved in URBAN GreenUP. This includes both successes and problems encountered in the 'real world', and lessons learned through the process of implementing NBS in the 'leading' cities of Liverpool (UK), Izmir (Turkey), Valladolid (Spain), and simultaneously validated in 'follower' cities of Mantova (Italy), Ludwigsburg (Germany), Medellin (Colombia), Changdu (China), and Quy Nhon (Vietnam).

3 Renaturing Urban Planning Goal

3.1 Sustainability pillars on behind of diagnosis process

The overarching aim of implementing NBS in urban areas is to achieve sustainability across the three pillars (i.e. the planet, people, and profit). Key considerations in each of these pillars deals with the environmental, the social, and the financial or economic aspects of sustainability. Enhancing sustainable urbanisation through the use of NBS can address environmental challenges as well as stimulate economic growth, making cities more attractive, and enhancing human well-being. Restoring degraded ecosystems using NBS can improve the resilience of ecosystems, enabling them to deliver vital ecosystem services and also to meet other societal challenges. Using NBS as a means of climate change adaptation and to mitigate carbon emissions can provide more resilient responses than conventional approaches and enhance the storage of carbon et al. Improving risk management and resilience using NBS can lead to greater benefits than conventional engineered methods and offer synergies in reducing multiple risks.

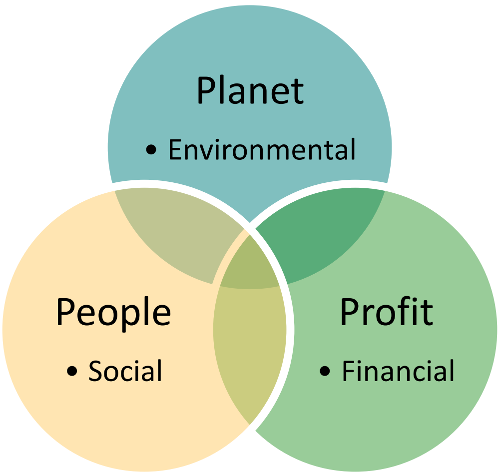


Figure 3.1: Considerations guiding NBS performance and impact evaluation (John Elkington, 2004)

The diagnosis process should be linked and focus to those principles, and it should have into account all the factors that evaluating them. As a final result of the diagnosis process, we should get the NBS Catalogue offer adapted to the local city conditions. The URBAN GreenUP NBS catalogue, as a base, it includes all possible characteristics of each NBS identified (technical, economic, environmental, and social). The features considered into the catalogue indicating also the potential scale of value for each societal challenges selected in the previous step.

3.2 Re-naturing methodology steps and actions linked

The diagnosis actions is one of the main and initial steps of a holistic re-naturing methodology considered in URBAN GreenUP Project. It aims to provide an integrated methodology to support the Urban Planning of NBS at the local city level, as a powerful strategy to contribute to increase sustainability, addressing a range of societal challenges. The methodology actions according the city targets definition, and what comes city NBS adopted scenario, it is strongly dependant the city real needs and capacity.

The objective of the diagnosis methodology step is to deliver the results of the detailed exploration, analysis and diagnosis of the city/area in respect to the societal challenges selected for a city. The deep analysis on barriers, boundaries and opportunities for corresponding NBS indicated completing the study. The information allowing the selection of the city societal challenge scenarios with selected NBS. The systemic method proposed and the tools developed supporting the process.

Table 3.1: Graph to the main components of the diagnosis process (Source: D1.13 URBAN GreenUP).

How to start?	1st. Understand your present	2nd. Choose your future aspirations	3rd. Integrate RUP and keep	"Renaturing Urban Plan"
A. Engage and Co-create	Action 1A. Identify and involve stakeholders	Action 2A. Prepare for co-delivery		**Chapter I.** Introduction to Re-naturing
B. Explore	Action 1B. Understand your "city" needs	Action 2B. Choose your "city" targets	Action 3B. Prepare RUP Plan integration into the Urban Plans of Local Municipality	**Chapter II.** City Targets
C. Diagnose	Action1C. Understand your "city" capacity	Action 2C. Evaluate NBS Scenarios and select one	Action 3C. Define list of NBS Projects and Actions	**Chapter III.** City NBS Adopted Scenarios
D. Visualize	Action 1D. Map challenges	Action 2D. Set spatial priorities for NBS	Action 3D. Prepare assessment of the Impact and Risk	**Chapter IV.** City Impact
E. Plan	Action 1E. Establish Baselines	Action 2E. Choose how success will be monitored	Action 3E. Prepare the Up-scale Plan	**Chapter V.** Monitoring Program and Action Plan
F. Inform	Action 1F. Promote the initiative	Action 2F. Publish the RUP	Action 3F. Define budget, roles and responsibilities	**Chapter VI.** Roles and Responsibilities
A. Engage and Co-create	Action 3A. Assess lessons learnt and validate the strategy			**Chapter VII.** Processes and reforms

The diagnosis process include the actions as described below:

- **Action 1B. Understand your "city" needs.** Understand the "value" of the re-naturing for your particular city. Identify the main "city" tendency and the main goal.
- **Action 2B. Choose your "city" targets.** Identify the "city" targets and translate them into the URBAN GreenUP language of challenges and sub-challenges.
- **Action1C. Understand your "city" capacity.** The main goal of this action is to detail the city profile and to prepare it for deep analysis in respect to the NBS implementation.

The actions evaluating the NBS scenarios will support and conclude to city scenario selected with the diagnosis process:

- **Action 2C. Evaluate NBS Scenarios and select one.** The main goal of this action is to prepare the supporting tool where to provide the user with a list of the best NBS for the needs, targets and capacities of the city (diagnosis/challenges/barriers/enablers). Using this list the user will refine the NBS list if needed.
- **Action 1D. Map challenges.** The main goal of this action is to define the green infrastructure picture, identifying the key areas of focus for each challenge and NBS.

Once concluded the city NBS scenario, the process continue preparing the implementation process, and preparing for the evaluation of the of the city impacts:

- **Action 1E. Establish Baselines.** The main objective of this task is to establish the baseline condition in the locations where the interventions will be implemented, e.g. within a region, city, or neighborhoods.
- **Action 2E. Choose how success will be monitored.** The main goal of this action is to help cities to choose and prioritize KPIs. In addition, with this action, a framework will be drawn on monitoring the results of NBSs to be implemented, taking into account the challenges and needs of the cities.

The main actions are described in deep into the next document section, in continuation, the action related the main diagnosis process are drafted.

3.2.1 NBS scenario evaluation

"NBS **scenario" is defined** as a set of NBS selected to respond to the city challenges under a determined city context including physical, environmental and socioeconomic characteristics and taking into account existing barriers and boundaries. This scenario could be generated for a specific street, neighbourhood, area or city.

City/area diagnosis is the previous step in order to define the context and boundary conditions. Thus, diagnosis will feed the inputs for the generation of the NBS Scenarios.

NBS Scenarios Generation Tool, **ToolUGU**, has been developed to offer a solution using NBS to specific city challenges following the user's requirements. The tool will generate one NBS scenario integrating the knowledge developed in URBAN GreenUP about NBS and challenges (*Source: Deliverable 1.1 and 1.2*), existing barriers, boundaries and enablers (deliverable 1.5) and collecting user requirements and actuation characteristics following the framework defined in the city diagnosis and baseline definition process *(Source: Deliverables 1.3 and 1.4).* **¡Error! No s e encuentra el origen de la referencia.** shows the ToolUGU workflow.

ToolUGU integrates the knowledge developed in URBAN GreenUP to **support the user in the selection of proper NBS** to face up specific city challenges. It will provide a report with the information about the NBS scenario and links to get information about how to implement and assess it. A complete description of ToolUGU can be found in deliverable 1.7.

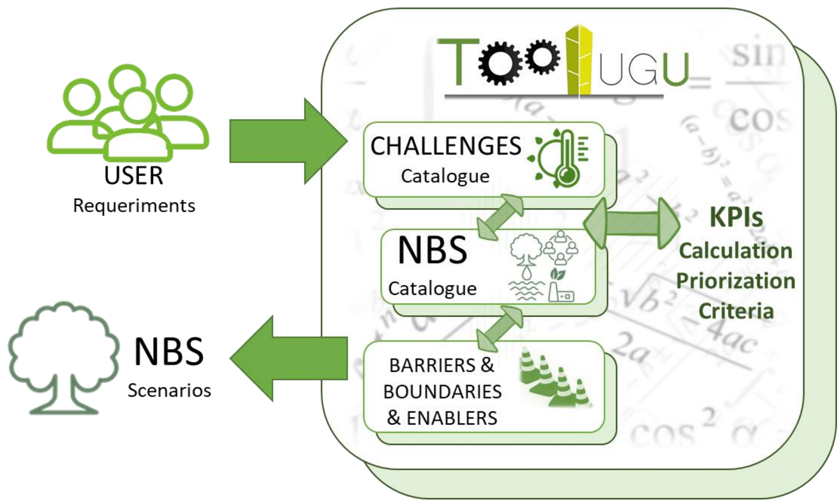


Figure 3.2: ToolUGU workflow proposed (Source D1.7 URBAN GreenUP).

3.2.2 Mapping supporting

There is an ever-increasing range of mapped data available. There is also a growing array of data than can be mapped. This data can help to inform the City and area diagnoses and, using maps and other infographics, be used to visualize information to help with the understanding of the data. However, in order to avoid being overwhelmed with data and maps, it is important to have a clear strategy to select the right data to support the decision making process for NBS interventions. This data strategy will be informed by Action 1B in the City Diagnosis process.

Mapping tools are effective ways to analyse data and develop scenarios for implementation of NBS. Bringing data from different sources and analysing the data spatially.

Within the URBAN GreenUP project we have produced a document that looks at zoning of areas for Nature Based Solutions This document has a focus on the use of mapping for zoning that is transferrable to the work to develop baseline assessments. *(Sources: Deliverable 1.5).*

The Zoning document identifies a range of commercial and open source products that can support mapping and identifies the types of data that can be sourced to support mapping for NBS.

With the increased range of data available, it is important to focus mapping on gaining the data that is robust, data that is verified and accepted as having been collected using best practice and sound science.

Good data management practices include developing effective processes for:

- consistently collecting and recording data (data should be adequate to the purpose, complete, precise, up to date and clearly referenced);
- effectively presenting data and making data accessible for verification;
- checking data consistency with experts;
- storing data securely, clearly and in a traceable way, making data accessible for further analysis or audit.

There are three main options of collecting data:

1. Traditional data collection methods to collect public and municipalities' owned data already available	2. Capture of data from high resolution satellite imagery analisys	3. Capture of data from aerial inspection via drones

1. Traditional data collection methods to collect public and municipalities' data that is already available and possible already widely used by the municipalities. The data may be available on the city platforms with open sources and services, following the possible key word to city/municipality data, georeferenced data, cartography data, GIS viewers, ortho- photos, historical maps, and dynamic maps. This method is cost effective and provides access to data that is already likely to be accepted as accurate by the municipality.
2. Innovative ways to collect data to fill data gaps and data collection difficulties include data from high-resolution satellite imagery analyses. They can be used to collect and produce urban data at a city and neighbourhood scale. Indeed, using remote sensing, it is possible to characterise the urban environment at different scales, sampling electromagnetic radiation (EMR), acquiring and interpreting non-immediate geospatial data from which to extract information about urban spaces. Remote sensing systems

that acquires images with small spatial extents will generally have a higher resolution and thereby capture more details, than images acquired with larger extents and therefore lower resolution. The data may be available at European access points to the data provided by EU Member States according to the European directives or as a result of research projects and observation programs such as Copernicus, accessing the global earth observation system platforms and data bases, open street maps, local or euro statistics or networks.

In a similar way to high-resolution satellite imagery analysis, aerial inspections by drones can be used to capture and produce urban data in an innovative way, allowing new insights and filling gaps in available data. Drone inspections allow investigation and acquisition of information at small urban scale, for which the high-resolution imagery analyses are not adequate due to the presence of shadows that can hide certain elements of the images. The use of drone inspections allows to achieve higher resolution than using satellite imagery, this could be useful and needed in some cases. Depending on the drone equipment (type of camera, thermal sensors, CO_2 sensors and other) it is possible to capture different parameters. Most of the constraints to the application of aerial inspection by drones for the data collection is represented by the limits related to citizen's privacy and the presence of secure-sensitive areas (restricted flight zones).

In addition, Data may be available from local open sources data bases and services, or as a result of research projects and observation programs. A private service is available to specify or/and focus the data obtained from the global earth observation systems. The data may be gathered for sectors like audiovisual, industry, R&D, agriculture, other, consultancy and assessment.

All of these data sets are mappable. There will be a balance between mapping to provide clarity in decision making, enabling new approaches and insights and mapping everything possible, which light lead to confused mapping, providing very little support for NBS intervention and potentially undermining the arguments for NBS.

At its best mapping for NBS is an effective communication tool. In creating maps and collecting data that audience with whom we are trying to engage to develop NBS interventions should always be our main concern.

3.2.3 Baseline establishment

The foundation of any successful NBS project is to understand the baseline conditions that the project seeks to change, and evaluate the capacity of the city and partners to undertake the project. The baseline calculation procedure outlines a framework that assists and supplements the process of NBS implementation that helps municipal governments to:

1. Diagnose socio-ecological issues their city experiences,
2. Select the most suitable NBS intervention(s) to address them, and

3. Set key performance indicators (KPIs) that serve to monitor the performance and effectiveness of the intervention(s).

Baseline establishment is central to the planning stage of any NBS project, as it informs on-going design, implementation and maintenance of NBS interventions, as well as help structure and guide future investment in NBS.

The baseline calculation procedure uses 'Process Chain' to provide signposts for stakeholders and to structure decision-making. This mechanism outlines the conceptual chain-links that guide NBS the integration of policy, legal requirements, thematic design principles and local needs assessment leading to more effective implementation. The process also provides guidance on when and how KPI metrics and targets should be set, although these will be reflective of local contextual analysis, i.e. of local socio-economic, ecological and political factors.

The process outlined focuses on the first four components of the chain-links: policy structures, governance structures, local environmental context and thematic development objectives. The aim here is to provide a scalar analysis of what municipal governments and other urban actors must take into consideration when deciding on how to approach their NBS vision(s). Understanding and appreciating context, place-based priorities, and the overlapping levels of governance and policies influencing development and implementation of NBS is essential if plans are to meet the requirements or aspirations of local government or communities. The process outlined in this document has been designed in such a way that it can be adapted to a wide variety of urban contexts. Rather than prescribing a set of objectives and procedures to meet them, it provides a flexible procedure that allows cities to understand how local conditions can be leveraged and adapted to effectively re-nature urban areas and address key societal challenges. The 'Process Chain' outlined in this document provide the foundation on which NBS plans can be constructed and success monitored.

3.2.4 KPIs indicators list

KPIs evaluation method is described, and process assigned under Action 2C, according technical KPI definition *(Sources Deliverable 5.1)* and monitoring procedures associate *(Sources Deliverable 5.3).* The process followed a methodology for the monitoring of different NBS and a global perspective, shall be approached by outlining the main challenges and focused on goals that have been drawn directly from the EKLIPSE Mechanism; a self-sustained mechanism under the umbrella of the European Union's Horizon 2020.

The KPIs are based on the EKLIPSE mechanism framework, where a robust set of KPIs shall be selected and established by challenges that relate to NBS. These challenges are:

- Climate mitigation & adaptation
- Water Management
- Coastal Resilience

- Green Space Management
- Air Quality
- Urban Regeneration
- Participatory Planning and Governance
- Social Justice and Social Cohesion
- Public Health and Well-being
- Potential of economic opportunities and green jobs
- Other challenge/s

Technical KPIs definition providing a detailed definition of calculation formulas and indices in order to measure and evaluate the accuracy and quality of the Key Performance Indicators (KPIs). Document on Technical KPIs definitions on the project has become a living document. There was an internal submission adding new information and codes that weren't include in the mentioned deliverable. A final version of the document will be submitted at the end of the project.

Down below can be found an updated version of the KPI list, per city.

CHALLENGES	TYPE OF INDICATORS	DB_Code	KPI_Standard	VALLADOLID	LIVERPOOL	IZMIR
CHALLENGE 1: Climate mitigation & adaptation	Chemical	CH0101	Ton C02 CARBON REMOVED per Ha	X		X
		CH0102	Ton C02 CARBON REMOVED per year	X		X
		CH0103	CARBON STORED		X	X
		CH0104	CARBON SEQUESTRATION		X	
	Physical	CH0105	TEMPERATURE DECREASE	X	X	
		CH0106	TEMPERATURE REDUCTION (PROJECTION)		X	
		CH0107	HUMAN COMFORT			X
		CH0108	HEATWAVE RISK	X	X	X
	Biological	CH0109	SPECIES MOVEMENT		X	
	Economic	CH0110	kWh SAVINGS PER YEAR	X	X	X
		CH0111	t C/y SAVINGS PER YEAR	X		X
		CH0112	SAVINGS IN ENERGY USE DUE TO IMPROVED GI	X		
CHALLENGE 2: Water Management	Physical indicators	CH0201	RUN-OFF COEFFICIENT	X	X	X
		CH0202	FLOOD PEAK REDUCTION			X
		CH0203	ABSORPTION CAPACITY (m3/m2)	X		X
		CH0204	ABSORPTION CAPACITY (m3/tree)	X		
		CH0205	TEMPERATURE REDUCTION	X		
		CH0206	INTERCEPTED RAINFALL	X		
	Chemical	CH0207	NUTRIENT ABATEMENT (Chemical Oxygen Demand, COD)	X	X	
		CH0208	NUTRIENT ABATEMENT (Biochemical Oxygen Demand, BOD)	X		
		CH0209	NUTRIENT ABATEMENT (Total Solids, SST)	X		
	Socioeconomic indicators	CH0210	DRINKING WATER PROVISION			X
		CH0211	IRRIGATION WATER PROVISION	X		
		CH0212	WATER REMOVED FROM THE SEWAGE WATER SYSTEM	X	X	X
		CH0213	WATER SLOWED DOWN FROM ENTERING SEWER SYSTEM		X	
	Economic	CH0214	SAVINGS IN TREATMENT OF STORMWATER	X	X	
CHALLENGE 4: Green Space Management	Spatial	CH0401	GREEN SPACE DISTRIBUTION (m2/capita)	X		X
		CH0402	GREEN SPACE DISTRIBUTION (km cycle lane/capita)	X		
		CH0403	PEOPLE LIVING WITHIN 300M TO GREEN AREAS			X
		CH0404	PEOPLE LIVING WITHIN 10KM TO GREEN AREAS			X
		CH0405	GREEN SPACE ACCESSIBILITY	X	X	X
		CH0406	GREEN INFRASTRUCTURE CONNECTIVITY	X	X	X
	Social	CH0407	GREEN INFRASTRUCTURE FUNCTIONALITY		X	
		CH0408	RECREATIONAL VALUE	X		
		CH0409	RECREATIONAL OPPORTUNITIES			X
		CH0410	ELDERLY PEOPLE LIFE QUALITY	X		
		CH0411	CONNECTIVITY PERCEPTION	X		
		CH0412	FOOD PRODUCTION	X		X
	Biological	CH0413	POLLINATOR SPECIES INCREASE	X	X	X
		CH0414	FLORAL RESOURCES INCREASE		X	
		CH0415	PLANT SPECIES INCREASE		X	
		CH0416	INSECTIVORE INCREASE		X	
		CH0417	GREEN AREAS SUSTAINABILITY	X		
CHALLENGE 5: Air Quality	Physical indicators	CH0501	ANNUAL MEAN LEVELS OF FINE PM2.5 PARTICULES	X	X	X
		CH0502	ANNUAL MEAN LEVELS OF FINE PM10 PARTICULES	X	X	X
		CH0503	EMMISIONS TRENDS of NOx		X	X
		CH0504	EMMISIONS TRENDS of SOx		X	
		CH0505	ANNUAL MEAN LEVELS OF O3	X		
		CH0506	POLLUTANTS REMOVED BY VEGETATION			X
	Economic	CH0507	AIR QUALITY MONETARY VALUES	X	X	
CHALLENGE 6: Urban	Social	CH0601	ACCESSIBILITY / DIVERSITY NBS		X	X
		CH0602	BENEFITS FROM INTERVENTIONS	X	X	
CHALLENGE 7: Participatory Planning and Governance	Social	CH0701	OPENNESS	X		
		CH0702	SOCIAL LEARNING		X	
		CH0703	CITIZEN PERCEPTION	X	X	X
		CH0704	URBAN FARMING PARTICIPATION			X
CHALLENGE 8: Social Justice and Social Cohesion	Social justice	CH0801	CRIME REDUCTION	X	X	
	Social cohesion	CH0802	GREEN INTELLIGENCE AWARENESS (Educational actions)	X		X
		CH0803	GREEN INTELLIGENCE AWARENESS (Communication activities)	X		
CHALLENGE 9: Public Health and Well-being	Psychological	CH0901	NOISE REDUCTION	X		X
	Health	CH0902	WALKING AREA INCREASE	X		X
		CH0903	CYCLING AREA INCREASE	X	X	
		CH0904	HEALTH QUALITY PERCEPTION		X	
CHALLENGE 10: Potential of economic opportunities and green jobs	Economic	CH1001	TAX REDUCTION	X		
		CH1002	JOB CREATION	X	X	X
		CH1003	BUSINESS REVENUE	X	X	
		CH1004	PROPERTY VALUE CHANGE		X	
		CH1005	CONSUMPTION BENEFITS	X		
	TOTAL NUMBER OF KPIs	**68**		**45**	**34**	**31**

Figure 3.3: KPIs list by specific challenge, code, and cities assigned (Sources D5.3 URBAN GreenUP)

In these documents can be found a link between each NBS against KPI for Valladolid City Diagnosis and Monitoring Procedures *(Sources Deliverable 2.4)*; Monitoring Protocol for Liverpool *(Sources Deliverable 3.4);* Monitoring Program to Izmir *(Sources Deliverable 4.4)*.

3.2.5 KPIs prioritization vs NBS

In the KPI prioritization process, the challenges which defined by the EKLIPSE methodology, re-adapted in URBAN GreenUP T1.2-D1.2 and identified for each city on earlier studies of the project, will be listed. For each challenge listed, the KPIs previously determined in WP5 monitoring studies will appear in the next column. Then, the cities will match those KPIs with NBSs which are being implemented in their demo sites. With taking into consideration the results of this output and the pre-determined prioritization questions, scoring will be made between 1 and 5 for each KPI to determine the priority of this KPI for each NBS. The list of the questions and their explanations are given in the table below.

Table 3.2: List of questions KPI prioritization associated (Source: D1.7 URBAN GreenUP).

List of Questions	Comments / Explanations
Q1 - Is the methodology/KPI credible?	Who uses this method? Is it recognized as best practice or widely accepted/used in decision making or compliance monitoring?
Q2 - Is it practical, reliable and replicable?	Can one/two people do this quickly and accurately?
Q3 - Does other similar data exist for comparison and benchmarking?	Here or in other comparable cities or partner cities. Are there accepted thresholds?
Q4 - Does it offer good value for time/money invested?	Can we get results quite quickly? Are consumables and parts affordable? Is it resource efficient?
Q5 - Will it further our understanding / add value to the NBS solutions? How much does it tell the story of the NBS solutions?	Is it meaningful? Is it appropriate? Is it understandable? Is it convincing?
Q6 - Do we have the expertise/software/time to make the analysis?	Can this be done in-house? Is there a training need?

After scoring process the average score for each KPI vs. NBS match will be visualized. In this way, the results will be made meaningful and understandable for the user. KPI prioritization process and all components of the tool; challenges, matching KPIs with NBSs, questions, scoring, expected results, visualization of the results and the benefits of the tool are explained under D1.8.

4 How to prepare the diagnosis process

4.1 SWOT tool on behind of the analysis

The SWOT analysis tool was selected for diagnosis process allowing the selection of the best strategies supporting RUP. This methodology allows cities to analyze the problem from the point of view of the different influential positive and negative factors:

- *Offensive (to eliminate all Weaknesses and Threats)*
- *Orientation (to take advantage of Opportunities, and improve the Weaknesses)*
- *Defensive (to protect the Strengths and minimize the Threats, or avoid them)*
- *Of survival (to avoid Threats and to reduce the Weaknesses)*

Table 4.1: SWOT analysis chart (Source: Wiki Web et al.).

	Strengths	***Weaknesses***
Opportunities	***Offensive*** *(to <u>eliminate all Weaknesses and Threads</u>)*	***Orientation*** *(to take advantages from opportunities, and <u>improve the weaknesses</u>)*
Threads	***Defensive*** *(to perfect the Strengths for <u>minimizing of Threads</u> and avoid them)*	***Of survival*** *(to <u>avoid Threads</u> and to reduce the Weaknesses)*

In the diagnosis of the close and immediate environment there are problems often repeated, however, it is also common to detect opportunities. It is not always possible to avoid all threats or to exploit maximum the strengths. The option to take advantage of opportunities and improve the weaknesses seems to be the balanced option at different scales: city, area, district or street. Deciding this option, we still facing new challenges, but also minimizing unnecessary risk.

To start with the evaluation process, it should be tried to answer the following questions:

- *Are you a city leader in any aspect related re-naturing?*
- *What would be your strategy for re-naturing?*

The SWOT analysis should provide sufficient inputs into scenario planning, strengths and weaknesses that characterize the development of the city.

4.2 Set of existing initiatives and projects

Start identifying the existing re-naturing initiatives and plans. You may analyze:

- City existing SWOT analysis (street, district, city, region, country level)
- City Actions Plans driving the aspects related re-naturing (societal challenges)
- Local projects and initiatives NBS driving
- Local stakeholder groups related

Continue identifying the regulatory framework that restricts the implementation of the City Urban Plan – RUP – with NBS selected. This includes all the legal elements for the municipality including international and national level (standards, laws, regulations) and local level (rule, norm, ordinance, plan), as well as identifying the procurement processes and the funding's opportunities.

4.3 Interactive process including stakeholders

4.3.1 City workshops with relevant stakeholders

Attracting the relevant stakeholders to participate in the scenario building workshops. These might include city planners, politicians, businesses, economist, service providers, and academia and community representatives. Bringing together various stakeholders and guiding their individual choices towards consensus and also high acceptance of the future developments.

The stakeholders may support the definition of the city scenario for sustainable growth towards city re-naturing with NBS solutions. The workshop should be a part of the process, well established, divided into phases treating to solve not some many aspects by session, maintaining informed their participants with the results and decisions the workshop has influenced:

- Local communication & dissemination plan.
- Social networks (Twitter, Facebook, YouTube, etc.)
- News in the websites and newsletters.
- Local newspaper, TV, radio.

Creating an NBS Community of Innovators, and improving communication and NBS awareness are some of the main actions to promote NBS when renaturing urban areas.

• Internal stakeholders: Local Govern (politicians: Mayor, Councilors). Public workers of the different involved areas.

• External stakeholders: Citizens.

• Public workers: Communication Department. External experts on Communication.

4.3.2 Questionnaires and Surveys

The valuable feedback may be gathered thanks to the interactive- questionnaires or surveys. There are multiple forms of doing, focusing to those on-line accessible, and attractive, treating the city specific aspects and gathering the data needed for re-naturing analysis and diagnosis, but also in answer, sharing publicly the results of that analysis. The objective is to gather the data needed for diagnosis, defining the base scenario/situation that city is facing, but also visualizing the list of wishes, choices, and stakeholder's preferences for the future scenario.

The surveys should not be too long, or to complex, and highly adapted to the specific stakeholder group in use of technical language, focus, complexity, accuracy of the questions. Should be anticipated with proper information campaign, clearly defining the objectives, and impact of the analysis for city growth and well-being of their citizens.

• Adapt the language of communication to the recipient. It is not the same to transmit the RUP aspects to the City Council technicians, the Academia, professionals or to the general public.

• Use the media and platforms that already exist, such as website, newsletter, social networks, etc.

• Provide examples of good practice and success stories, as well as enhancing the expected benefits for the city.

Communication channels should be open to receive the views of stakeholders and interested parties. Feedback and iteration are decisive characteristics that distinguish NBS logic and decision making from projects using grey elements or grey infrastructure (Source: ThinkNature Handbook).

Stakeholders can bring improvements to NBS and proposed solutions to the environment in which they operate. The voices of all kinds of stakeholders must be heard. Opinions can have a knowledge base, if they come from trained technicians, academics, etc. But the opinions of citizens in general are also important, as they are the ones who are most aware of the problems in the places where they live.

5 Steps to the city and area diagnosis process

5.1 City needs and the re-naturing target

5.1.1 The city`s scenario of grow

What is the real value of re-naturing in my city? How to establish the goals? How can NBS be designed and implemented? What is the step by step action plan that can help you to achieve the goals you have in your city? The diagnosis process proposed should addresses these questions, and is directed toward cities who are developing plans to re-nature their cities through the use of NBS on respect of the societal challenges identified.

	+city challenge
City Vision considering: +city challenge -re-naturing	City Vision considering: +city challenge +re-naturing
-re-naturing	
	+re-naturing
City Vision considering: -city challenge -re-naturing	City Vision considering: -city challenge +re-naturing
	-city challenge

Figure 5.1: Definition of city vision scenario (Source URBAN GreenUP)

To begin to answer these questions, let´s try to answer the opposite question, **what would be a potential scenario of growth for our city without consideration of re-naturing?** How would your city address challenges related to climate mitigation and adaptation? How would you address public health and well-being, air quality, urban regeneration and space management? What about the potential for a better economy; are there opportunities to develop a green economy or expand the number of green jobs in your city? Without the clear position of the city to the city`s renaturing will be difficult to cross full process on NBS scenario adoption. But try to understand the possible consequences of “not doing”, instead of “insisting in doing”.

To complete the picture to the **city re-naturing vision**, try to identify the **societal challenges that are/or will be the main drivers for your city**. URBAN GreenUP approach contains 10 challenges (Source: based on classification created by the EKLIPSE initiative). The nature-based solutions (NBS) are solutions to a number of societal challenges and not only climate change issues. First we should be able to define, which of those challenges are the most relevant ones, and which, the most uncertain ones. The most relevant challenges refers to the level of its importance for the city´s development and growth, and the most uncertain, refers to the likelihood that the challenge will become a reality with selected NBS. But how to select the best NBS solutions set for that scenario?

Table 5.1: Graph to the main city challenges linked to the diagnosis process (*Source: URBAN GreenUP).*

City Societal Challenges:	Most Relevant	Most Uncertain with NBS solutions
• **Climate mitigation and adaptation;**	IIIIIIIIIIIIIIII	IIIIIIIIIIIIIIII*
• **Water management;**	IIIII	IIIIIIIIII
• **Coastal resilience;**		
• **Urban green space management (including enhancing/conserving urban biodiversity);**	IIIIIII	IIIIIII
• **Air/ambient quality;**	IIIIIIIIIIIII	IIIIIIIII
• **Urban regeneration;**	IIIIIIIIIIIIIII	IIIIIII
• **Participatory planning and governance;**	IIIIIIIIIIIIIIIIIIIIII	IIIIIIIIIIIIIIIIIIII
• **Social justice and social cohesion;**	IIIIIIIIII	III
• **Public health and well - being and**	IIIIIIIIIIIIIIIIII	IIIIIIIIIIIIIIIIIIIIIIIII
• **Potential for new economic opportunities and green jobs.**	IIIIIIIIIIIIIII	IIIIIIIIIIIIIIIIIIIIIII

*Test to hypothetical votes (In link to politics adopted, but also stakeholders feedback through Workshop, Questionnaire, Survey)

Once considered the city re-naturing vision, the **NBS solutions can be suggested** using the URBAN GreenUP catalogues to NBS and Societal Catalogues. The "city" targets, in form of city challenges and sub-challenges, are translated there into the list of the best NBS for the needs, targets are listed.

Table 5.2: NBS Cards suggestion depending challenge and sub-challenge selection *(Source: D1.7 URBAN GreenUP Tool).*

NBS Card		Scale: Street/ District/ City/ Region*	
Challenge*	Sub-challenge	*List of the NBS linked to Societal*	• *List of the KPIs linked*

		Challenges Selected (Tool)	*the NBS Scenario*
**UGU D1.2*		**UGU D1.1, D1.7*	**UGU D1.8*

*the city scale filter and zoning aspects should be attached

Once get the agreement according to the **city`s renaturing vision, including the NBS specific list**, the diagnosis should be placed to **determined location.** This will be dependent the impact associated to our future NBS scenario, the same it determines the scale of the intervention, that may refer to city, city region, city specific district or maybe one street or square only.

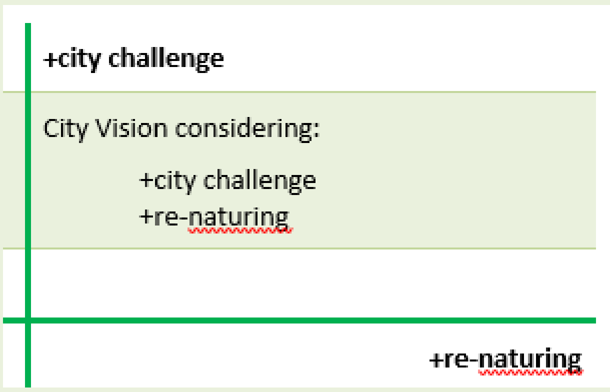
What can happen is that during the previous exercise, according selection of the city challenges, you will realise that the challenges that are more relevant, are at the same time most uncertain with the specific NBS solution. In some cases the level of innovation of the NBS solution, or complexity coming from their implementation, might significantly difficult the probability of success due to high risk associated, also city barriers existence according that specific solution. Using the NBS solutions catalogues, and analysing the barriers associated, the user will refine the NBS list depending the city capacity.

5.1.2 City re-naturing vision

The final result should refer to the city sustainable vision to re-naturing crossed with the specific challenge to attached and specify the potential **projects and initiatives related the urban Environment and Socio-Economic** ones (Source, recommendation of “Agenda21”).

Table 5.3: NBS Cards suggestion (Source: URBAN GreenUP Tool).

City Vision “Masterplan” Selected



List of the NBS Projects, group of projects suggested “NBS Scenario”:

NBS projects/initiatives selected from the previous list and organized below the strategic city objectives:

Environment	*Social*	*Economic*
NBS project/ initiative linked	…	…

*Differentiation not considered into the catalogue, strongly depends the local interpretation

Vision Timeline should complete the city vision definition. Two dimensions at least should be proposed, the Short - Medium Term (Actual), compared to Long Term (Future). The information also help in preparation of the City Baseline in accordance to the local goals and the NBS selected. The state indicators answering the situation of the actual state, and should be extended with sustainable indicators determining the future state.

Finally, the list of Challenges and NBS can be crossed with the city real capacity for NBS adoption.

5.2 City capacity and NBS scenario selected

5.2.1 Understand/ analyse your "city" capacity

Once determined the city´s most influential challenges, and the potential NBS to be implemented, the **city`s capacity** may be determined with corresponding **strengths and weaknesses** should be determined based on the relevant background materials.

The main goal of this action is to detail the city profile and to prepare it for deep analysis in respect to the NBS implementation.

Depending on the specific **city context** (including political, technical, legal, social, and financial implications), as well as different NBS characteristic and needs, we will have to consider some influential advantages and disadvantages of their potential integration. Some NBS strategies will work better in some situations, being unnecessary until damaging the functioning in others.

This action will start with the analysis of the different factors of the city and surrounding the potential NBS implementation. The database of city information covering aspects such as:

- **Site analysis and climate** (geomorphology, water, subsoil, vegetation, but also and for specific climate definition, solar impact, average temperatures, wind direction)
- **Urban zoning analysis** (construction and public spaces balance, and equipment's, build environment character, use of soil, construction elements available for NBS)
- **Local legal regulations and politics** (NBS related and other related specific city data)
- **List of city specific goals** proposed and **SWOT analysis** (weaknesses, strengths, opportunities and treads identified)

The user will classify the Strengths, Weaknesses, Opportunities, and Threats (SWOT) prioritizing the most urgent and important, and also those improbable, for NBS implementation in the local city context.

5.2.2 City NBS capacity

This step is crucial during the previous analysis process, as defining the potential limits for some implementations at the early beginning and accuracy of the NBS proposed, as same indicating the steps needed to be taken to potentially overcome the obstacles and increase the potential of success for the RUP`s planning.

Focusing the **list of Barriers** defined in the project, we may try to specify the risk for each NBS implementation, as well as its probability according to the city local situation and progress performance. **Country specific barriers** were identified under the followed categories.

- **Political barriers**
- **Technical barriers**
- **Legal / Organizational barriers/ Administrative**
- **Social / Cultural barriers**
- **Financial/ Economical barriers**

This list corresponding the experiences gathered from the implementation actions for Nature based Solution in large scale demonstration in three European front-runner cities of Valladolid (Spain), Liverpool (UK) and Izmir (Turkey), as well as planning constrains identified by the followers cities Ludwigsburg (Germany), Mantova (Italy), Medellin (Colombia), Quy-Nhon (Vietnam) and Chengdu (China). The barriers associated each specific NBS, and level of influence, were rank depending city location and characteristics (from -1 – low influence, to 5 – high influence, Source D1.7 Scenario Tool). The systematic procedures used for the identification of the barriers and boundaries, can be replicated into the same city process, thanks to the identified questionnaires' and workshops.

The resulting Risk Value Impact, related the specific barriers identified, includes levels of probability (0 – negative; 1- positive), and influencing the risk associated the NBS implementation (low-medium; high risk).

Table 5.4 NBS Cards suggestion by barriers associated *(Source: D1.7 URBAN GreenUP Tool*).

NBS Card (NBS by group) vs Barriers				
	Barriers List ****What are the barriers associated the NBS***	***Risk Value Impact*** ****What is the total Risk Value depending the probability indicated***	***Probability*** ****Short-Medium Term (Actual)***	***Probability*** ****Long Term (Future) according European plans till 2030).***
Political	*barriers by groups/ sub-groups, as established *URBAN GreenUP Deliverable D1.5*	*low – médium – high relevance	0-1 0: no (most probably no) 0,5: could be 1: yes (most probably yes)	0-1
Technical				
Legal				
Social				
Financial				

The different barriers may occur at the same NBS implementation, or can be multiplied in NBS Scenario, in consequence, the risk also will increase, as a result of multi barrier implementation. Contingency plan should be adopted at least in medium-high risk barriers scenarios.

Finally, we get a list of the best NBS solutions for the needs, targets and capacities of the city (diagnosis/challenges/barriers/enablers). Using this list the user will refine the NBS list if needed.

6 Conclusions

The diagnosis process enable cities to meet the main objective on renaturing urban areas with NBS helping to adapt those to the specific city needs and capacity.

The diagnosis will provide the cities with a critical topics and main input for city re-naturing vision generation and coherent action plan adoption for NBS scenario implementation. The specific zoning analysis and scale of intervention will determine the city impacts according the societal challenges identified.

We can distinguish different errors during the diagnosis process:

- It focuses only environmental aspects, living out the social and economic ones.
- Too much data under analysis
- Citizens are not considered, their needs are not considered
- Out of the city zone or area defined
- Lack of georeferenced data, lack of visualization methods
- It is not structured by homogenous areas (historical zone, new districts…)

The city real compromise to re-naturing, enabling the relevant stakeholders to enter to the discussion on greening with NBS from the early beginning, will guide and enforce the RUP journey. In consequence, it position your city between the model cities towards the innovation in collaborative and renaturing planning.

7 References

All references are included into the text.

- **Re-naturing methodology *(URBAN GreenUP D1.13), Source: URBAN GreenUP, July 2020,*** https://www.urbangreenup.eu/resources/deliverables/

List of Catalogues and Guides will help to specify the particular methodology components:

- **NBS Catalogue *(URBAN GreenUP D1.1), Source: URBAN GreenUP, May 2018,*** https://www.urbangreenup.eu/resources/deliverables/
- **Societal Challenge Catalogue *(URBAN GreenUP D1.2) , Source: URBAN GreenUP, July 2018***, https://www.urbangreenup.eu/resources/deliverables/
- **Baseline Calculation Guide *(URBAN GreenUP D1.4), Source: URBAN GreenUP, September 2020*** *(on-going)*
- **Barriers and Boundaries Guide *(URBAN GreenUP D1.5), Source: URBAN GreenUP, July 2018***, https://www.urbangreenup.eu/resources/deliverables/
- **Zoning and Mapping Guide *(URBAN GreenUP D1.6), Source: URBAN GreenUP, May 2020***, https://www.urbangreenup.eu/resources/deliverables/
- Tendering Process Guide *(URBAN GreenUP D1.9) , Source: URBAN GreenUP, December 2020 (on-going)*
- Scaling UP Guide *(URBAN GreenUP D1.10), Source: URBAN GreenUP, May 2022, URBAN GreenUP, September 2020 Interim ver. D1.18 (on-going)*
- **Co-creation and Co-development Guide** *(URBAN GreenUP D1.11), Source: URBAN GreenUP, May 2022 (on-going);* ***URBAN GreenUP, December 2019 Interim ver. D1.19,*** *currently available,* https://www.urbangreenup.eu/resources/deliverables/

List of the Tools

- **NBS scenarios generation Tool *(URBAN GreenUP D1.7) with KPIs prioritization criteria Guide (URBAN GreenUP D1.8),*** *Source: URBAN GreenUP, September 2020 (on-going)*
- **Co-creation and Co-development Tools** *(URBAN GreenUP WP6), Source: URBAN GreenUP, May 2022 ,* https://www.urbangreenup.eu/resources/nbs-selection-tool/nbs-selection-tool.kl

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