D2.4 Handbook on Identifying Low carbon | High air quality NbS potentials in Cities

JUSTNature | Work Package 2, Task 2.3

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* PU = Public
PP = Restricted to other programme participants (including the Commission Services)
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1 EXECUTIVE SUMMARY

The overall objective of the Horizon 2020 project JUSTNature is the activation of nature-based solutions (NbS) by ensuring a just transition to low-carbon cities, based on the principle of the right to ecological space. Key focus of the project is to advance the integration of NbS into urban planning and governance frameworks, by harnessing the power of nature to mitigate climate change, enhance biodiversity, and improve human well-being. Achieving these goals necessitates proactive strategic planning and inclusive decision-making processes.

In this regard, this deliverable introduces the Strategic Planning Method-kit for Ecological Justice – JUSTPlanT, a practical guide designed to facilitate collaborative and participatory processes in the design and planning of NbS that effectively tackle urban challenges. The method-kit provides practical guidelines and methods to empower users to develop integrated and inclusive strategies for implementing NbS in their communities.

JUSTPlanT constitutes the final output of the Work Package 2 on Recognizing Low carbon | High air quality NbS potentials. It is delivered as part of the Task 2.3 and it is informed by the various results of the different activities part of the work package.

It draws upon the insights of the conceptual and action framework developed in Deliverable 2.1 - *Conceptual & action framework on Low carbon | High air quality NbS potentials* - with the main objective to translate key justice concepts into actionable strategies, suggesting a practical approach to achieve integration of justice considerations into NbS implementation.

It integrates the results of Deliverable 2.2 - *Setting the stage for ecological and socioeconomic status & disparities profiles in the CiPeLs* - through the development of practical instructions aiming at facilitating the integration of spatial data in the NbS planning process. D2.2 emphasizes the relevance of considering justice dimensions, demographic and socio-economic characteristics and their spatial distribution in urban planning. The integration of such information in participatory processes aims to better navigate trade-offs and enhance benefits of NbS, fostering a deeper understanding of the disparities existing within the city and of the complex interactions amongst different challenges.

It also builds on the results of Deliverable 2.3 on *Assessment report Low carbon | High air quality NbS potentials & scenarios future trajectories*, to examine avenues for employing participatory methods in co-creating climate scenarios. To foster actionable knowledge of how expected climate and environmental hazards may affect local ecosystems and communities, and consequently how NbS interventions can be strategically developed or sustained to mitigate these impacts.

JUSTPlanT targets municipal public administrations, urban planners, (landscape) architects or site developers as well as citizen and neighborhood initiatives who want to collaboratively navigate the complexity of justice considerations when activating NbS.

Community of practices are invited to further expand the method-kit's scope, by integrating additional ecological (space) justice dimensions not yet captured and exploring its application at different scales, including regional or national levels.

2 OVERVIEW

Rather than developing yet another standard handbook, already at the early stages of work package 2 it was decided to focus on the development of something that allows a collaborative as well as creative and playful approach to navigating the complexities of strategically planning for ecological justice. Based on the various tasks of the work package, building on some existing examples of toolkits as well as being inspired by the organization of the local stakeholder workshops in the City Practice Labs, the Strategic Planning Method-Kit for Ecological Justice – JUSTPlanT evolved.

JUSTPlanT consists of a handbook, but is also formed by its various Annexes.

The handbook introduces JUSTPlanT, starting with '*how to use*' the method-kit, introducing its aim and scope, which key audience it addresses and an overview of its structure. Insights on its development and testing during the project's activities are provided together with some tips for the organization of interactive sessions.

The Chapter '*What else to know before you start*' presents the key background with which the method-kit works. It introduces some key concepts in relation to ecological justice and NbS in cities that will be further explored within the different modules.

Finally, the *individual modules* of the method-kit are introduced as well as their components. This part consists of six modules:

- Module 1, "Identifying key challenges/(in-)justices" focuses on identifying justice opportunities and (in-)justice challenges within the city's context, to provide insights into common visions of justice and inform the development of NbS options.
- Module 2, "Activating Nature-based Solutions" initiates reflections on NbS categories and measures, exploring their role in addressing identified challenges or identifying opportunities within the city.
- Module 3, "Setting up NbS for group inclusiveness" introduces the concept of group inclusiveness, emphasizing the importance of ensuring equitable participation and representation in the planning and implementation of NbS.
- Module 4, "Seeking inspiration on a just NbS activation" guides ecological justice considerations, offering a set of inspiration cards to stimulate reflection on key principles and concepts related to NbS implementation.
- Module 5, "Co-assessing NbS potentials" facilitates a collaborative assessment of the potential impacts and effectiveness of NbS within the urban environment by ensuring social and ecological inclusiveness.
- Module 6, "Developing future scenarios of NbS potentials" focuses on exploring future climate scenarios and their implications for NbS activation.

Each module includes activities that aim at fostering collaborative work on key aspects of ecological justice and NbS. The modules contain specific instructions for their use:

- A description of the main objectives and purpose,
- Instructions for how to prepare, and
- Steps for carrying out the activities.

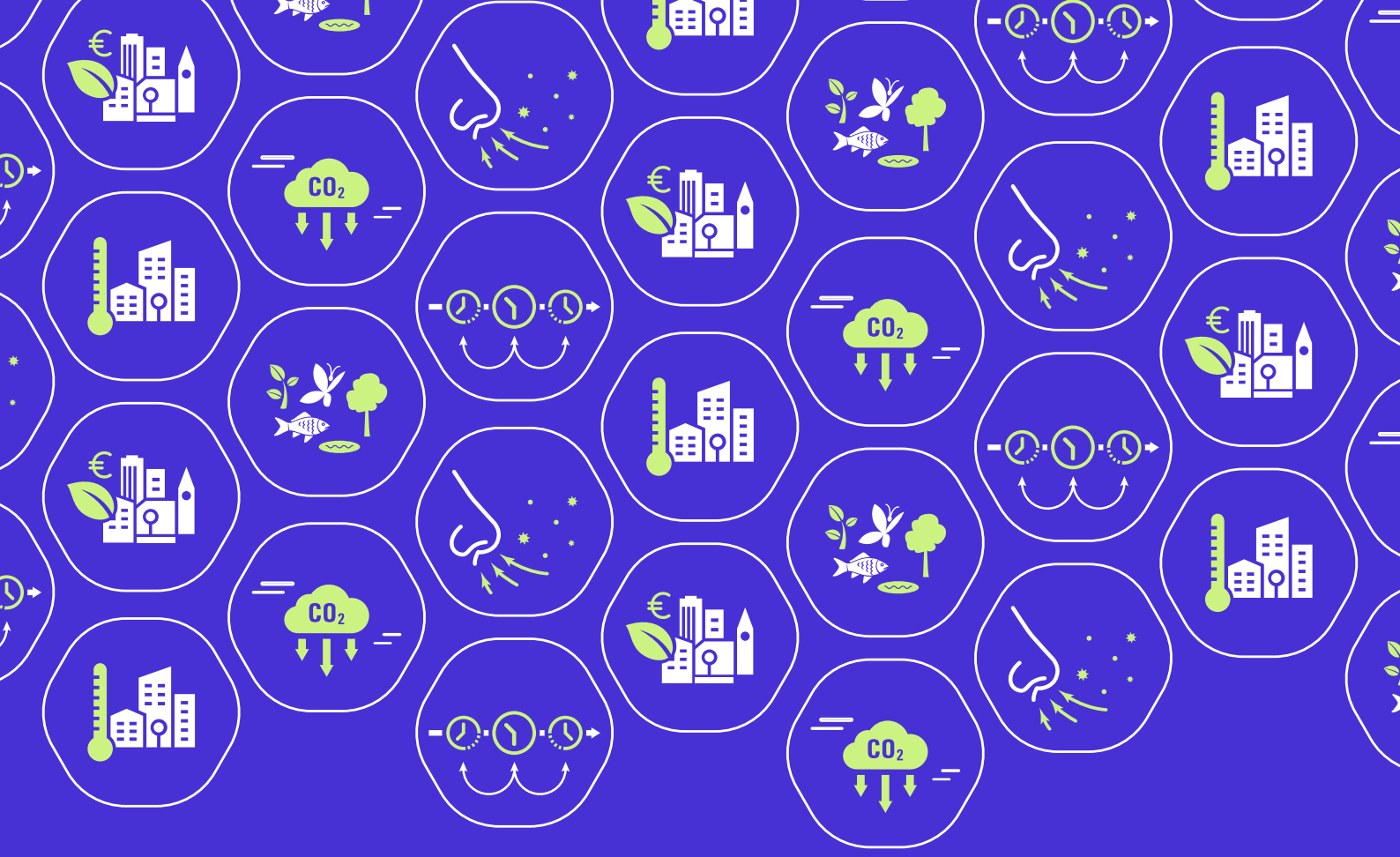
The importance of potential combinations of different modules is emphasized and an overview of recommended combinations is provided in the "*Potential Combinations*" Chapter.

The handbook is accompanied by a series of annexes containing material to print:

- Handout material as background information,
- Set of tokens and inspiration cards,
- Tables providing additional explanation on the interpretation of the inspirations cards, and
- Individual templates to use for the modules.

3 JUSTPLANT AND ANNEXES

What follows are the JUSTPlanT handbook and its various annexes, which compose the Strategic Planning Method-kit for Ecological Justice.



JUSTPlanT

Strategic Planning Method-Kit for Ecological Justice

JUST NATURE

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www.networks-group.de/de/networks-4/infokarten.html

Photos:

Pg 11, 15, 57: Katalin Lutor.

Pg 12: Comune di Bolzano.

Pg 13: Eurac Research/Ludovica Galeazzi.

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Contents

Abbreviation list

Term	Description
CiPeLs	City Practice Labs
GCM	Global Climate Models
NbS	Nature-based Solutions
RCM	Regional Climate Models
SSPs	Shared Socio-economic Pathways

Foreword

Cities are home to nearly 40% of Europe's population, and thus their design, planning and governance significantly affects the living conditions of many people. Awareness is increasing that in cities and beyond, environmental and climate impacts are unevenly distributed: low-income households are often more exposed to environmental ills such as air pollution or a changing climate, while environmental amenities are increasingly exclusive to high-income households. Nevertheless, as fertile environments for innovative and transformative changes, urban areas frequently become focal points for collaboratively discussing, identifying and implementing potential solutions.

Activating nature-based solutions (NbS) involves protecting, conserving, restoring, sustainably using, and managing natural or modified ecosystems (e.g. urban parks, green roofs or urban forests), to provide benefits for human well-being and to support biodiversity. These solutions have the potential to significantly improve the quality of life in cities, tackle complex challenges and promote ecological resilience, including preserving and enhancing urban biodiversity and fostering community engagement.

For providing equitable access and a fair distribution of nature's benefits, it is crucial to integrate NbS within the strategic planning of the city. To ensure that this complex process is just requires embracing **collaborative and participatory approaches** that engage various actors, from urban planners, architects, public administration representatives as well as local communities in planning, designing, implementing and maintaining NbS. Such processes ensure that NbS interventions are responsive to local needs and priorities and empower communities of practice to actively take ownership of NbS development in their city or neighborhood, cultivating a more inclusive and sustainable urban environment.

The Strategic Planning Method-kit for Ecological Justice (JUSTPlanT) is the result of collaborative efforts within the context of the JUSTNature project, whose main objective is the activation of NbS to ensure a just transition to low-carbon cities of high air quality. At the core of the project lies the principle of the **right to ecological space**, which refers to the fundamental entitlement of individuals and communities to a healthy and sustainable environment for a good life. Specifically, it advocates for equitable access to favorable ecological conditions, ensuring their preservation for present and future generations, while also emphasizing the responsibility not to limit the ecological space of others.[1]

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1 Gantioler 2018. The right to ecological space | in the city. Operationalising 'Green Infrastructure' as strategic urban planning concept for a just access. TUM.University Press. DOI: 10.14459/2018md1428708

How to use the Method-Kit

1 WHOM IT IS FOR

The Strategic Planning Method-kit for Ecological Justice (JUSTPlanT) is a practical and engaging tool designed to **support collaborative and participatory processes** in the design and planning of NbS that effectively tackle several urban challenges.

As such, it addresses all those involved or interested in collaboratively identifying related future priorities for their city, neighborhood or community.

Recognizing the importance for strategic and systemic foresight and collaborative decision-making, JUSTPlanT aims to foster integrative approaches centred on **ecological justice** within urban environments. **Key emphasis** is put on challenges such as air quality, thermal and climate justice, as well as spatial and temporal considerations, and flora, fauna and habitat inclusiveness. In addition, it mainly targets the activation of **urban NbS**, although it can also be applied to activating NbS beyond the city.

Through a set of modules and methods, using tokens and Inspiration cards as well as various templates, JUSTPlanT encourages users to develop **integrated and inclusive strategies** for implementing NbS in their communities. JUSTPlanT targets municipal public administrations, urban planners, (landscape) architects or site developers as well as citizen and neighborhood initiatives who want to collaboratively navigate the complexity of justice considerations when activating NbS.

> **GETTING the most out of JUSTPlanT ideally entails some minimum experience with facilitation or familiarity with the facilitation of interactive sessions. Asking someone with related expertise for support may be advisable. In addition, JUSTPlanT highlights opportunities to combine these approaches with assessing spatial quantitative data that integrate social, economic and environmental aspects.**

2 HOW IT IS STRUCTURED

JUSTPlanT consist of this handbook as well as its various Annexes, which provide material to print:

- Handout material, as background information.
- The set of tokens and Inspiration cards.
- Tables providing additional explanations on how to interpret the Inspiration cards.
- Individual templates to use for the modules.

The Handbook will introduce JUSTPlanT starting from some key concepts in relation to ecological justice and NbS in cities. A brief overview of the method-kit development and testing during the project's activities is provided together with some tips for the organization of interactive sessions.

Finally, the modules of the method-kit are introduced in each of its components.

There are six modules:

- **Module 1**, "Identifying key challenges/(in-)justices" focuses on identifying justice opportunities and (in-)justice challenges within the city's context, to provide insights into common visions of justice and inform the development of NbS options.
- **Module 2**, "Activating Nature-based Solutions" initiates reflections on NbS categories and measures, exploring their role in addressing identified challenges or identifying opportunities within the city.
- **Module 3**, "Setting up NbS for group inclusiveness" introduces the concept of group inclusiveness, emphasizing the importance of ensuring equitable participation and representation in the planning and implementation of NbS.
- **Module 4**, "Seeking inspiration on a just NbS activation" guides ecological justice considerations, offering a set of Inspiration cards to stimulate reflection on key principles and concepts related to NbS implementation.
- **Module 5**, "Co-assessing NbS potentials" facilitates a collaborative assessment of the potential impacts and effectiveness of NbS within the urban environment by ensuring social and ecological inclusiveness.
- **Module 6**, "Developing future scenarios of NbS potentials" focuses on exploring future climate scenarios and their implications for NbS activation.

Each module includes activities that aim at fostering collaborative work on key aspects of ecological justice and NbS. The modules contain specific instructions for their use:

- A description of the main objectives and purpose,
- Instructions for how to prepare, and
- Steps for carrying out the activities.

Overall, the method-kit aims to facilitate collaborative planning processes and inform decision-making regarding the activation of NbS in urban contexts. The method-kit encompasses several interconnected components aimed at generating actionable knowledge.

Thus, the modules can be applied individually, as well as combined with other modules. Figure 1 provides an overview of the modules and how they interlink.

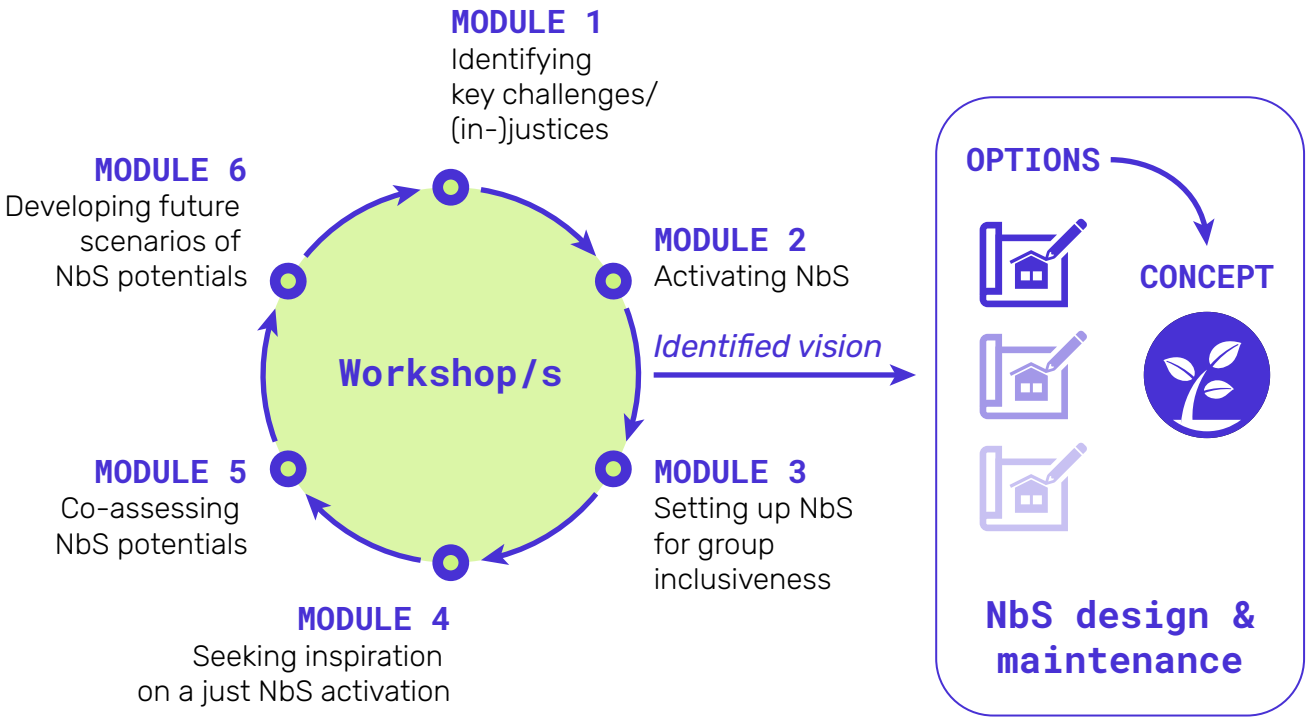

Figure 1: The various modules and their overall integration in the strategic planning for ecological justice

3 HOW IT WAS DEVELOPED

The idea of the method-kit starts from the **planning toolkit** developed in the framework of **netWORKS 4 – Resilient Networks | Contributions of urban supply systems to climate justice**.[1] The aim of the initial method-kit was to support the integrative planning of green, blue and grey infrastructure. It includes a set of information cards and tokens to be applied in a collaborative planning process approaching multiple scales.

When discussing the method-kit with its original developers, the difficulty of approaching matters of environmental justice more profoundly became apparent, and partners of the JUSTNature project decided to use this experience to further develop and test such a method-kit.It started with the development of an **additional set of tokens** to help identify ecological (in-)justices or justices as key challenges or opportunities linked to a city, municipality, neighborhood or site. Given the focus on defined challenges such as air quality justice, thermal justice, climate justice, spatial justice, flora and fauna habitat inclusiveness and temporal justice, the initial set of tokens referring to **vulnerable groups** was further expanded. This included references to group inclusiveness and **adding**

groups related to 'low-income' and 'high income' or including 'important ecosystems' and their stewards as a defined group. Empty tokens were also added to allow further complementing the set if needed. The set of NbS tokens was adapted to the **NbS categories and measures** defined as part of the development of JUSTNature's conceptual and action framework.[2]

Figure 2: Example of JUSTPlanT in action: Workshop in Szombathely

The set of tokens on (in-)justices (Module 1), NbS (Module 2) and group inclusiveness (Module 3) are those that have been most extensively tested, first internally and subsequently in the framework of various **Local Stakeholder Workshops** (LSW), organized in the **City Practice Labs** of the project (CiPeLs), especially involving the cities of Bolzano, Chania, Gzira and Szombathely (see pictures for JUSTPlanT in action). The presentation template and the set of tokens were translated into the local languages, and subsequently feedback was collected in the framework of the Collaborative CiPeLs Workshops (CCW). The feedback received from the testing process further influenced the refinement and improvement of the modules, including adjustments to the quantity of questions, the number of NbS tokens, and the design of the tokens to enhance the method-kit's effectiveness and user experience.

Figure 3: Example of JUSTPlanT in action: Workshop Industrial Zone Bolzano

The experience gained from the implementation of the first modules and the use of the tokens informed the development of the **Inspiration cards**. They were named so to avoid suggesting that the included insights provide extensive information on what the various justice challenges concretely imply without considering the complexity of the context. The first set of the Inspiration cards was tested during one of JUSTNature's meetings with project partners in a dedicated workshop setting. It proved to be particularly useful to carry out an exercise with an empty inspiration card, and to subsequently discuss the filled inspiration card. This was thus incorporated into the various steps of Module 4.

The extensive experience of discussing the development of the so-called **socio-ecological profiles**, which visualize spatial disparities by integrating and clustering different indicators and thus potential areas for interventions (see picture 4), with the city representatives of the CiPeLs proved to be important to increase their validity and practical use. It also helped in defining a process to evaluate potential blind spots, including on data, which informed the development of Module 5.

Figure 4: JUSTPlanT presentation at the EU week of Regions and Cities

Finally, insights from the development of initial quantitative **climate scenarios** and their limits to better understand how a changing climate could impact the activation of NbS for the JUSTNature CiPeLs[3] informed the development of modules. It led to the emergence of a participatory approach for the co-creation of climate scenarios. This approach was introduced in a webinar for the CiPeLs, although the subsequently evolving module was not tested in practice. However, it will be a key element of research to be carried out in the next phase of the project.

4 HOW TO READ THE INDIVIDUAL MODULES

There are six modules of JUSTPlanT, each of which has specific instructions for their individual use. The description of the modules corresponds to the following structure.

1. **Aim of the module**: To provide an explanation of the main objectives and purpose of the module, including key aspects to be considered.
2. **Preparation**: Includes instructions on key considerations and to prepare all the material that is needed before starting with the activity.
3. **Carrying out the activity**: Describes the steps and methods deployed to conduct the activities, and includes estimates of the required time.
4. **Methods**: Provides further details on specific methods that have been applied, including important notes and suggestions on how to report to be effectively used in further decision-making processes.
5. **Materials to print**: Includes a list of materials that are needed to carry out the activities.
6. **Further reading**: Finally, there is a list of further documents and references for a deeper exploration of the concepts introduced in each module.

5 WHAT TO KNOW ABOUT FACILITATION

Engaging stakeholders in a **participatory and interactive process** fosters inclusivity, transparency, and ownership in decision-making. Effective organization and facilitation are crucial for meaningful participation and successful outcomes.

- First, **define objectives and scope**: clearly define objectives, scope, and expected outcomes to ensure stakeholders understand the purpose and their contribution.
- Second, **identify stakeholders**: identify all relevant stakeholders, including individuals, groups, organizations, and communities affected by the issue.
- Third, during the process **invest time in building relationships**, fostering trust, and creating a favourable environment for collaboration. Also encourage active participation, respect diverse viewpoints, and manage conflicts to ensure all voices are heard. For this purpose, it is recommended to have max. 10 people per table, and ideally not more than 4 to 6 tables.
- Fourth, **ensure accessibility and equity**: make the process accessible and equitable for all stakeholders, considering language, disabilities, and cultural differences.

The role of the facilitator is crucial in these processes to assure trust, collaboration, and active participation (see box 'About facilitation'[4]). In conclusion, by following these best practices, organizers can create an inclusive, transparent, and empowering participatory process that maximizes stakeholder engagement and contributes to more informed decision-making.

ABOUT FACILITATION

Facilitation in participatory processes refers to the role of a facilitator who guides and supports a group of people through collaborative decision-making or problem-solving processes.

In the participatory processes, the facilitator must ensure each participant's right to speak. However, the mere right to speak is not enough as it risks creating a debate on conflicting positions, fostering polarising dynamics and crystallising power dynamics among participants. The facilitator must foster a dialogue, in which each participant takes the floor to offer his or her own point of view to stand alongside the other points of view in order to reach a common vision of the problem.

Fundamental to creating a dialogue between participants is active listening, emotional self-awareness and creative conflict management. The dynamics of active listening, fundamental for the facilitation of participatory processes, are related to the awareness and intelligent use of our emotions and creative conflict management.

References

1 netWORKs 4: Project financed by the German Ministry for Education and Research and involving research partners such as the Institute for Socio-Ecological Research (ISOE), the German Institute for Urbanistic (Difu) and the Berlin Municipal Department for Environment and Climate Protection: https://networks-group.de/de/networks-4/das-projekt.html

2 Gantioler, S. et al (2023). Report Conceptual and Action framework Low carbon | High air quality NbS potentials. D2.1—JUSTNature project.

3 Vance et al (2023). Assessment report Low carbon | High air quality NbS potentials & scenarios and future trajectories. D2.3—JUSTNature project.

4 Sclavi, Marianella e Buraschi, Daniel (2022). Democrazia partecipativa e arte di ascoltare. Ascolto Attivo srl, Milano

6 QUICK OVERVIEW OF THE MODULES

	MODULE 1	MODULE 2	MODULE 3
Topics & questions addressed	**(In-)justices** **Where** do you think issues of air quality, thermal and carbon (in-)justices, as well as flora-fauna-habitat (non-)inclusiveness, spatial and temporal (in-)justices occur the most in your city?	**Nature-based Solutions** **What** and where can NbS most impact urban challenges?	**Inclusiveness** **What** NbS could benefit from group inclusiveness in the city?
Aim of the module	**Identify key (in-)justices** in the city, looking for quality, thermal and carbon (in-)justices, as well as flora-fauna-habitat (non-)inclusiveness, spatial and temporal (in-)justices. **Identify places** in the city where various (in-)justices require urgent attention.	**Identify NbS suitable** for the city and able to meet urban challenges. **Identify places** in the city where the identified NbS should be implemented to enhance their effectiveness, utility, and contribution to broader justice.	**Identify the potential of group inclusiveness** in the city and discuss the effects of diverse NbS on marginal and vulnerable social groups. **Prioritize some areas of intervention** in the city where needs are more urgent or prevalent.
Activities steps	**Introduce** the main concepts in relation to ecological (space) (in-)justice aspects in urban context and briefly introduce the collaborative activity. **Collaboratively** identify in groups key challenges and (in-)justices and place them in the city. **Collaboratively** identify in groups key justices and place them in the city. **Plenary** session for joint discussion and conclusion.	**Introduce** suggested NbS categories and measures, the action hierarchy, and its substantive principles. **Collaboratively** discuss in groups various locations and potential implementation of NbS in the city. **Plenary** session for joint discussion and conclusion.	**Provide** a brief overview of the importance of NbS in the context of the city and for vulnerable groups. **Collaboratively** identify key vulnerable social groups and the main reasons why those vulnerabilities should be tackled by NbS. **Plenary** session for joint discussion and conclusion.

MODULE 4	MODULE 5	MODULE 6
Ecological (space) justice **What** is the implementation scale of the NbS and at what scale might it produce an impact? **Is** NbS newly constructed or does it involve the management, protection or restoration of an existing ecosystem? **What** are the main challenges that the chosen NbS could address most effectively? Why?	**Socio-ecological profiles and spatially explicit data** **What** are the urban features to consider for strategic planning of NbS? **What** are the prior NbS to be implemented to actively broad justice in the city?	**Climate scenarios** **What** key climate hazards can define the future climate scenario? **How** can the climate scenario impact urban ecosystems and society? **What** major (in-)justices will be exacerbated in the climate change scenario?
Get inspired by various considerations on the ecological (space) justice, related NbS vulnerable social groups, and matters for strategic planning. **Prioritize some NbS based** on their contribution to ecological (space) justice.	**Utilize, interpret, and discuss spatially explicit data** in participatory processes to support strategic planning of NbS in cities, by using maps illustrating the spatial distribution of conditions. **Create distinct profiles** of socio-economic and ecological conditions and disparities and co-assess the NbS potential.	**Collaboratively explore future climate scenarios** and how they will impact on NbS. **Develop common and actionable knowledge** of how locally expected climate/ environmental hazards potentially impact local ecosystems and society, and thus how NbS can effectively be designed or maintained to alleviate the impact.
Provide a brief overview of the Inspiration cards and the main concepts they include i.e., action hierarchy, principles adherence, justice potential, group inclusiveness. **Collaboratively** discuss the interconnections between NbS, justice, impacts on vulnerable groups, and other issues related to the implementation. **Plenary** session for joint discussion and conclusion.	**Introduce** the urban and/ or site context, presenting socio-ecological profiles or existing spatially relevant datasets and maps (e.g. distribution of air pollutants) **Collaboratively** reflect on major challenges in various areas of the city by placing the most relevant (in-)justices. **Co-create** socio-ecological profiles by using available maps and the persona method. **Select** NbS categories to be co-assessed. **Prioritize** activation of NbS potentials. **Plenary** session for joint discussion and conclusion.	**Present** and discuss the framework in which the climate scenarios are evolving. **Collaboratively** develop various climate scenarios with participants. **Get** an understanding of the spatial impact of the scenario narratives. **If** you are bold, try to cast back developments that might lead to a defined scenario narrative (preferred future).

What else to know before you start

The method-kit is designed to translate **ecological justice** and its components into actionable strategies, and suggests a practical approach to achieve integration of related considerations into the design and planning of cities and NbS activation more specifically. It draws upon insights from the conceptual and action framework developed in JUSTNature. The need to discuss **justice regarding NbS** emerges with respect to how NbS are expected to transform cities and their living conditions, to the distribution of their benefits and accessibility (who gets what), who has a voice in related decision-making processes (who gets asked) and to what extent different value systems are considered (who gets asked how). It is also important to ensure that various justice concepts are not applied superficially and interchangeably. Ideas of equality, inequality, equity, justice and injustice mean different things, and research as well as practical and civil society initiatives have different reasons for using a defined term (see Figure 5). Thus, their use should be carefully considered, though at the same time supported by practical guidance.

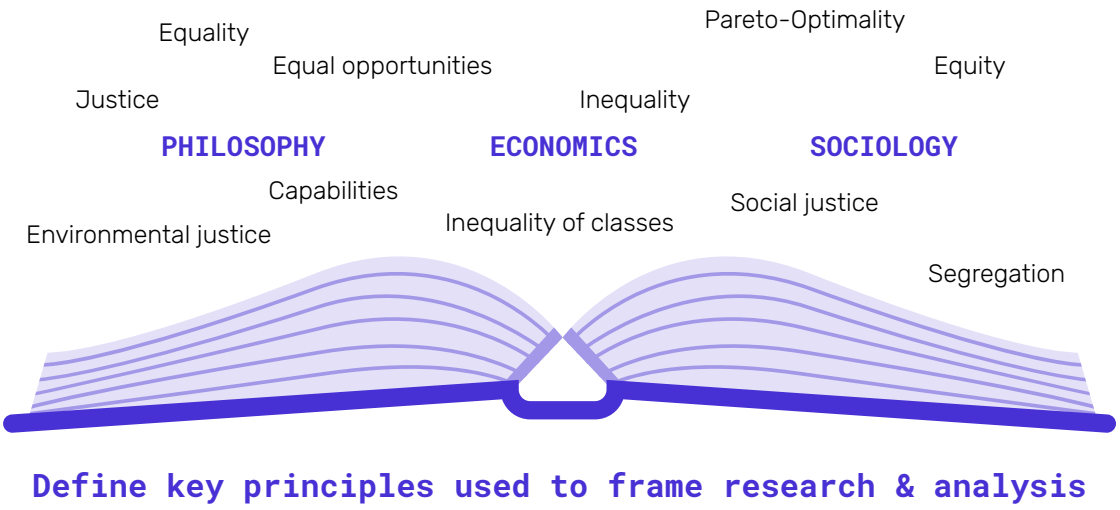

Figure 5: Disciplines and applied ethical notions, based on Gantioler, 2019[1]

Social justice is the most well-known and widely adopted concept and is mostly used to argue for a decrease of social inequalities, whether regarding higher or lower socio-economic status or linked to aspects as age, gender, religion or immigration background.

The concept of **environmental justice** evolved from the need to address the uneven distribution of environmental burdens (e.g. air and water pollution) between neighborhoods and communities. It was widened to also take the distribution of environmental goods (e.g. access to urban parks and gardens) into account. It also considers aspects such as procedural justice (which refers to who decides and participates in the decision-ma-

king process) and recognition justice (which refers to the basic respect and engagement of a diversity of cultures and perspectives).

Concepts of **climate justice, energy justice, and just transitions** have emerged on the international scene, bringing a more global perspective to the consequences of climate change, and/or especially for vulnerable groups (e.g. accountability global north and south, energy poverty). The just transition concept attempts to integrate all these concepts, based on the necessity to shift away from fossil fuels towards renewable energy sources or operating within planetary boundaries. While addressing multiple sustainability issues simultaneously, applying this concept does not necessarily yet help with addressing conflicting objectives and interests between the different concepts, for example, the placement of energy infrastructure and environmental justice concerns.

All these concepts have in common that they relate to the temporal aspects of justice and the long-term consequences for future generations.

1 WHAT IS ECOLOGICAL (SPACE) JUSTICE

The concept of **ecological space** puts emphasis on the interconnected relationship between human actions and the natural environment and hence is integral to NbS. It also stresses the importance of acknowledging and respecting the limitations imposed by ecological conditions, while also considering the needs and values of both humans and nature.

This perspective highlights the importance of addressing **ecological (space) (in-)justices**, understanding the different conditions driving them (see figure 6), the disparities cutting across various drivers (e.g. socio-economic status and building typology) and identifying effective intervention strategies to tackle these issues.

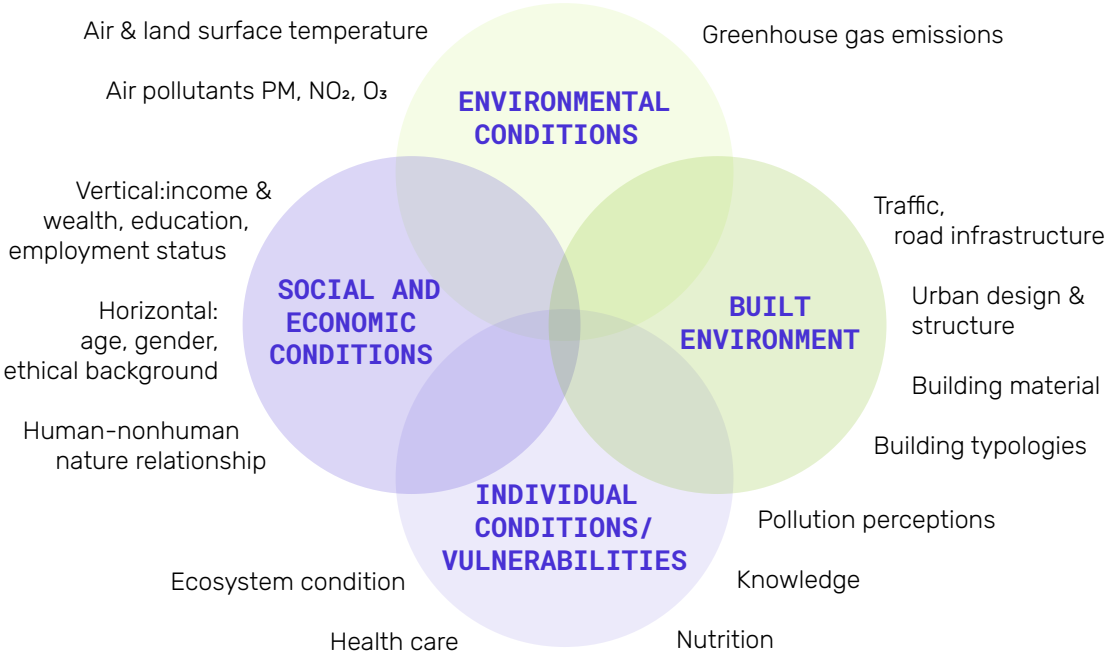

Figure 6: Drivers of ecological (space) (in-)justices. Source: Deliverable 2.1[2]

To better capture the multi-dimensional space of ecological justice and its complex interactions, we have identified **six key components** of justice, to serve as important entry points for strategically evaluating the potential of NbS.

These components encompass challenges such as disparities in exposure to air pollution and heat stress, disparities among groups in carbon emissions, disparities in the accessibility to the benefits of NbS for different groups, considering the inclusiveness in decisions of needs of the nonhuman element (natural environment) and long-term consequences of actions, especially in the context of climate change. A brief description of these challenges is provided in Annex 1.

2 HOW TO ACTIVATE NATURE-BASED SOLUTIONS

NbS encompass diverse solutions like greening infrastructure, parks, urban agriculture, and blue spaces. We propose a set of NbS categories and a list of intervention types for each of them (see Annex 1 for the list of NbS categories and measures).

What defines a NbS is its potential to: first address several societal challenges or injustices at the same time (systemic), second follow a defined order of taking action (action hierarchy), third respect a series of substantive and procedural principles, and last use a range of NbS categories and intervention types (see Figure 7). **NbS potentials** refer to the various capabilities and opportunities this approach offers.

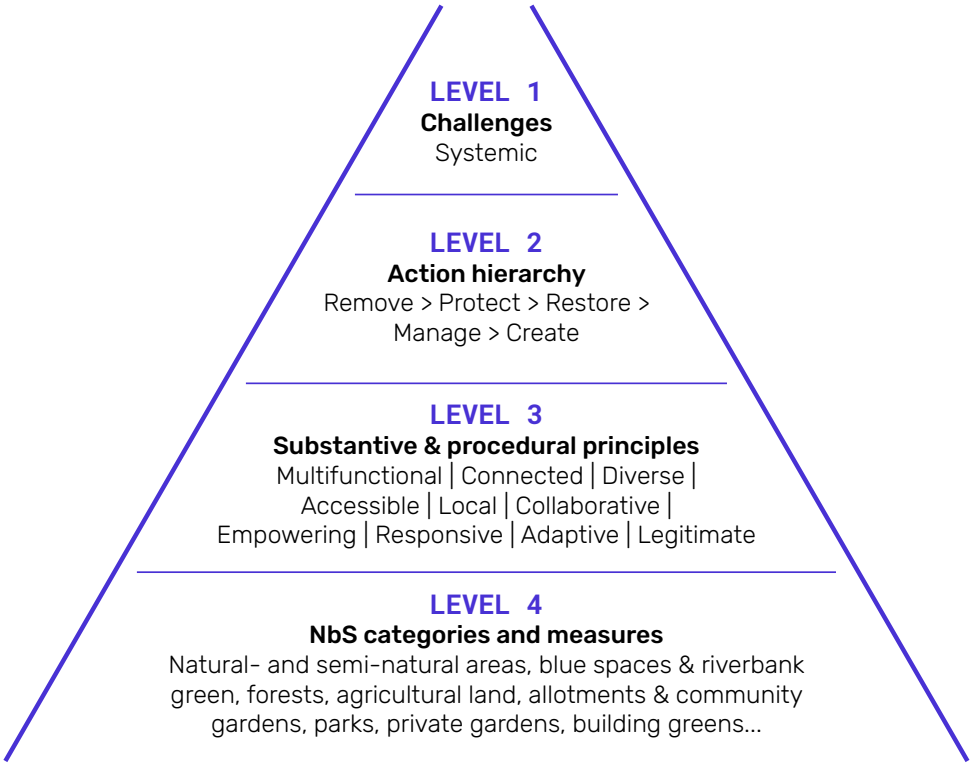

Figure 7: The various levels of activating NbS. Source: Deliverable 2.1, Deliverable 7.1[3]

These potentials encompass the **ability of NbS to contribute to multiple objectives** such as climate change mitigation and adaptation, air quality improvement, and overall environmental sustainability. They are not solely determined by ecological conditions like ecosystem health, structures, and configurations, but also by human and non-human needs, values, and visions of justice.

The potential of an NbS also depends on the respect of a specific **action hierarchy** (see Figure 8). When considering NbS to address specific challenges, the first choice of action would be to remove any disturbances at its root (e.g. causes of air pollution, greenhouse gas emissions) and eliminate threats to existing NbS (e.g. changing climate). NbS interventions should then be planned giving priority to existing ecosystems, protecting, managing or restoring existing solutions, and only as a final step engineering new NbS.

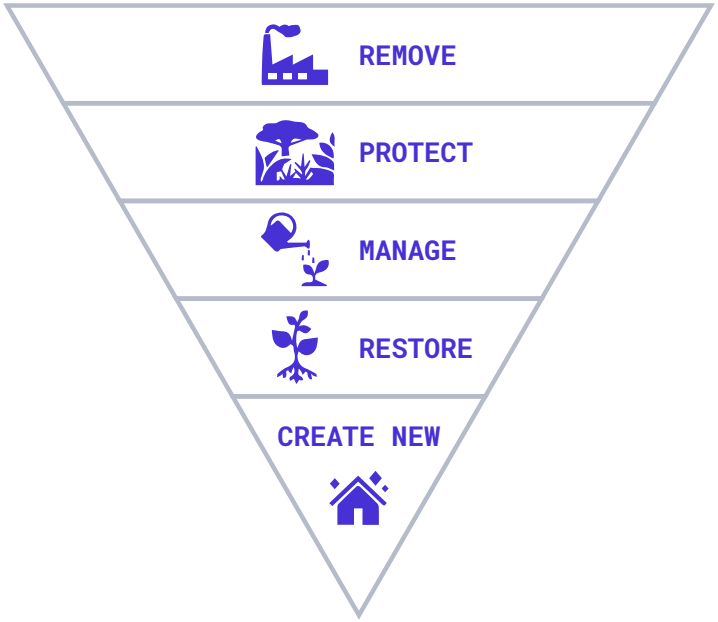

Figure 8: Action hierarchy. Source: Deliverable 2.1

NbS should be planned and designed according to key principles that aim to ensure that NbS potential is effectively realized and produces multiple benefits. These criteria are described below.

a. **Multifunctionality:** NbS should deliver a range of functions and benefits for people, nature and places, considering synergies and trade-offs. This principle emphasizes the need for planning NbS strategically to provide multiple benefits.
b. **Connectedness:** NbS should be planned in order to be physically (e.g. green link) and functionally (e.g. critical mass) connected to each other, as a living network for people and nature at all scales (within sites, across regions, at national scale).
c. **Diversity:** This principle refers to considerations of bio- and cultural-diversity. Key elements are implementing the right NbS in the right place, enhancing a mix of significant NbS, increasing diversity of habitats and species, and increasing the variety of cultural opportunities.

d. **Accessibility:** NbS should be planned to ensure accessibility to their benefits to various groups and to guarantee access to quality green spaces that are inclusive, safe, welcoming, well-managed and accessible for all.

e. **Responding:** NbS should respond to the local character of an area, meant as the natural, cultural, and perceptual aspects of landscape and how these elements interact, incorporating local needs and aesthetics.

3 THE MATTER OF INCLUSIVENESS

Questions of **social** and **ecological inclusiveness** give importance to the safeguarding of those environmental conditions on which social and economic goals depend. It is important to go beyond the anthropocentric approach and give importance to placing constraints on human activity that might exacerbate environmental degradation, while ensuring the inclusiveness of social groups that can be considered vulnerable or marginalized.

To effectively address justice challenges, the inclusion of considerations of vertical and horizontal **inequalities** is essential in the activation of NbS.

Vertical inequalities are based on the different distribution of resources (e.g. infrastructural, social, economic) that leads to some social groups to benefit disproportionately (e.g. green neighborhoods with no large road systems) and other social groups or some areas of the city to be vulnerable or marginalized. This includes living conditions of uncertainty and social and economic deprivation. Socially vulnerable groups (including people living below the poverty level, older people living alone, and people with pre-existing medical conditions) are the most affected by the health impacts of thermal injustice as well as air quality injustice. Age is the most relevant heat-vulnerability factor, as the elderly have shown higher mortality and hospital admission rates during heatwaves. In general, the areas of the city most exposed to high heat levels are often inhabited by socially vulnerable groups. Furthermore, the marginalized communities (e.g. individuals struggling with addiction, the homeless) are the least prepared for adapting to the effects of high temperatures, and for coping with their adverse impacts.

Beyond vertical inequalities, **horizontal inequalities** stem from, for example, diverse cultural backgrounds as well as different ages that lead to different lifestyles and milieus. These factors must also be taken into account in the strategic planning of NbS, considering needs, aspirations, and challenges.

Generally, NbS can serve as practical interventions aimed at enhancing human well-being, including physical and mental health. They can also mitigate the vulnerabilities faced by specific groups such as the elderly and low-income households during extreme weather events like heatwaves and other climate-related phenomena. Moreover, NbS can contribute to socio-psychological benefits by fostering stronger social relationships and improving mental well-being. Additionally, NbS can be planned according to diverse needs and aspirations of citizens.

From this perspective, it is crucial to promote collaborative efforts towards a co-creation of NbS to create environmentally sustainable solutions for all citizens.

4 THE NEED FOR INTEGRATED PROFILES

There is a growing need for strategic planning when activating NbS in cities. '**Strategic planning**' can be described as a process of sharing intentions and developing objectives and actual options to frame future activities (and operative planning). Although no common understanding of strategic planning exists, JUSTPlanT adopts the following definition: *'… a transformative and integrative, (preferably) public-sector-led socio-spatial process through which a vision, coherent actions, and means for implementation are produced that shape and frame what a place is and what it might become'*.[4]

Wider attention should be given to effective and strategic planning that allows enhancing the benefits of NbS as well as navigating trade-offs, considering the characteristics of different urban areas. To gain a better understanding of the distribution of certain environmental and social characteristics within the city (and existing disparities) we promote the use of spatial data in an integrated way.

In the context of the JUSTNature project, **ecological and socioeconomic disparities profiles** (referred to as **socio-ecological profiles** within JUSTPlanT) have been developed at the city level. A **profile** is defined as an agglomeration of urban units that are homogeneous in terms of injustice components. Comparing the different profiles, a description of the disparities and different situations of urban neighborhoods can be obtained. This, in turn, provides relevant information on the intervention priorities and needs.

The profiles developed in JUSTNature integrate different spatial indicators to provide a general picture and overview of the interrelation between several (in-)justices occurring in the city. It is expected that the development of socio-ecological profiles contributes to enhancing the **integrative knowledge base** in relation to the strategic planning and activation of NbS. The profiles were created through a **cluster analysis** considering the main features of the city in terms of morphology, infrastructures (green and others), air quality, and carbon emissions. Socio-economic information per census area was also included to discuss potential impacts on specific socio-economic configurations. The results of the analysis produced several profiles for each city. The resulting profiles only provide a first knowledge base for strategic decision-making, offering a preliminary analysis and suggesting areas where further **in-depth scrutiny** might be needed. These areas can then be the focus for discussions with stakeholders, centred on the identified critical issues.

To this end, the method-kit supports the co-creation of profiles through the use of available spatial indicators at the city level.

The profiles are built by working with the integration of available data and participants' knowledge of the most critical issues. This provides the opportunity to discuss the availability of data and their potential to provide a reliable representation of the main issues in the city.

5 ABOUT FUTURE NBS POTENTIALS

Securing biodiversity and managing urban ecosystems to ensure a long-term provision of multiple benefits is becoming increasingly challenging, due to the exacerbating impacts of climate change on cities. Understanding how these impacts affect the activation of NbS and especially their future potentials is of high importance. However, while there is a large body of literature on the potential of NbS to contribute to climate change mitigation and adaptation, there is much less research on how a changing climate impacts future NbS effectiveness.

Quantitative climate scenarios offer the possibility to explore future impacts, assess current and future vulnerabilities, to help identify and prioritize NbS as a measure for climate change mitigation and adaptation. To investigate the impacts of climate change at different scales and considering different scenarios, **climate models** are used. These models simulate the physical processes controlling the transfer of energy and materials through the climate system over time. Global climate models (GCM) simulate climate changes across the entire planet, encompassing the major components of the climate systems, i.e. atmosphere, land surface, oceans and sea ice. The GCM are combined with the **Shared Socio-economic Pathways (SSPs)** scenarios (see Figure 9), i.e. complex socio-economic scenarios that account for future regional changes in economic growth, urban planning, environmental policies and technological advances, and other anthropogenic climate drivers that influence greenhouse gas emissions and are linked to the resulting climate radiative forcing.[5]

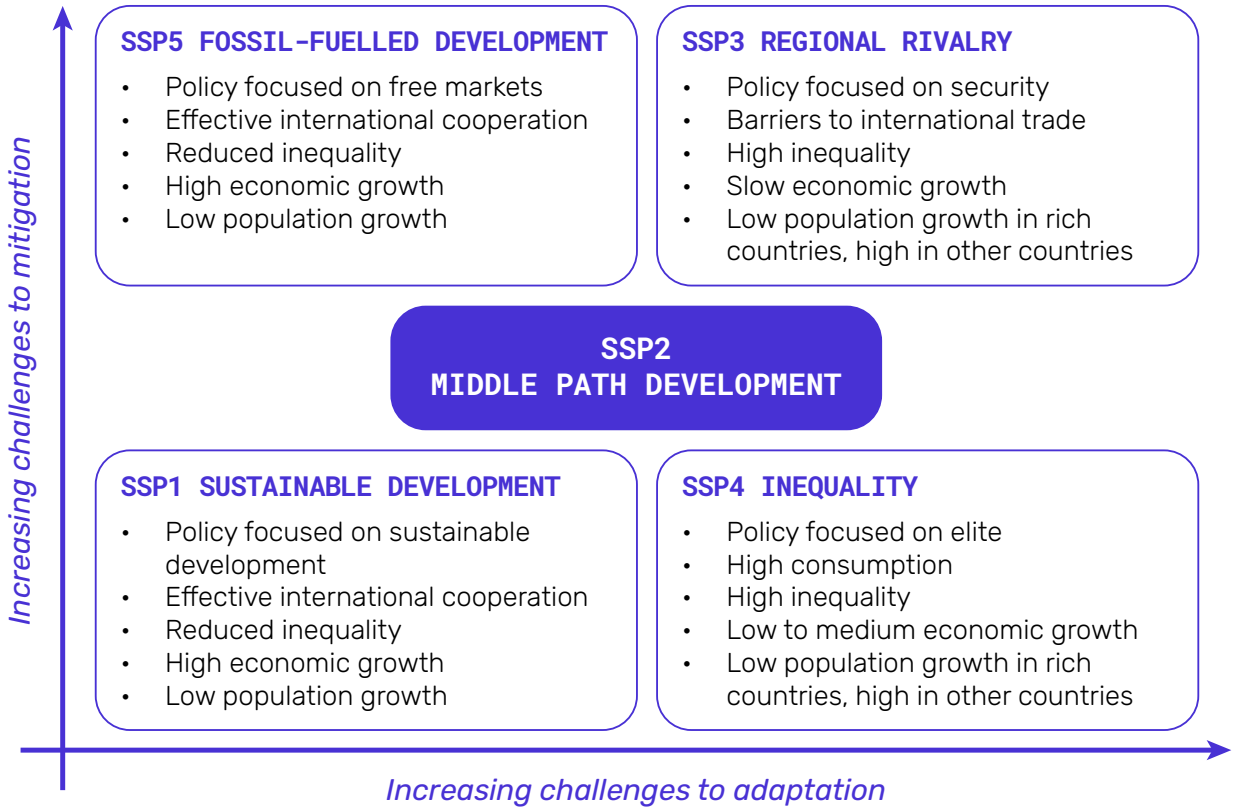

Figure 9: SSP scenarios categorized according to adaptation and mitigation challenges.[6] Note: The figure refers to five scenarios that describe alternative social and economic pathways that would lead to different future challenges in mitigating and adapting to climate change. Five more concrete scenarios linked to their radiative forcing are investigated by the Intergovernmental Panel on Climate Change.[7]

For assessing several, also more local impacts of climate change, including the influence on urban areas, models need to be downscaled to finer spatial resolutions than those offered by traditional GCM. This is partly happening by using regional climate models (RCM). However, the development of reliable quantitative climate change scenarios for cities faces several **challenges**:

- The availability or ability to compute data with the appropriate high-resolution required for policy considerations at the urban scale may be constrained. The development of climate scenarios requires the link between different scales - global, national and local - in a way that remains meaningful for stakeholders.
- Quantitative approaches based on SSPs and the use of climate models are time consuming and resource intensive, and still remain only a first approximation of alternative futures. Furthermore, they are not easily applicable at the urban scale with high-spatial resolution outputs.
- These approaches also privilege biophysical knowledge, potentially neglecting social aspects, such as the justice dimension.

Another option, which does not exclude the previous one but can be complementary, is the use of **participatory approaches to co-create scenarios** with local people based on experience, risk awareness and community aspirations. These can also be combined with further evolving future frameworks, building on more normative aspects, and taking into consideration human-nature relationships and associated value systems. This includes, for example, the IPBES **Nature Future Framework**.[8] The framework aims to support the development of scenarios of positive futures for nature, putting emphasis on the human-nature relationship using differentconceptions of value. One such conception values nature intrinsically, that is, 'nature for nature' and independent of its use to humans. Another values nature for the relationships it provides (relational values with e.g. a territory, landscape, or 'nature as culture'). Yet another values it for the services it provides to the individual, society, and the economy (instrumental values or 'nature for society').

References

1 Gantioler, S. (2019). The Right to Ecological Space in the City. TUM.University Press. https://www.ub.tum.de/en/node/786

2 Gantioler, S. et al (2023). Report Conceptual and Action framework Low carbon | High air quality NbS potentials. D2.1—JUSTNature project

3 Lim, Y. et al (2023). Report State-of-the-art on Good Practice for Co-governance of NbS. D7.1—JUSTNature project

4 Albrechts, L. (2006) 'Shifts in strategic spatial planning? some evidence from Europe and Australia', Environment and Planning A: Economy and Space, 38(6), pp. 1149–1170. doi:10.1068/a37304

5 https://atmosphere.copernicus.eu/climate-forcing

6 Riahi, K., et al (2017). The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global environmental change, 42, 153-168

7 IPCCC. (2021). Climate Change 2021, The Physical Science Basis, Summary for Policy Makers of the 6th Assessment of IPCCC. Working Group I, Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). https://www.ipcc.ch/report/ar6/wg1/

8 Nature Futures Framework developed by IPBES – Intergovernmental Platform on Biodiversity and Ecosystem Services https://www.ipbes.net/scenarios-models

Module 1
– Identifying key challenges/(in-)justices

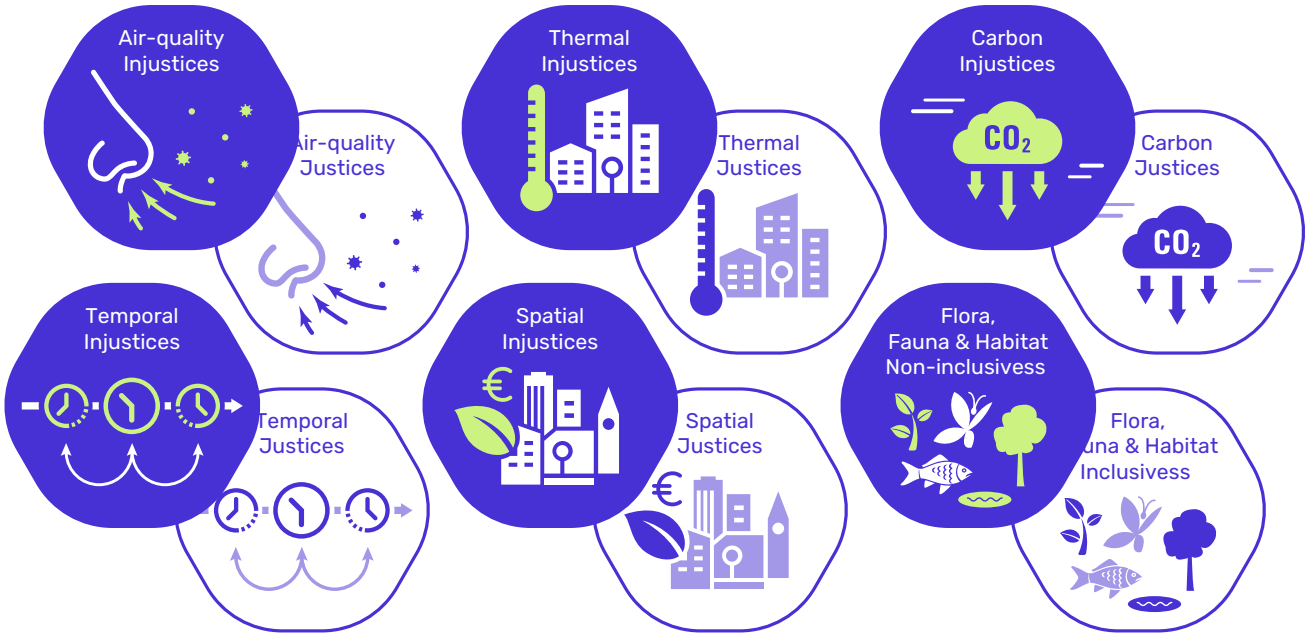

Figure 10: (In-)justice set of tokens

1 AIM OF THE MODULE

The overall objective of this module is to collaboratively identify justices and (in-)justices within a city's context and explore how (in-)justices are connected with NbS. This module provides essential insights on developing a common vision of (in-)justices and informing the development of various NbS options. To do that, the module uses tokens that represent six initial dimensions of ecological (space) justice considered relevant for determining Low carbon High air quality NbS potentials. These include air quality, thermal and carbon (in-)justices, as well as flora-fauna-habitat (non-)inclusiveness, spatial and temporal (in-)justices.

2 PREPARATION

To effectively prepare the module, please check the following list:

- Depending on your objectives, decide whether you would like to apply the module at a municipality scale or to discuss interventions and possible impacts at a defined development site. By employing maps and tokens, this process can be applied across various planning scales, from specific sites to city-wide initiatives, considering the different stages of NbS development.
- For each table, prepare a printed map (satellite image) of the city (preferably A2 or also A3) or the concerned neighbourhood or a defined site.
- Print 2-3 sets of the (In-)justice token files on A4 for each table, if possible, on thicker paper. Print out the NbS categories set double-sided and cut out the tokens.
- It is recommended to print 1 handout per table of Justice Challenges
- Prepare any additional materials to support the activities (e.g. post-its, dot stickers).
- Consider involving experts in relevant fields such as urban planning, climate change, social and environmental justice to provide insights through presentations at the beginning of the workshop or by facilitating the workshop sessions.

3 CARRYING OUT THE ACTIVITY

STEP 1: Introducing dimensions of justice

Time: 20 minutes Introduction and presentations | 10 minutes Introduction to the activity

Method: Presentation

- Present the scope of this activity.
- Introduce the main concepts in relation to justice aspects in an urban context. Open the floor for any initial questions or comments. Highlight any relevant information related to the city, neighborhood or site of interest.
- Using the Justice challenges handout, present and discuss the initial justice challenges described.
- To begin the activity, clearly state the module's objectives and describe the (In-)justice set of tokens and all the other materials on the table.

STEP 2: Identifying key (in-)justice or challenges

Time: 5-10 minutes Organisation | 20 minutes Facilitated work at tables

Method: Facilitated table discussion, using city/site maps and tokens

- Utilize the map of the city/neighborhood/site along with the (In-)justice set of tokens.
- If the focus of the activity is the entire city, let participants familiarize themselves with the map, recognizing key locations and familiar or known areas or neighborhoods.
- Using the injustice tokens and the (in-)justice description handout, briefly discuss the different (in-)justice components, providing a brief description of the aspects related to each of them and open the floor for any initial questions or comments.
- Once participants have become familiar with and discussed the different areas of the map and the various (in-)justices concepts, let them select the tokens they believe apply to the entire city (or to the selected site or neighborhood). Ask them to position the tokens on the map where the challenges or (in-) justices particularly occur.
- Guide the positions of tokens on the maps asking participants the following questions:

  a. Where do you think issues of air pollution occur the most?
  b. Where do you think heat stress has the greatest impact?
  c. Where do you think higher carbon emissions occur?
  d. Where do you think consideration of flora, fauna and habitat inclusiveness are less prevalent?
  e. Where do you think the main spatial (in-) justices occurs in relation to the distribution and impacts of major disturbances or the uneven distribution of environmental benefits?

f. Where on the map do you think historical developments and decisions had an impact on a specific current situation? Which are the affected social groups? And where are the most vulnerable areas to climate change located?

- Ask participants to provide a brief description of the situation for the different areas selected. Take notes of the reasons for selecting/positioning a token using post-its or hand-outs.
- Once all the selected tokens have been positioned on the map, let participants get an overview and discuss, answering the following questions:

  a. Are there key challenges that come up more frequently?

  b. Are there locations where more than one challenge appears?

  c. Are there key challenges that are less used or not used at all? For what reasons?

- Document this information by taking notes or by marking points on the maps to visually indicate challenges.

STEP 3: Identifying key justices or opportunities

Time: 15 minutes Facilitated work at tables

Method: Facilitated table discussion, using city/site maps and tokens

- Using the "Justice" set of tokens, let participants select tokens that apply to the defined site and position them on the map where opportunities particularly occur.
- Are there any particularly positive situations or successful examples in the city in relation to the six aspects considered? If specific situations are identified, let participants place the justice tokens on the map and provide a brief description of their reasoning.
- Reflect on and document answers to the following questions:

  a. Are there key opportunities that come up more frequently?

  b. Are there any locations where more than one opportunity appears?

  c. Are there key opportunities that are less used or not used at all? For which reasons?

STEP 4: Reflection and Documentation

Time: 10 minutes Recap | 15 minutes Final discussion and conclusion

Method: Facilitated table discussion, using city/site maps and tokens | Discussion in plenary session

- Document the information gathered from previous steps.
- Facilitate discussions by comparing the results of tables and highlighting challenges and opportunities .
- Encourage participants to reflect on the implications of their findings.

4 METHODS

Methods applied for the module include presentations, organization of facilitated tables using defined templates and materials, as well as moderated discussions.

NOTES

The set of tokens are structured in such a way as to lead participants to focus initially on (in-) justices within the urban context, i.e. on urban aspects and processes perceived as negative. Subsequently, participants focus on justices, i.e. on urban elements and processes perceived as positive that should be emphasized or further promoted. By shifting the focus from aspects perceived as negative to aspects perceived as positive, the activity aims to guide participants in the development of autonomous visions for socio-ecological transformations that consider the complexity of processes, emphasize the positive aspects and processes already present in the urban context, and highlight the issues to be addressed.

| REPORTING

To effectively report workshop results in a functional and practical way, provide the participants with materials to collect and summarize main findings and results of the discussion. It is recommended to work as much as possible on templates or tables, using pens, post-its etc., as they will represent the key results of the modules.

Consider taking pictures of all the materials on the tables, maps, positioned tokens, post-its, which also can be included in a presentation to be sent to the participants. Alternatively, the main results can be summarized in a small report.

MATERIALS TO PRINT

Please refer to Annex and print:

- (In-)justice set of tokens
- Overview handouts:
  - Justice Challenges

Additionally, please print:

- Map (satellite image) of the city (preferably A2 or also A3) or the concerned neighborhood or a defined site

Also, provide:

- Post-its, dot stickers, pens, markers

5 FURTHER READING

Deliverable 2.1 - Conceptual & action framework on Low carbon | High air quality NbS potentials

https://zenodo.org/records/7669322#.ZAB33T-3MK5c

Module 2
– Activating Nature-based Solutions

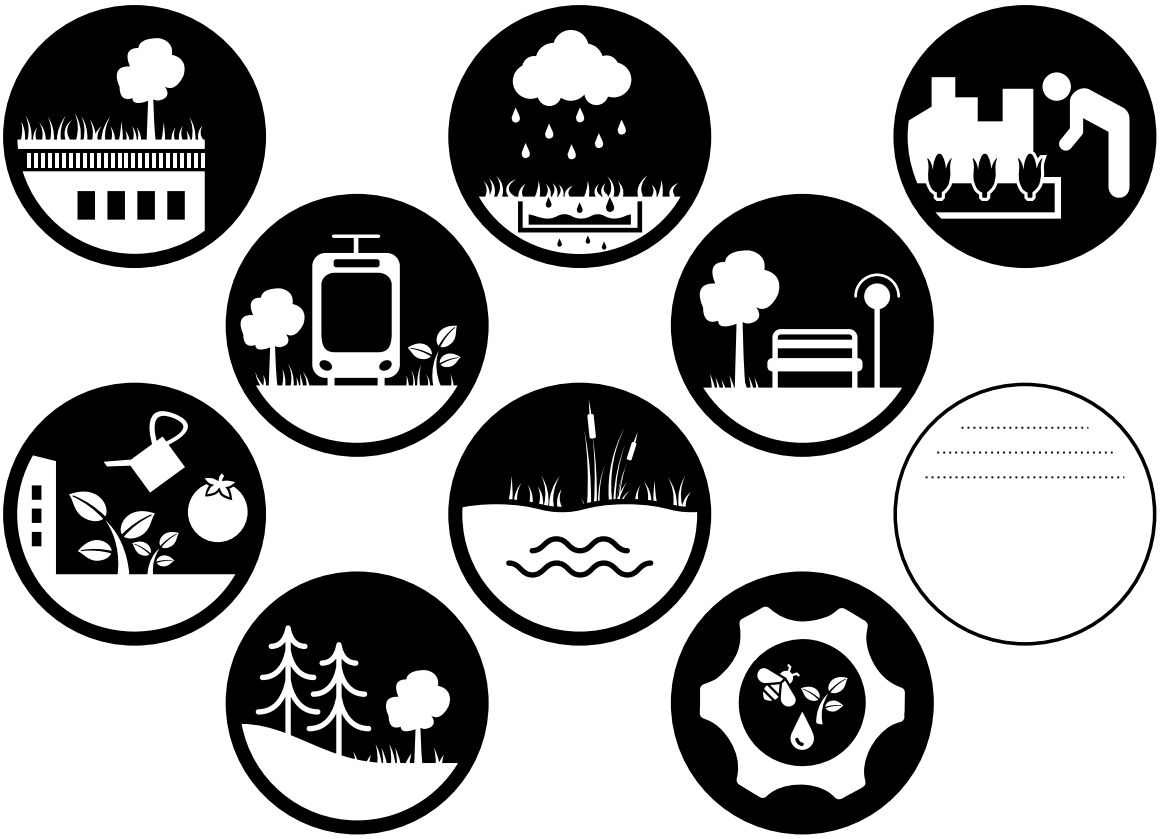

Figure 11: NbS categories and measures set of tokens

1 AIM OF THE MODULE

The overall objective of this module is to stimulate reflections on how NbS categories and measures can address urban challenges and leverage space (ecological) opportunities within the context of the city, neighborhood or selected site.

The NbS tokens can be used to discuss NbS, addressing their potential in relation to specific needs, challenges, or social groups that might be relevant because of the positive or negative impact the NbS could have on them. For these reasons, the tokens can be applied to the entire city, discussing potential suitable locations for specific NbS. Alternatively, they can be used to discuss the most suitable solutions for a defined site or neighborhood.

2 PREPARATION

To effectively prepare the module, please check the following list:

- Depending on your objectives, decide whether you would like to apply the module at a strategic municipality scale or to discuss interventions and possible impacts at a defined development site.
- For each table, prepare a printed map (satellite image) of the defined site (preferably A2 or also A3).
- Print 2-3 copies the according sets of token files on A4 for each table, if possible, on thicker paper. Print the NbS categories set double-sided and cut out the tokens.
- It is recommended to print 1 handout per table for:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles
- If necessary, distribute for each table all the material that might be used during the activities (e.g. post-its, dot stickers).
- Consider involving experts in relevant fields such as urban planning, climate change, social and environmental justice to provide insights through presentations at the beginning of the workshop or by facilitating the workshop sessions.

3 CARRYING OUT THE ACTIVITY

STEP 1: Introducing nature-based solutions

Proposed time: 20 minutes Introduction and presentations | 10 minutes Introduction to the activity

Method: Presentation

- Introduce the main concepts in relation to justice aspects and NbS in an urban context. Open the floor for any initial questions or comments.
- Using the material provided, introduce the suggested NbS categories and measures, the action hierarchy, and the substantive principles.
- Introduce any relevant information related to the city, neighborhood or site of interest.
- To begin the activity, clearly state the module's objectives and describe the NbS tokens and all the other materials on the table.
- Depending on the type of stakeholders involved, decide the distribution of people around tables. For example, to spark a discussion based on different perspectives, you can strive to ensure in each table diversity among the actors involved, including private actors, individual citizens, and public administrations, while also ensuring gender diversity at each table.
- It is recommended to have a facilitator at each table who provides information and assistance to the participants and facilitates discussion.

STEP 2: Identifying suitable NbS

Proposed time: 5-10 minutes Organisation | 20 minutes Facilitated work at tables

Method: Facilitated table discussion, using city/site maps and tokens

- If the focus of the activity is the entire city, use the map of the city and the NbS tokens to discuss various locations and potential implementation of NbS. Ask participants to evaluate suitable NbS for specific locations.
- Using the NbS tokens on the table, let participants position them on the map to identify key locations for specific NbS.
- Allow participants to reflect upon the token location by asking the following question:
  a. Why do you think this NbS category is particularly useful?
- In relation to the documentation and introductory material provided earlier, ask participants to reflect upon the following questions:
  a. What measure does the chosen NbS category involve?
  b. What action is needed for it to be a NbS?
  c. How does it represent key principles of a NbS?

| STEP 3: Conclusion and discussion

Proposed time: 10 minutes Recap | 15 minutes Final discussion and conclusion

Method: Facilitated table discussion, using city/site maps and tokens| Discussion in plenary session

- Allocate time for each group to briefly summarize the main discussion points and the main findings.
- Document the information gathered using the provided template.
- Encourage participants to reflect on the implications of their findings and identify possible implementations and strategies.
- Conclude with a plenary session for final discussion and conclusions.

4 METHODS

Methods applied for the module include presentations, organization of facilitated tables using defined templates and materials, as well as moderated discussions.

| NOTES

The tokens have been created to identify the main categories of NbS, such as green constructions (for example, green roofs), green spaces (such as parks or tree-lined avenues), and sustainable drainage systems (for example, swales). However, attributable to these categories, there are numerous examples of NbS. Before conducting this workshop, it is recommended to brainstorm local examples of NbS within the specific city context. These examples can be showcased during the workshop, providing clarification if someone asks for details on what is meant by each category.

| REPORTING

To effectively report workshop results in a functional and practical way, provide the participants with materials to collect and summarize main findings and results of the discussion. It is recommended to work as much as possible on templates or tables, using pens, post-its etc., as they will represent the key results of the modules.

Consider taking pictures of all the materials on the tables, maps, positioned tokens, and post-its, which also can be included in a presentation to be sent to the participants, or include the main results in a small report.

MATERIALS TO PRINT

Please refer to Annex and print:

- NbS tokens
- Overview handouts:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles

Additionally, please print:

- Map (satellite image) of the city (preferably A2 or also A3) or the concerned neighborhood or a defined site

Also, provide:

- Post-its, dot stickers, pens, markers

5 FURTHER READING

Deliverable 2.1 - Conceptual & action framework on Low carbon | High air quality NbS potentials

https://zenodo.org/records/7669322#.ZAB33T-3MK5c

Module 3
– Setting up NbS for group inclusiveness

Figure 12: Group inclusiveness set of tokens

1 AIM OF THE MODULE

The overall objective of this module is to enlarge group inclusiveness by exploring (in-)justices in the city. This includes the effects of specific NbS implementation on particular social groups and their non-involvement/ over-engagement in processes of activating NbS. The aim is to integrate social and ecological dimensions into the design of NbS interventions, enhancing the diverse inclusiveness of the solutions.

2 PREPARATION

To effectively prepare the module, please check the following list:

- Depending on your objectives, decide whether you would like to apply the module at a municipality scale or to discuss interventions and possible impacts at a defined development site.
- For each table prepare a printed map (satellite image) of the city (preferably A2 or also A3) or the concerned neighborhood or a defined site.
- Print 2-3 copies of the relevant set of token files on A4 for each table, ideally on thicker paper. Please print Group Inclusiveness set double-sided and cut out the tokens.
- It is recommended to print 1 handout (cheat sheets) per table of:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
- If necessary, distribute all the material that might be used during the activities to each table (e.g. post-its, dot stickers).

3 CARRYING OUT THE ACTIVITY

STEP 1: Introducing NbS and group inclusiveness

Proposed time: 20 minutes Introduction and presentations

Method: Presentation

- Provide a brief overview of the importance of NbS in the context of the city and for vulnerable groups. Consider engaging an external expert from the social sector, if needed, or involve a representative from a defined municipal department or initiative. Open the floor for any initial questions or comments.
- Using the material provided, introduce the specific concepts that will be important to understand and carry out the activity.
- To begin the activity, clearly state the module's objectives and describe the Group inclusiveness set of tokens and all the other materials on the table.
- Depending on the type of stakeholders involved, decide how to group the participants. For example, to spark a discussion based on different perspectives, you can strive to ensure each table has diversity among the actors involved, including private actors, individual citizens, and public administrations, while also ensuring gender diversity at each table.
- It is recommended to have a facilitator at each table who provides information and assistance to the participants and facilitates discussion.

STEP 2: Recognizing needs of group inclusiveness

Proposed time: 45 minutes Table activity

Method: Facilitated table discussion, using city/site maps and tokens

- Take the Group inclusiveness set of tokens.
- The scope of the activity will be to reflect upon i) which (in-)justices are experienced by different groups in the city, ii) whether some are more exposed or benefit more from certain conditions, and iii) how this (in-)justice could be addressed through NbS activation (see Module 2).
- Using the tokens on the table, let participants position them on the map. Ask them to position a token and briefly state:
  a. Why do you think this group is particularly important to be considered in the strategic planning of NbS?
  b. Are the social groups located on the map unevenly distributed? Is it worth prioritizing certain areas or social groups for NbS implementation?
- In relation to the groups positioned on the map, ask participants to reflect upon the following questions:
  a. What NbS (design) could be beneficial for this particular group?
  b. What action is needed to co-create NbS with this particular group?

STEP 3: Conclusion and discussion

Proposed time: 10 minutes Recap | 15 minutes Final discussion and conclusion

Method: Facilitated table discussion, using city/site maps and tokens| Discussion in plenary session

- Allocate time for each group to briefly summarize the main points discussed and the main findings.
- Encourage participants to reflect on the implications of their findings, identify possible implementations and strategies.
- Conclude with a plenary session for final discussion and conclusions.

4 METHODS

Methods applied for the module include presentations, organization of facilitated tables using defined templates and materials, as well as moderated discussions.

The method of active listening should be promoted during the discussion, irrespective of whether a facilitator is present. Active listening promotes understanding the other person's point of view characterized by genuine interest, a desire to explore the discussed concepts, and asking probing questions for further understanding. This approach may help to delve into some social vulnerabilities present in the city that are sometimes overlooked or unrecognized. Active listening can also initiate a network among social actors who have not collaborated yet, specifically those interested in implementing new NbS, those with an ecological perspective, and those with a perspective linked to the need to find benefits for vulnerable social groups.

NOTES

Beyond discussions on vulnerable social groups and the impact of NbS on their well-being, it is important to delve into the issue of horizontal and vertical inequalities to understand if addressing these inequalities is a priority in the implementation of NbS. This includes recognizing not only the differences between vulnerable and non-vulnerable social groups, but also acknowledging the diversities that should be considered, such as cultural or generational diversity, which can lead to different preferences, challenges, and conceptualizations of justice.

REPORTING

To effectively report workshop results in a functional and practical way, provide the participants with materials to collect and summarize the main findings and results of the discussion. It is recommended to work as much as possible on templates or tables, using pens, post-its etc., as they will represent the key results of the modules.

Consider taking pictures of all the materials on the tables, maps, positioned tokens, and post-its, which also can be included in a presentation to be sent to the participants, or include the main results in a small report.

MATERIALS TO PRINT

Please refer to Annex and print:

- Group inclusiveness set of tokens
- Overview handouts:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy

Additionally, please print:

- Map (satellite image) of the city (preferably A2 or also A3) or the concerned neighborhood or a defined site

Also, provide:

- Post-its, dot stickers, pens, markers

5 FURTHER READING

Deliverable 2.1 - Conceptual & action framework on Low carbon | High air quality NbS potentials

https://zenodo.org/records/7669322#.ZAB33T-3MK5c

Module 4
– Seeking inspiration on a just NbS activation

Front **Back**

Figure 13: Example of Inspiration card

1 AIM OF THE MODULE

Module 4 aims to guide considerations of ecological justice. A set of Inspiration cards is developed with the objective of inspiring reflection on a series of key principles and concepts related to NbS implementation.

The module is therefore built on the previous ones, complemented with additional concepts and principles to support the design, implementation, and maintenance of NbS. These new elements provide key indications related to prioritization and application of NbS in a way that allows expressing their full potential from a socioecological justice perspective.

The Inspiration cards can be used to discuss NbS, addressing their potential in relation to specific needs and challenges. Moreover, Inspiration cards can also be used to consider how NbS might impact specific social groups, either positively or negatively. For this reason, the Inspiration cards can be used to evaluate potential NbS and their implementation within the city, or to evaluate different NbS options in specific areas of a city.

INSPIRATION CARDS

Each card presents one NbS measure or a set of similar measures belonging to the same category. A short description of each NbS category and specific measures is shown in the back of the cards, together with example pictures.

The information included in each card refers to:

1. The level of the **action hierarchy** to which the NbS usually refers
2. The **scale** of potential implementation of the NbS
3. The **substantive principles** which are more critical for each measure and should be paid particular attention to
4. The **justice potential** of the measure or set of measures in relation to each component according to literature at present
5. The most **relevant groups** to pay particular attention in the design, implementation and maintenance of the NbS measure due to its potential impact or lack of impact

2 PREPARATION

To effectively prepare the module, please check the following list:

- Consider involving experts in relevant fields such as urban planning, climate change, social and environmental justice to provide valuable insights through presentations at the beginning of the workshop or by facilitating the workshop sessions.
- Depending on your objectives, decide whether you would like to apply the module at a municipality scale or to discuss interventions and possible impacts at a defined development site.
- If working on a development site, determine if any NbS solution(s) has already been identified. This will allow basing the activity and discussions around those solutions or enable participants to propose potential suitable solutions for the specific site.
- Depending on the number of participants expected, identify the number of tables needed. It is recommended to have max. 10 people per table, and ideally no more than 4 tables.
- For each table, prepare a printed map (satellite image) of the defined site (preferably A2 or also A3).
- Print 2-3 copies of the relevant sets of token files on A4 for each table, ideally on thicker paper. Please print the NbS categories set double-sided and cut out the tokens.
- Print a sufficient number of blank cards according to the number of participants/tables (preferably not more than 4 people working on the same card).
- Print a set of Inspiration cards per table in A5 format, preferably on thicker paper.
- It is recommended to print 1 handout per table of:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles
  - Additional insights

Some activities are supported by handouts and require the use of materials (e.g. post-its, dot stickers). Please decide whether this is useful and prepare material.

3 CARRYING OUT THE ACTIVITY

STEP 1: Introducing ecological justice and NbS

Proposed time: 20 minutes Presentation | 10 minutes Introduction to the activity

Method: Presentation

- Introduce the main objectives of the workshop.
- Present the main concepts in relation to justice aspects and NbS in the urban context. Introduce any relevant information related to

the city, neighborhood or site of interest.

- Using the material provided, introduce the specific concepts that will be important to understand and carry out the activity.
- To begin the activity, clearly state the module's objectives and describe the Inspiration cards and all the other materials on the table.

STEP 2: Discussing NbS potentials

Proposed time: 5-10 minutes Organisation | 20 minutes Facilitated work at tables

Method: Facilitated table discussion, using city/site maps and tokens

- Based on the objectives of the workshop and using the provided list of NbS categories and measures, choose at least two NbS to focus on.
- Using the blank Inspiration cards, let the participants fill in the card reflecting upon the following questions:

  a. What is the implementation scale of the NbS and at what scale does it have an impact?

  b. At what level of the action hierarchy is the NbS usually implemented? E.g. is it usually newly constructed? Does it involve the management, protection or restoration of an existing ecosystem?

  c. What are the main challenges the chosen NbS addresses? Why?

  d. What are the principles that are more critical when implementing the NbS?

  e. What are the groups that might be more affected by the NbS; what positive or negative impact might the NbS have on them?

Figure 14: Blank card

STEP 3: Comparison and discussion

Proposed time: 5-10 minutes Table discussion | 15 minutes Final discussion and conclusion

Method: Facilitated table discussion, using city/site maps and tokens | Discussion in plenary session

- Using the set of Inspiration cards provided, let participants take the card that includes the NbS measure discussed in the previous step.
- Facilitate a discussion allowing participants to compare and discuss about the results, and to reflect upon the following questions:

  a. What new insights or perspectives do the Inspiration cards offer?

  b. Are there any additional justice potentials or relevant groups identified on the Inspiration cards?

  c. Do the critical principles outlined on the Inspiration cards align with the previous discussion? If not, why not? Use the Additional insights handout for information on the different cards.

- Emphasize the importance of critically evaluating the Inspiration cards in the context of the local environment, socio-economic dynamics, and community needs.
- Encourage participants to draw connections between the insights gathered from the activity and existing literature or best practices in the field of ecological justice and NbS implementation.

4 METHODS

Methods applied for the module include presentations, organization of facilitated tables using defined templates and materials, as well as moderated discussions.

| NOTES

The complexity of Module 4 is greater than the previous three modules because it combines various concepts and categorizations. Therefore, it is very important to develop a simple and effective introduction to Inspiration cards. Furthermore, in order to propose inclusive NbS that reflect different elements of justice and incorporate multiple perspectives from future users, it is recommended to involve participants from different groups. These should include local administrations, businesses, civil society associations, research institutions, and all stakeholders and citizens who can in some way influence or be influenced by the NbS discussed. Engaging diverse perspectives and groups, the outcomes of this workshop are more credible and inclusive.

| REPORTING

To effectively report workshop results in a functional and practical way, provide the participants with materials to collect and summarize main findings and results of the discussion. It is recommended to work as much as possible on templates or tables, using pens, post-its etc., as they will represent the key results of the modules.

Consider taking pictures of all the materials on the tables, maps, positioned tokens, post-its, which can also be included in a presentation to be sent to the participants, or include the main results in a small report.

MATERIALS TO PRINT

Please refer to Annex and print:

- Inspiration cards
- Overview handouts:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles
  - Additional insights on Inspiration cards

Additionally, please print:

- Map (satellite image) of the defined site (preferably A2 or also A3)

Also, provide:

- Post-its, dot stickers, pens, markers

5 FURTHER READING

Deliverable 2.1 - Conceptual & action framework on Low carbon | High air quality NbS potentials

https://zenodo.org/records/7669322#.ZAB33T-3MK5c

Module 5
– Co-Assessing NbS potentials

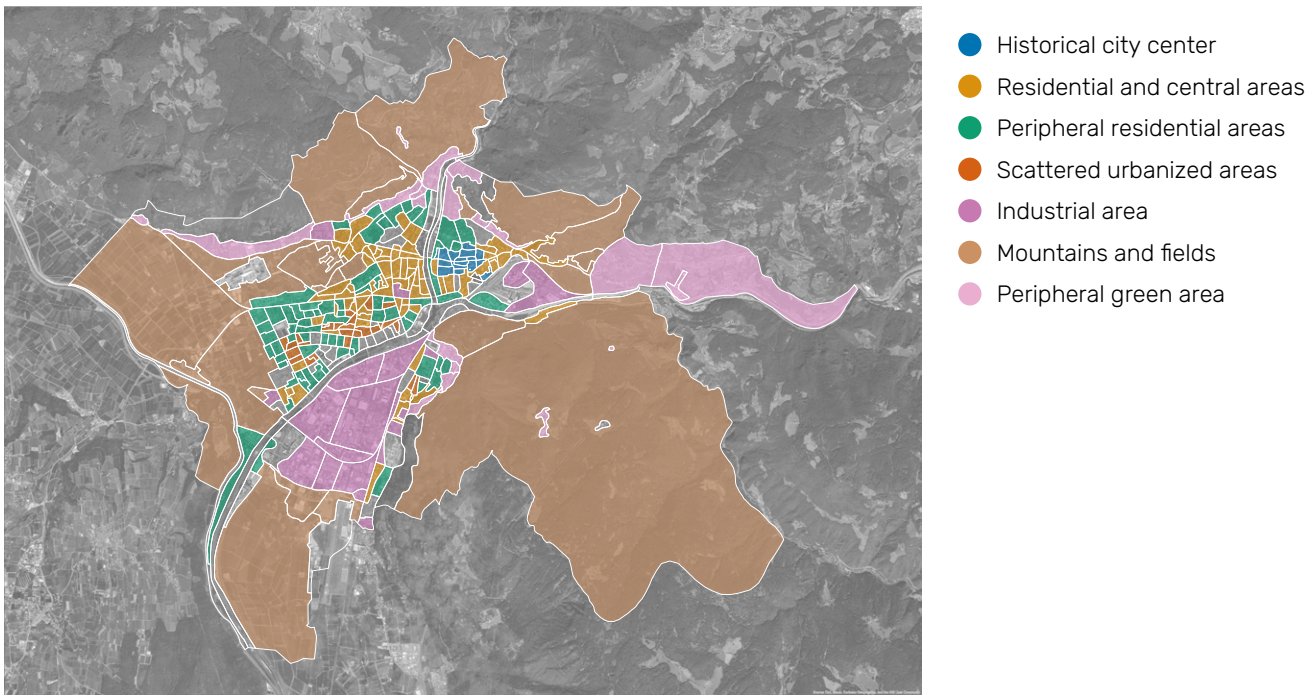

Figure 15: Example of Profiles, based on Deliverable 2.2

1 AIM OF THE MODULE

This module is developed with the objective of exploring the use of spatial data in participatory processes to support the strategic planning of NbS in cities. It introduces how the use of spatially explicit data can be used as an initial knowledge base for increased understanding and reflection on the main challenges in a city and their potential interactions. This, in turn, allows for a co-assessment of the potential for activating NbS.

The module requires the use of any available spatially explicit information at the city level for a co-creation process of socio-ecological profiles. This approach supports an interactive understanding of how different challenges occur and interact in the city, thereby facilitating the identification of suitable NbS that best address the defined profiles.

2 PREPARATION

To effectively prepare the module, please check the following list:

- Depending on your objectives, decide whether you would like to apply the module at a municipality scale or to discuss possible NbS to be applied at a defined development site in a distinct neighborhood. If you focus on a site of intervention, refer to defined areas of the neighborhood in which the site is located.
- It is essential to scrutinize the existence and availability of any relevant spatial information at the city level. Collect all site-specific data that are already available. It is important to have any data that can support the understanding of current (in-)justices or disparities, as well as other relevant social or environmental data that is spatially visualized or geographically correlated.

RELEVANT DATA TO COLLECT

Potentially useful data at the urban level include:

- Maps of the spatial distribution of air pollutants (e.g. PM2.5, PM10, NO_2; SO_2, O_3) or alternatively maps containing any information related to pollution sources (e.g. main and high-speed roads, industrial and residential sites).
- Maps indicating carbon emissions concentrations.
- Maps of carbon storage potential or alternatively land cover maps to be used as proxies for carbon storage potential for different landcovers.
- Maps of the vegetation quality and/or protected areas and sites or maps of the location and distribution of existing green infrastructure.
- Maps showing land use and land cover changes that have occurred over time.
- Maps of the population distribution according to socio-demographic characteristics (e.g. immigrant background, presence of elderlies and children). Maps of the availability of health and social services as well as other services relevant for well-being (e.g. markets).

These datasets can be obtained from environmental agencies, local inventory and datasets, satellite imagery e.g. Copernicus products.

- Any available sociodemographic and socio-economic data, possibly at municipal level or at district neighborhood level, if available.
- Any other available data set considered relevant for discussing main concerns and criticalities in cities can be also used.

- Like the previous recommendations, regarding the interactive part and discussions at tables, it is recommended to have max. 10 people per table, and ideally no more than 4 to 6 tables.
- For each table, print, if available, a map and one copy of the Profile template (preferably A2 or also A3).
- Optionally, you can also print the (In-)justice tokens (see STEP 2 below), the set of set of NbS tokens and the set of NbS Inspiration cards (see STEP 3 below) for each table.
- Print the Evaluation matrix for each NbS that facilitators want to be evaluated (max. 5), preferably on A2 or also A3, as this allows participants to work with post-its. The number of copies to be printed could be less than five if the NbS being considered for the site has been pre-selected, but preferably not.
- Each table will also need a printed map (satellite image) of the defined site (preferably A2 or also A3). It is recommended to print 1 Overview handout (a cheat sheet) per table including:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles
- Other required material & resources:
  - Post-its, pens & if needed dot stickers for rating results.

3 CARRYING OUT THE ACTIVITY

STEP 1: Introducing ecological justice and NbS

Proposed time: 20 – 30 minutes presentation | 15 – 20 minutes Q&A

Method: Presentation | Moderated question & answers session

- An overview of all the available information to be considered for the activity should be presented to participants. The most crucial data to be presented would be related to
  - Existing spatially relevant datasets and maps
  - Overview of NbS categories and measures.
- If this module is following the completion of other modules, briefly present again the outputs from the previous modules. In this way, they can be seen together as a collective pool of resources to be considered cohesively rather than distinct, separate pieces of information.
- Open the floor for any initial questions or comments. Please ensure that all the participants feel familiar with the available data. This may take more time depending on whether participants have had any previous exposure to such information as well as the quantity or complexity of what is available.
- When participants feel ready to move on, it is time to separate the participants into small groups and allow participants to identify internal table facilitators & note-takers, if it has not been done so already.

STEP 2: Co-creating socio-ecological profiles

Proposed time: 5-10 minutes Introduction & organization | 10 minutes major challenges | 10 minutes Set of (In-)justice tokens (optional) | 30 minutes Filling and naming profiles

Method: Facilitated discussion at participants tables using profiles template; persona method

- If you are working on different datasets, use the map to allow participants to identify the major challenges the maps hint at and where these are assumed to occur.
- If Module 5 is carried out independently, it could be useful to integrate the (In-)justice tokens (Module 1) to help identify the main locations on the map where one or more challenges appear to be particularly prevalent (for example, if you are focusing on air pollution, after analyzing the air pollution concentrations dataset, position the air quality (In-)justice tokens where the issues appear more prominent).
- Invite the groups to divide the city or the neighborhood where an intervention site is located into different smaller areas that

they think have some defined commonalities (or seem to be rather homogenous). It can be helpful to use the persona method: invite participants to think and describe an archetypal inhabitant of an area and the conditions the inhabitant lives in. Do not hesitate to use colored pencils to delineate such areas on the provided map of the city or the neighborhood.

- Following the discussions, use the Profile template to describe the identified areas (or personas) or revisit the presented profiles regarding key (in-)justices and socio-economic characteristics. Fold over or cover the 'Suitabale NbS' column, as this is going to be used in the following step.
- Try to give them a profile name (or discuss the names of already existing profiles) that synthesizes the key characteristics (e.g. rich and green).

Profile template

JUST NATURE

	PROFILES	KEY (IN-)JUSTICES	SOCIOECONOMIC CHARACTERISTICS	SUITABLE NBS
Area 1				
Area 2				
Area 3				
Area 4				
Area 5				
Area 6				

Fold here

Figure 16: Profile template – What socio-ecological disparities profiles do appear?

STEP 3: Selecting NbS categories to be co-assessed

Time: 10 minutes Selection | 20 minutes Discussion and filling of template | 30 minutes Suitability check (optional)

Method: Facilitated discussion at participants tables, using profiles template

- Use the overview of NbS categories and measures and ask each participant to identify 1-2 NbS they believe might be most relevant to the profiles of selected areas. If the NbS being considered for a specific intervention site has been predetermined, discuss the neighbouring areas and possible solutions.
- You can use the following question to guide participants:

  a. If there is a certain (in-)justice or stakeholder group(s) of special interest, how are needs addressed by the selected NbS?

- Ask the group to identify max. 5 NbS per area and include them in the Profile template. Allow groups to choose which parameters they use to select NbS. For example, groups may want to choose NbS based on whether it targets a particular (in-)justice (i.e. air quality or carbon justice) or a particular stakeholder group's needs or capacities (i.e. non-humans, future residents, other groups based on socio-demographic or –economic characteristics, etc).
- Optionally, or if the module is combined with Module 4, in a subsequent step draw the respective NbS Inspiration cards of the NbS that have been attributed to the profiles. Subsequently, carry out a suitability check of

NbS potential. For example, check to what extent the action hierarchy is respected, which principles are followed, which are the justice potentials addressed, and which groups need attention. Discuss whether the filled-out Profile template needs to be revised and keep track of the occurring changes.

STEP 4: Prioritizing activation of NbS potentials

Time: 25 minutes Delineation hubs & blind-spots | 10 minutes Initiating discussion | 30 minutes Evaluation matrix | 15 minutes conclusive session

Method: Facilitated discussion at participants tables, using Evaluation matrix

- Identify with the participants which profiles they consider as i) 'winner-takes-all hubs' (e.g. many environmental amenities, not much transformation), ii) 'looser-takes all hubs' (e.g. many environmental ills, highly transformative areas of increasing density), or iii) 'blind-spots' (e.g. not much knowledge about the area). For example, ask participants to allocate a specific color to those areas they identify as such on the Profile template (e.g. winner-takes-all hubs = yellow dot sticker).
- Detect those hubs or blind-spots on the maps of the city or the neighborhood provided at each table.
- Using the maps as the focal point, groups should now engage in a short collaborative discussion for understanding i) the key challenges or (in-)justices present, ii) which NbS can provide the best integration of justice at iii) which location, and iv) where there is a lack of information or data gap to be addressed.
- Draw on a flipchart sheet or provide a print-out of the Evaluation matrix. Based on the previous discussion, ask participants to use post-its to place i) selected challenges, ii) NbS categories & measures, iii) key locations, and iv) data blind spots according to:

  a. What could be worthwhile to further pursue if you consider its development desirable though not probable, e.g. a system of green roofs covering the city to improve water retention.

  b. What needs to be kept an eye on, given participants do not consider it desirable and also not probable, e.g. transformation of an urban park in a defined neighborhood.

  c. What to pay particular attention to (less desirable/ probable), e.g. disappearance or informal green used as recreation areas in looser-takes-all hubs.

  d. The main prize (desirable/probable), e.g. the development of new urban park in an otherwise neglected neighborhood.

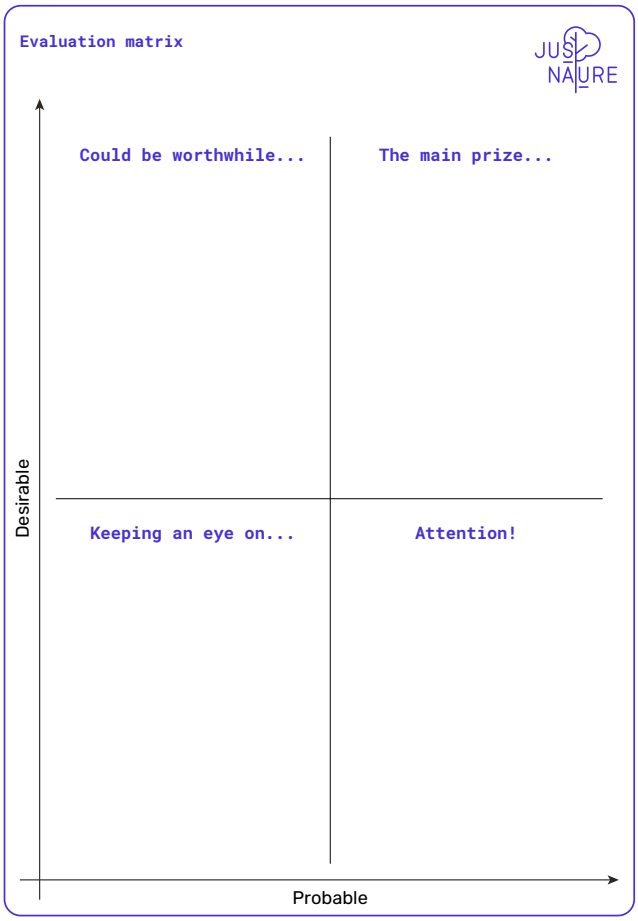

Figure 17: Evaluation matrix – What NbS potentials are revealed?

- Add a final conclusive session, during which the profiles developed at each table are presented and briefly discussed OR present results of challenging previous findings.

4 METHODS

Besides being strongly focused on the organization of facilitated tables using defined templates and materials, the module also introduces the approach of using personas. This approach is used in different contexts and sectors (e.g. ICT development), in order to get a better understanding of the key audience, target group or user group, combining quantitative and qualitative insights. In the framework of Module 5, the approach is recommended to be used to describe an archetypical fictional inhabitant of a defined area, district, neighborhood, in order to help describe socio-economic and living conditions, and possible key challenges.

Additional: If you are up to a challenge and would like to explore with experts the development of socio-ecological disparities profiles, please have a look at the box 'Working with socio-ecological profiles'. If time allows in your workshop, it is recommended that you use them at the beginning of STEP 2.

WORKING WITH SOCIO-ECOLOGICAL PROFILES

This module is created from the experience of creating and validating the socio-ecological profiles within JUSTNature (see Chapter 1.3).

One possible application of the module could involve the creation of socio-ecological profiles according to the methodology developed in JUSTNature (Zambelli et al., 2024[1]) to use them as a basis for the interactive session.

This would allow exploring the role and importance of such integrated information for better understanding how the main challenges are distributed and interact across the city. Such applications will also provide the opportunity to explore potential gaps in data and blind spots to be addressed.

The use of the socio-ecological profiles in participatory activity should be focused on two main objectives:

- First, gaining a better understanding of: (i) how different challenges interact within the city context; (ii) the disparities existing in the distribution of disturbances or environmental goods; (iii) how socio-economic characteristics of specific areas might interact (have an impact or being affected by) with the presence of specific environmental burdens.
- Second, integrating participants' considerations in relation to their specific knowledge or perceptions of the critical issues in the city. This will be an opportunity to discuss the current representation of critical issues gained from available data and assess potential gaps and blind spots to be addressed.

If you are interested in working with the socio-ecological profiles approach, please consult D2.2 for a detailed methodology, description of the work to be done, and a list of who to involve well in advance of the workshop.

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1 Zambelli, P. et al. (2024) Setting the stage for ecological and socioeconomic status & disparities profiles in the CIPELS, Zenodo. Available at: https://zenodo.org/records/10845144 (Accessed: 22 March 2024).

| NOTES

This activity can be slightly adapted if a single NbS type has already been chosen, but it is unclear which location or scale can be the most multifunctional or address as many principles as possible. In this alternative version, a few small changes would need to be made to the activities. While STEP 2 can generally be skipped, it would be worthwhile to still reflect on whether and how the NbS fulfills certain justice dimensions. This can help participants when choosing locations to include the strengths and weakness of the chosen NbS to better integrate those considerations into their choices. The materials are the same, but the matrix would be used to explore each proposed location rather than distinct NbS.

| REPORTING

It is recommended to work as much as possible using the Profile template and the maps, working with pens and post-its etc., as they will represent the key results of the module. Consider taking pictures of all the results, especially if also working with the maps, which can then be included in a presentation to be sent to the participants. The obtained results can be transformed into key recommendations to form the basis of a small report that outlines the next steps. This report is especially valuable as it offers an integrated knowledgebase to guide the integration of these recommendations into city-wide development programs.

MATERIALS TO PRINT

Please refer to Annex and print:

- Profile template
- Evaluation matrix
- Overview handouts:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles
- Additional insights on Inspiration cards

Additionally, please print:

- Map (satellite image) of the city (preferably A2 or also A3) or the concerned neighborhood or a defined site

If considered useful (as described in the Step description), print:

- (In-)justice set of tokens
- Inspiration cards

Also, provide:

- Post-its, dot stickers, pens, markers

5 FURTHER READING

Deliverable 2.1 - Conceptual & action framework on Low carbon | High air quality NbS potentials

https://zenodo.org/records/7669322#.ZAB33T-3MK5c

Deliverable 2.2 - Setting the stage for ecological and socioeconomic status & disparities profiles in the CiPeLs

https://zenodo.org/records/10845144

Module 6
– Developing future scenarios of NbS potentials

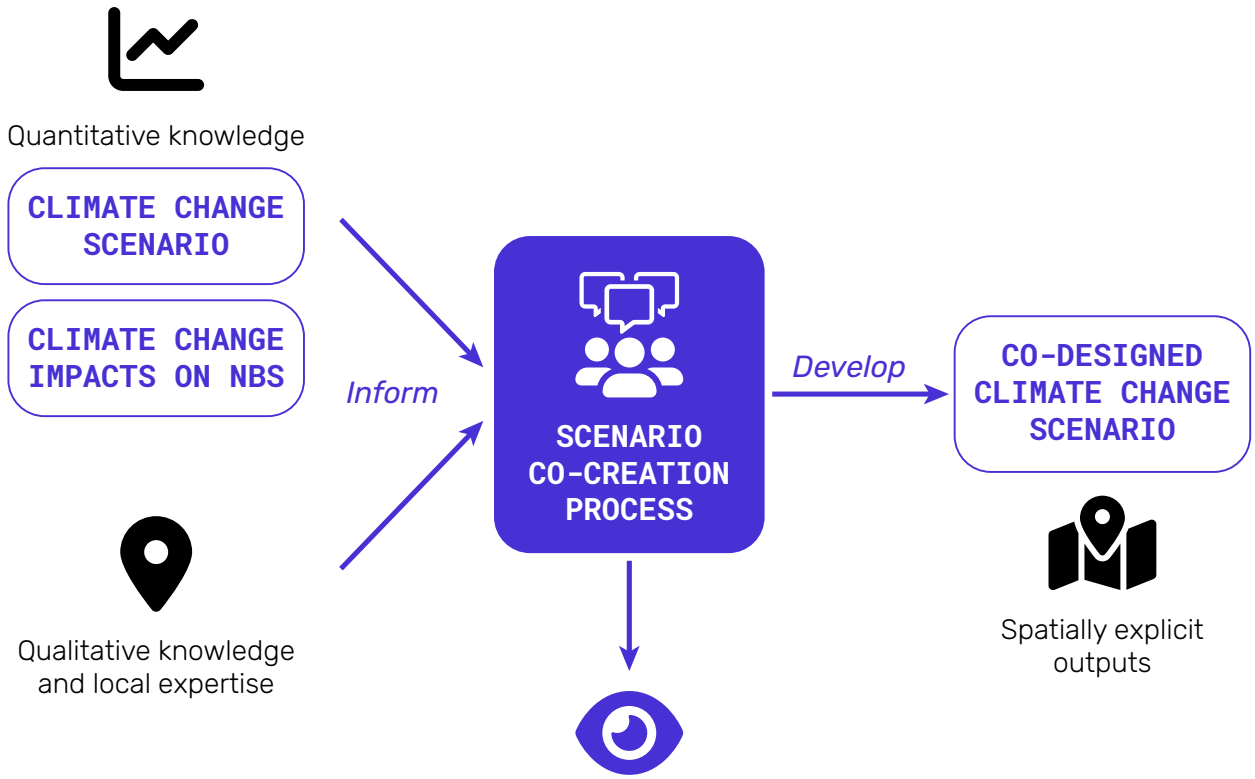

Figure 18: Combined and explored participatory climate change scenarios

1 AIM OF THE MODULE

The overall objective of this module is to collaboratively assess how the potential of NbS is envisaged to be impacted by future climate scenarios. These scenarios can be participatively explored or combined with quantitative scenarios. The aim is to develop common and actionable knowledge of how locally expected climate/environmental hazards potentially impact local ecosystems and society, and thus how NbS can effectively be designed or maintained to alleviate the impact.

Scenarios are stories that describe alternatives of how a future environment is envisioned to develop. Each scenario explores how different conditions are assumed to support or constrain the provision of a policy, strategic objectives, or, in this case, NbS potentials. Scenarios are not predictions, and are hence not right or wrong, but offer alternative pictures of the future.

2 PREPARATION

To effectively prepare the module, please check the following list:

- Depending on your objectives, decide whether you would like to apply the module at the strategic municipality scale or to discuss interventions and possible impacts at a defined development site,
- Inquire, for example, with research institutions, whether quantitative climate scenarios are already available and at what scale (e.g. local/regional/national).
- If scenarios are not at the desirable scale (e.g. local level), decide whether you can use those available (e.g. regional or national scale) as a basis to drive discussions for a combined participative climate scenarios approach.
- If no quantitative scenarios are available, consider involving a representative of a research institution to introduce the methodology used to develop quantitative climate scenarios, such as the shared socio-economic pathways framework (SSP) for an exploratory participatory climate scenarios approach. If the latter is used, consider printing the SSP overview (see chapter "What else to know before you start", p. "About future NbS potentials").
- Think about the timeframe or period you would like to consider, depending on whether you aim to discuss potential impact in the short-term (e.g. 2030-40), mid-term (2050-70) or long-term (2080-100). This should be aligned with key policy objectives (e.g. city development programme, sustainable energy and climate action plan, SECAP or biodiversity strategy and action plan).
- In line with previous recommendations, it is suggested to have max. 10 people per table, and ideally not more than 4 to 6 tables, to develop 1-2 scenarios per table.
- For each table, print 2 copies of the Scenario template, preferably A2 or also A3, as this allows participants to work with post-its. If only A4 is an option, consider printing several copies of the Scenario template.
- If you aim to do a forecasting or backcasting exercise, as described in STEP 1 and STEP 3 below, as well as under methods, please print an equal amount of the Timeline template as the scenarios template.
- If Module 6 is carried out as a stand-alone module, for STEP 3 of the activity, prepare a printed map (satellite image) of the defined site (preferably A2 or also A3).
- It is recommended to print 1 handout (A4) as cheat sheets per table including:
  - If available, any quantitative climate scenarios that are presented OR the shared socio-economic pathways overview
  - If part of the activity, an overview of the fore- and backcasting methodology
  - Overview of NbS categories and measures, to help discussions in STEP 2
- Other required material & resources:
  - Post-its, pens & if needed, dot stickers for rating results, e.g. STEP 4
  - Identify internal table facilitators & note-takers or let participants pick roles

3 CARRYING OUT THE ACTIVITY

This section describes the various steps of which the activity can be composed. Not all steps and components necessarily must be considered. They give, however, indications as to which ones are key, and which can be used to expand the exercise, potentially requiring more time.

STEP 1: Present and discuss the framework in which the scenarios are evolving

Proposed time: 20 minutes presentation | 10-15 minutes discussion OR 45' Forecasting (optional) | 5-10 minutes conclusion

Method: Presentation | Moderated discussion | Facilitated tables for forecasting exercise

- If quantitative scenarios at the local level are available, present them, including their underlying assumptions (e.g. shared socio-economic pathways) OR invite an expert to contribute with a presentation of the quantitative scenarios.
- If no quantitative scenarios are available, consider briefly presenting the shared socio-economic pathways (SSP) framework and resulting scenarios at the global/regio-

nal level OR invite an expert to contribute with a presentation.

- The presentation should be followed by a short discussion on how pathways evolve at the local level, and by deciding the timeframe to be considered for the scenarios (e.g. 2030, 2040).
- Alternatively, a foresighting exercise can be considered: For defined topics or trends and the envisioned period (present to 2030 or 2040 or 2100), possible evolving pathways are collaboratively developed with participants at separate tables, leading to ONE defined image of the future per table. The results are discussed to inform the development of the scenarios or alternative futures.
- At this stage, you can consider whether to conclude the step by deciding with the participants which 4-6 key scenarios will be further used by naming them (provide a title), or you follow this decision up in the next step.

STEP 2: Collaboratively develop various climate scenarios with participants

Proposed time: 5-10 minutes Organisation | 50 minutes Facilitated work at tables (e.g. 10, 10, 20, 20 minutes) | 10-20 minutes conclusion

Method: Facilitated elaboration of the Scenario template by participants | Use of tokens & Inspiration cards (if not yet happened)

- If you have decided the title of 4-6 scenarios in the previous step, it is recommended to create a separate table for each scenario.
- If this was not the case, ask each table to define and develop 1-2 scenarios. Separate participants to different tables (4-6) and
- Use the Scenario template, to define a scenario narrative or story:
  - Decide on the scenario or vision | name (e.g. higher temperatures, increased precipitation, higher air pollution).
  - Discuss and define the key climate/environmental hazards that define the scenario.
  - Discuss and define the possible impacts on urban ecosystems and society (incl. economy).

Scenario template

JUST NATURE

SCENARIO

N° .....
Name .....

Climate hazards

Impact on urban ecosystems

Impact on society

Low carbon | High air quality NbS

Scenario template

JUST NATURE

SCENARIO

N° .....
Name Higher temperatures

Climate hazards

- More frequent heatwaves
- Exacerbated UHI effects
- Increased severe and intense drought periods
- Water shortages
- Decreased air quality

Impact on urban ecosystems

- Changes in habitat conditions and quality
- Increased physiological stress on fauna
- Reduced evapotranspiration from vegetation, cooling effect consequently diminished
- Wildfire risk
- Food insecurity

Impact on society

- Health impacts: heat-related illnesses
- Increased energy consumption due to air conditioning (link with energy poverty)
- Vulnerable groups are the most affected

Low carbon | High air quality NbS

- Definition of suitable solutions
- Management planning as climate change progresses (e.g. irrigation needs and water availability)

Figure 19: Scenario template, including example – What images of the future impact and NbS activation?

- Provide an overview of potential NbS using related tokens or Inspiration cards, discuss and define which solutions might be i) adequate, ii) inadequate or iii) need to be managed differently. Optionally, you can also label the NbS according to their attributed value, whether they are valued as 'nature for nature', 'nature as culture', or 'nature for society' solutions (see Chapter 'What else to know before you start).
- If you conclude with the scenario narratives, add a final conclusive session during which the scenarios developed at each table are presented and briefly discussed.

STEP 3: Getting an understanding of the spatial impact of the scenario narratives

Time: 5-10 minutes Organisation | 30 -50 minutes Facilitated work at tables (e.g. 10-10-10 minutes) | 10-20 minutes conclusion

Method: Facilitated table discussion, using city maps or project designs

- If you are combing this module with other modules of the method-kit, use the scenario narratives to challenge all the results of the previous modules considering future developments.
- Offer the opportunity to select 1-2 key scenarios at each participant table, and revisit the results of a table developed using sets of tokens/Inspiration cards OR discuss using a map or project designs:

  1a. What major (in-)justices will be exacerbated in the climate change scenario?

  1b. Which justice dimension or challenge should be prioritized?

  1c. Which groups will be most affected?

  2a. Which area of the city or site is going to be most affected?

  2b. Which area of the city or site requires more immediate interventions?

  3. What needs to be considered for the activation of NbS?

- Add a final conclusive session, during which the scenarios developed at each table are presented and briefly discussed OR present results of challenging previous findings.

STEP 4: If you are bold, try to cast back developments that might lead to a defined scenario narrative (preferred future)

Time: 5-10 minutes Organisation | 15 minutes Discussion differences present & future | 45 minutes Timeline & milestones development | 15 minutes Within control or outside control | 30 minutes key steps

Method: Backcasting from desirable images of the future

- Offer the opportunity to select 1-2 scenarios narratives at each participant table. Ask to select those that should be avoided at any cost, AND/OR offer a preferred future linked to the definition of suitable NbS solutions. These both constitute desirable images of the future.
- Discuss the key differences between the present and the preferred future.
- After agreeing on the preferred future(s), pathways can be drafted. To this end draw a timeline/using the Timeline template and posit milestones of key changes for various areas of intervention (e.g. climate and energy policies, city programmes/strategies/plans).
- Identify which changes you think are in the group's/department's/city's control and which are not, e.g. using coloured dot stickers.
- Identify 5 initial key steps carried out to reach the key change in your control.
- Identify 3 initial channels of influencing or facilitating key steps for changes outside your immediate control.

4 METHODS

Besides including presentations, the organization of facilitated tables using defined templates and materials, working with scenarios, as well as moderated discussions, the module also introduces the approach of back- and forecasting or foresighting.

The forecasting approach works from a present situation, defining key events, trends and drivers for agreed topics over a distinct period of time, which lead to one imagined future. Given this does not produce a prediction (e.g. like a

weather forecast) but refers to a vision of the future that is assumed to happen, it can also be referred to as foresighting, especially if multiple assumed images of the future are produced in the workshop setting. Such an approach can be helpful in getting a better understanding of how participants imagine a likely future to evolve and based on what assumptions, particularly if related quantitative data are not available at the desired scale (e.g. site level). For the collaborative exploration of climate scenarios at the local scale, this can, for example, refer to assumed population developments, urbanization & land use changes, socio-economic conditions or key policy developments.

The backcasting approach works back from images of the future, whether desirable or to be avoided, to define milestones of key changes for various areas of interventions. As such, the aim is different, as it puts the focus on how to collaboratively achieve or avoid a defined future by identifying important changes and the key steps to be carried out or facilitated. It can open spaces for collaborative actions for transformative change, engaging different stakeholders and citizens and gaining their support. For the collaborative exploration of climate scenarios at the local scale, areas of intervention can, for example, include climate and energy or biodiversity action plans and strategies as well as wider municipal development programs.

The Timeline template below can be used for both a forecasting and backcasting exercise. Resulting or selected images of the future (visions) can be included in the violet circles, while key periods are integrated in the violet boxes on the timeline. The empty boxes are used to record key events according to defined topics.

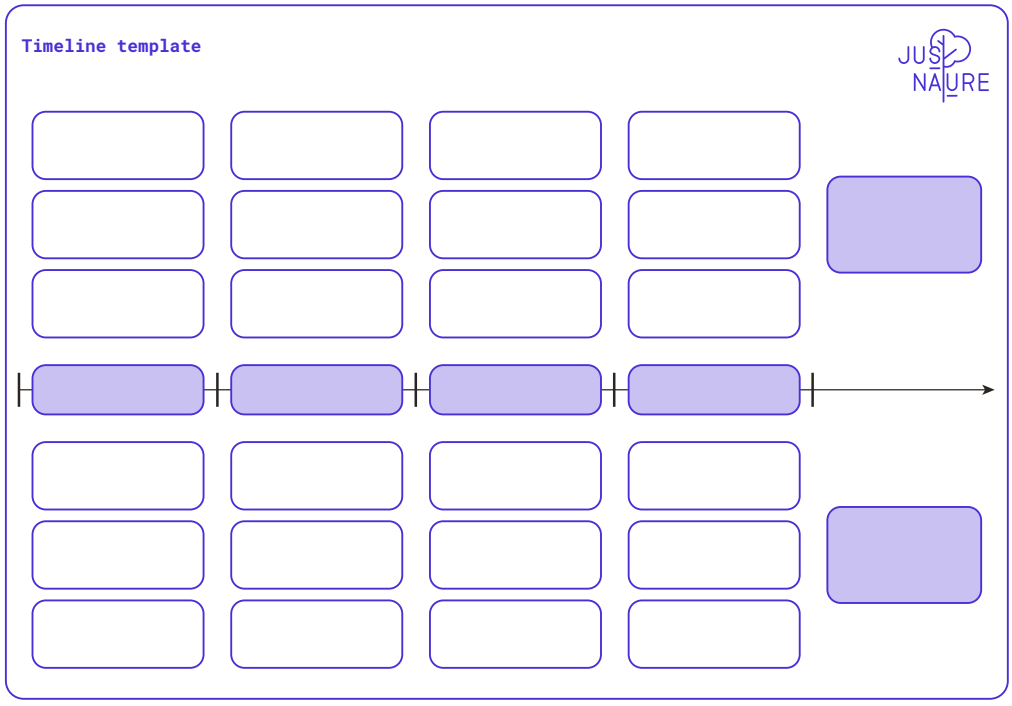

Figure 20: Timeline template – What visions appear and how do images of the future inform the present?

NOTES

If quantitative climate scenarios or shared socio-economic pathways are presented by external experts, careful consideration should be given regarding who to invite. The expert should be proficient in communicating at the science-policy-society interface, avoiding jargon, and providing sufficient humility to recognize the knowledge and value delivered by participatory climate scenarios development.

If forecasting or backcasting is adopted as a method, carefully consider what areas should be discussed and that the various participants cover those areas with regard to the knowledge they might bring to the table. This strongly depends on the objectives set for applying this method (e.g. development of policy options, re-elaborate urban programmes and plans).

| REPORTING

It is recommended to work as much as possible on the templates, using pens, post-its etc., as they will represent the key results of the modules. Consider taking pictures of all the scenarios narratives or back- and forecasting timeline, which also can be included in a presentation to be sent to the participants. If Module 6 is applied with other modules, it is important to document any changes that occurred, after assessing the results of previous modules under different scenarios. This can be achieved by taking pictures of the tables results BEFORE and AFTER working with Module 6.

The insights gained can also be transformed into a small report, particularly if STEP 4 on backcasting is applied, as this can form an important basis for further discussion and for defining a roadmap of activities.

MATERIALS TO PRINT

Please refer to Annex and print:

- Scenario template
- Timeline template
- Overview handouts:
  - Justice Challenges
  - NbS Categories and Measures
  - Action Hierarchy
  - Substantive Principles

Additionally, please print:

- Map (satellite image) of the city (preferably A2 or also A3) or the concerned neighborhood or a defined site

Also, provide:

- Post-its, dot stickers, pens, markers

5 FURTHER READING

Deliverable 2.1 - Conceptual & action framework on Low carbon | High air quality NbS potentials

https://zenodo.org/records/7669322#.ZAB33T-3MK5c

Useful and Creative Scenarios & Future Lab Toolkits

https://foresight.unglobalpulse.net/

Potential combinations

MODULE 1 + MODULE 2 + MODULE 3

Module 1, 2 and 3 can be used independently to discuss different key challenges and opportunities, different types of NbS and potential locations for their implementation, and the presence of specific vulnerabilities in the city.

However, the identification of justice challenges and opportunities is particularly useful as a starting point to discuss suitable NbS that could support overcoming the identified challenges. Additionally, it allows for exploring the potential impact of both the challenges and the proposed NbS interventions on specific social groups. For this reason, it is highly recommended to combine the three modules, thereby enhancing the richness of discussions and the potential impact of the workshop outcomes.

Aim: This combination ensures a general understanding of justice and (in-)justice in the urban context and the identification of vulnerable groups that are critical for implementing impactful NbS measures.

Time: 3 to 4 hours

| HOW to

Following the completion of Module 1, apply Module 2 and the NbS set of tokens to let participants select suitable NbS accordingly to the challenges and opportunities identified and let them position the selected NbS tokens where these particularly occur. Finally, conduct Module 3 and use the Group inclusiveness set of tokens to prompt reflection on the varied experiences of justice and (in-)justice among different groups, considering how this might affect priorities for planning, designing, or implementing NbS.

MODULES 1 - 2 - 3 + MODULE 4

Module 4 encompasses the concepts introduced in previous modules. Its integration can be useful to reach a more comprehensive discussion after the participants have familiarized themselves with the main key concepts through the use of tokens.

Aim: This combination enables participants to gradually delve into the different concepts related to NbS potentials, gaining a comprehensive understanding of how these relate to the NbS implementation. This gradual approach sets the stage for more thoughtful considerations of the different aspects involved.

Time: 4 to 5 hours

| HOW to

Following the application of all the previous modules, continue with Module 4, and based on the NbS identified in Module 2, discuss it using the set of Inspiration cards. Using the blank card, let the participant fill in the card reflecting upon the questions included in STEP 2 of Module 4. Proceed with STEP 3 to compare and discuss the results with the corresponding Inspiration card.

MODULES 1 - 2 - 3 - 4 + MODULE 5

Aim: An opportunity to revisit some of the previous outputs by comparing it with a defined knowledge based (e.g. quantitative and qualitative data).

Time: 1 day or more

Module 5 is designed as a stand-alone module. It is written in a way that can be used either with methodologies developed as part of JUSTNature or with alternative quantitative and qualitative data.

However, the full potential of Module 5 is realized when combined with any or all of the previous modules, if sufficient time is available. As already indicated in the description of the various steps, using Modules 1 through 4 and their outputs can directly inform this module.

| HOW to

There are 2 potential options on how to combine the different modules:

- **a.** Integrate the use of the different sets of tokens or the Inspiration cards as part of the activities of Module 5, as suggested in various steps of the activity. They will be helpful in guiding the discussion (e.g. identifying key challenges) or testing the results (e.g. suitability check).
- **b.** Consider applying the various modules and, in a final step, let participants at the tables compare the previous results with the provided socio-ecological profiles or other relevant maps. This can be guided by the question "*Which blind-spots (issues not addressed so far) are revealed by the profiles compared with the results by e.g. Module 1 & Module 2?*"

MODULES 1 - 2 - 3 - 4 - 5 + MODULE 6

Aim: An opportunity to challenge all the results of the previous modules considering future developments.

Time: 1 day or more

Whereas the previous modules put the focus on activating knowledge on current situations, challenges and solutions, Module 6 considers the role of future developments. Module 6 can also be applied individually, however, it reveals its full potential when combined with all other modules, if sufficient time is available.

| HOW to

Following the completion of all previous modules, continue with Module 6, and incorporate a final session that involves interactive work at participants tables regarding the following questions:

- **1a.** What major (in-)justices will be exacerbated in the climate change scenario?
- **1b.** Which justice dimension or challenge should be prioritized?
- **1c.** Which groups will be most affected?
- **2a.** Which area of the city or site is going to be most affected?
- **2b.** Which area of the city or site requires more immediate interventions?
- **3** What needs to be considered for the activation of NbS?

Please consult STEP 3 of the activities of Module 6 to get a better understanding of the process involved.

Other potential combinations

MODULES 1 + MODULE 4

| HOW to

Following the application of Module 1, use the results to continue with Module 4. Incorporate a final session that involves interactive work at tables, where participants select one or more NbS options that they believe could effectively address the identified (in-)justices. Facilitate this selection process by using the set of Inspiration cards. After selecting one or more NbS from the provided Inspiration cards, proceed to reflect on the activity by using the following guiding questions:

a. At what scale has the NbS the potential to produce an impact?

b. To what level of the action hierarchy is the NbS usually implemented?

c. What are the principles that are more critical when implementing the NbS?

d. What are the groups that might be more affected by the NbS; what positive or negative impact might the NbS have on them?

Aim: An opportunity to further discuss the (in-)justices identified and reflect upon the potential contribution of NbS along with considerations of the possible (negative) side effects of NbS implementation.

Time: 2 to 3 hours

MODULES 3 + MODULE 5

| HOW to

Following the completion of Module 3, use the results to continue the discussion with Module 5, and incorporate a final session that involves interactive work at participants tables regarding the following questions:

1a What major inequalities are present in the city?

1b What major vulnerabilities should be prioritized along the strategic planning of NbS?

1c What vulnerabilities emerged from the socio-ecological profiles beyond the perceived vulnerabilities discussed in Module 1?

Aim: An opportunity to further identify the vulnerabilities and level of inclusiveness present in the city. The perception of vulnerabilities is enlarged with socio-demographic and socio-economic quantitative data available in the socio-ecological profiles developed in Module 5. Furthermore, the social vulnerabilities will be discussed in a wider framework (the ones of socio-ecological profiles) that considers other types of vulnerabilities, such as the ecological system vulnerabilities.

Time: 3 to 4 hours

MODULES 5 + MODULE 6

HOW to

Carry out the various steps of Module 5 and continue with collaboratively developing various climate scenarios.

Aim: An opportunity to revisit how the identified key NbS potentials are affected by future climate scenarios. By carrying out both modules as recommended, more knowledge and insights can be gleaned from the activities.

Time: 4 hours

MODULES 5 + MODULE 6

HOW to

Carry out the various steps of Module 5 and continue with collaboratively developing various climate scenarios.

Aim: An opportunity to revisit how the identified key NbS potentials are affected by future climate scenarios. By carrying out both modules as recommended, more knowledge and insights can be gleaned from the activities.

Time: 4 hours

MODULE N[1] + MODULE 6

HOW to

Following the completion of Module N, continue with Module 6, and incorporate a final session that involves interactive work at participants tables regarding the previously listed questions:

Module 1:

- **1a.** What major (in-)justices will be exacerbated in the climate change scenario?
- **1b.** Which justice dimension or challenge should be prioritized?

Module 3:

- **1c.** Which groups will be most affected?

Module 2:

- **2a.** Which area of the city or site is going to be most affected?
- **2b.** Which area of the city or site requires more immediate interventions?
- **3.** What needs to be considered for the activation of NbS?

Module 4: **3** + **2a** + **2b**

Module 5: **2a** + **2b**

Aim: An opportunity to challenge results of individual modules (e.g. exacerbated (in-)justices, most affected groups and sites, NbS interventions) and how they might be impacted by future developments.

Time: 3 to 5 hours

1 One module from 1 to 5


Természetalapú megoldások - kategóriák és beavatkozások
Token
Nbs kategória
Példák beavatkozásra
Művelhető föld
Rét, mező, legelő
Gyümölcsös
Agrárerdészet
Kertészet, hidroponia
Ipari, és energetikai célú növénytermesztés
Gombatermesztés
Tápanyag-utánpótlás
Erdő, fás élőhelyek
Cserje
Elhagyatott, természet által alkotott
Sziklás területek
Homokbánya, nyílt talajfelszín
Homokbánya - nyílt talajfelszín
Vízi élőhely / tó, mocsár
Vízi élőhely
Vízvisszatartás
Vízvisszatartás és kitárolás
Karsztos
Tavak
Delta
Tengerpart
Nyílt vízfelszín
Vízi növényzet
Szivárgócsatorna
Fásított, kertészeti
Bővített
Mindzaki - zöld
Egyéb
Városi mezőgazdaság
Természetes, és természetközeli területek
Vízgazdálkodás
Parkfelületek
Mindzaki - zöld
Egyéb

What next

JUSTPlanT is a method-kit aimed at facilitating the strategic planning of NbS through discussions centered on an ecological (space) justice perspective. It enables the involvement of diverse stakeholders, including planners, city administrators, and citizens, fostering a collaborative approach. Overall, its purpose is to facilitate collaborative planning and the co-creation of inclusive NbS. JUSTPlanT consists of multiple modules that can be used independently or in combination with each other to guide discussions toward specific or broad themes. It encourages open-minded considerations to offer fresh perspectives on NbS planning, emphasizing concepts like group inclusiveness, climate scenario dependency, and ecological (space) (in-)justice. The key objective in developing JUSTPlanT is to explicitly outline discussion elements and characteristics, which facilitate collaborative efforts to define low carbon and high air quality NbS potential across cities and neighborhoods.

The idea of creating a method-kit to promote the co-creation of NbS stems from the participatory process applied in the JUSTNature project, evolving into the development of sets of tokens and inspiration cards. The handbook is crafted through various phases of testing, discussion, and engagement with project partners, city representatives, citizens, and other relevant stakeholders within the six JUSTNature CiPeLs. Their contributions addressed main planning needs and opportunities, advancing the strategic planning for NbS. This process remains open-ended, as JUSTPlanT allows for further research and testing to refine its use and development. We especially anticipate further research and testing to be conducted on the development of participatory climate scenarios.

JUSTPlanT presents an opportunity to reassess issues of ecological (space) justice through collective creation, reflection, and strategic planning of NbS based on these evolving climate scenarios. The aim is to foster shared and actionable knowledge of how anticipated local climate/environmental hazards may affect local ecosystems and society, and consequently, how NbS can be effectively devised or maintained to alleviate these impacts. Scenarios, serving as depictions or narratives of potential futures, offer insight into various trajectories for the environment. This aspect is particularly relevant for investigating the concept of ecological (in-)justice across diverse cities, considering the diverse perspectives of stakeholders involved in co-creating climate scenarios in different urban contexts. Such insights can inform strategies and policies for future developments. Moreover, we anticipate exploration of the connections between quantitative climate scenarios and the collaborative generation of climate scenarios through techniques like backcasting or forecasting, with the aim of addressing strategic planning considerations.

We call for a community of researchers and practitioners to contribute to the ongoing development and testing of JUSTPlanT, adapting it to diverse objectives and cities. This includes addressing additional key challenges, such as water justice, as an entry point for discussing ecological (space) justice and devising practical solutions. Further expansion may involve selecting additional NbS categories and measures or developing missing Inspiration cards. The application of JUSTPlanT in different cities is expected to yield diverse results.

CONTACTS

We welcome everyone to explore and test JUSTPlanT further, and we value any feedback provided.

For more information or detailed insights, please contact:

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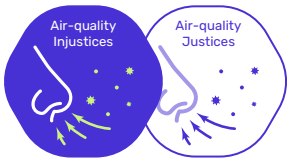
ANNEX – Material to print

1 OVERVIEW HANDOUTS

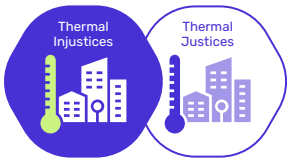
NOTE: to be printed in A4 format

Justice Challenges



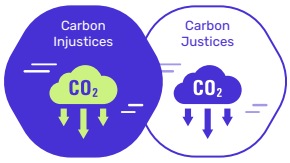
AIR QUALITY (IN-)JUSTICES

Air quality (in-)justices concerns the equal opportunity for all individuals to breathe air free from pollutants (e.g., NO_2, O_3, PM10).



THERMAL (IN-)JUSTICES

Thermal justice involves striving for a more equitable distribution of extreme heat conditions and related risks, ensuring that vulnerable people are not disproportionately affected by heatwaves.



CARBON (IN-)JUSTICES

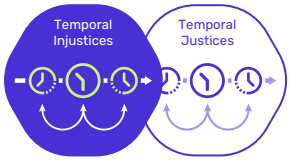
Carbon justice involves fairly assigning responsibility for greenhouse gas emissions and ensuring those responsible are held accountable for their actions, while also considering how different ecosystems in cities can help mitigate climate change.

FLORA, FAUNA AND HABITAT (NON-)INCLUSIVENESS

Flora, fauna, and habitat inclusiveness is about being just with nature. It means considering justice not only for humans, but also for plants and animals. This approach prioritizes the environment, whether it's protecting entire species, individual creatures, or whole ecosystems. It's different from most environmental justice discussions, which often focus mainly on human concerns.

SPATIAL (IN-)JUSTICES

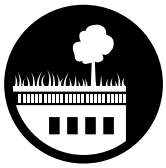
Spatial justice focuses on ensuring that environmental amenities and disamenities are distributed justly across different areas of the city. It involves efforts to minimize inequalities and prevent issues like urban population segregation and gentrification.



TEMPORAL (IN-)JUSTICES

Temporal justice refers to the interrelations between past, present and future conditions of (in-)justices and inequalities, considering lock-ins and path dependency processes occurring in cities as well as the consequences of today's actions on future generations.

Nbs Categories and Measures

CATEGORIES	MEASURES	
Building Green 	• balcony • ground based green wall • façade-bound green wall • extensive green roof	• intensive green roof • green fences • ceramic green wall
Urban Green Space connected to grey infrastructure 	• atrium • bioswale • tree alley and street trees, hedges • house garden • railroad bank • green playground, school ground	• green pavements • green parking pavements • cooling pavements (brightly painted, thinner pavements/ permeable) • green noise barriers
Sustainable drainage systems 	• runoff troughs • grassed swales • infiltration trenches • vegetated swales	• (street side) bioretention basins • rain gardens • riverbank green
Parks and recreation 	• large urban park • historical park/garden • pocket park – tiny forests • botanical garden/arboreta • zoological garden	• neighbourhood green space • institutional green space • cemetery and churchyard • green sport facility • camping area
Allotment and community gardens 	• allotment • community garden • community composting • small scale animal husbandry	

Nbs Categories and Measures

CATEGORIES	MEASURES	
Urban agriculture 	• arable land • grassland • tree meadow/orchard • biofuel production/agroforestry • horticulture	• food production and leisure pavilion (integrated hydroponic/ vertical growing systems) • urban mushroom farm • smart soils production and use
Natural, Semi-natural and Ruderal areas 	• forest (remnant woodland, managed forests, mixed forms) • shrubland • abandoned, ruderal and derelict areas	• rocks • sand dunes • sand pit, quarry, open cast mines
Green/Blue spaces 	• wetland, bog, fen, marsh • lake, pond • river, stream – engineering, maintenance, re-meandering, reopening corridors • dry riverbed, rambla • canal • estuary • delta • sea coast	• surface water reservoirs • retention and infiltration water reservoirs • water squares • infiltration wells • infiltration boxes • underground water reservoirs • blue roofs • electro wetland (microbial fuel cells) • extending floodplains
Technical 	• natural/modular boxes to encourage pollinators • floating gardens • grow tile • mobile vegetable garden	• Groasis Waterboxx – device designed to help trees grow in dry areas • beehive provision – constructed spaces for beehives • re-naturing/adapting existing infrastructure (unsealing surfaces, reprogramming areas under bridges, etc.)

Action Hierarchy

The action hierarchy supports the prioritization of planning, implementation, and investment in NbS by providing indications of which level should be prioritized over the others.

	**REMOVE:** the first choice of action would be to remove any disturbances (e.g. air pollution, greenhouse gas emissions) and address the challenges at their root to eliminate threats to existing NbS.
	**PROTECT:** secondly, the focus should be on protecting existing NbS.
	**MANAGE:** thirdly, managing existing NbS to ensure their longevity and quality.
	**RESTORE:** the fourth choice of action would involve restoring deteriorated NbS.
	**NEW:** this action would involve creating new NbS; it should be applied only as a final step, giving priority to alternatives such as restoring (e.g. brownfield site, wetland), managing (e.g. new conservation activities) or protecting (e.g. individual trees). Such an approach is important to avoid NbS being primarily applied as "end-of-pipe" solutions.

Substantive Principles

NbS should be planned and designed according to key principles that aim to ensure that NbS potential is effectively realized and produces multiple benefits. These criteria are described below.

Multifunctionality	NbS should deliver a range of functions and benefits for people, nature and places, considering synergies and trade-offs. This principle emphasizes the need for planning NbS to provide multiple benefits.
Connectedness	NbS should planned in order to be physically (e.g. green link) and functionally (e.g. critical mass) connected to each other, as a living network for people and nature at all scales (within sites, across regions, at national scale).
Diversity	This principle refers to considerations of bio- and cultural-diversity. Key elements are implementing the right NbS in the right place, enhancing a mix of significant NbS assets, increasing diversity of habitats and species, and increasing the variety of recreational facilities.
Accessibility	NbS should be planned to ensure accessibility to their benefits to various groups and to guarantee access to quality green spaces that are inclusive, safe, welcoming, well-managed and accessible for all.
Responding	NbS should respond to the local character of an area, meant as the natural, cultural, and perceptual aspects of landscape and how these elements interact, incorporating local needs and aesthetics.

Group Inclusiveness

The groups are meant to represent those social groups that might be particularly affected by a NbS measure.

The impact of a NbS measure can be positive for a particular social group, for example by addressing specific challenges that may make that specific group more vulnerable compared to others. However, the intention is also to raise awareness of the potential negative consequences of a not properly planned intervention on specific groups (e.g. gentrification effects on low-income groups), or the tendency of specific NbS interventions to provide benefits only for some part of the population (e.g. high-income groups).

Among groups, important ecosystems are included with the intent to represent them as environmental personhood, which assigns them the rights, protection, privileges and responsibilities of a legal personality.

2 SET OF TOKENS

NOTE: to be printed in A4 format, two-sided and cut-out

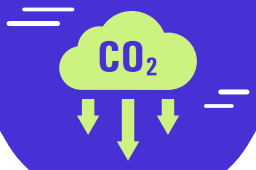
(In-)justice set of tokens

JUST NATURE

Air-quality Injustices

Thermal Injustices

Carbon Injustices



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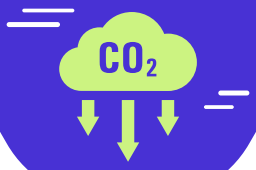
Air-quality Injustices

Thermal Injustices

Carbon Injustices



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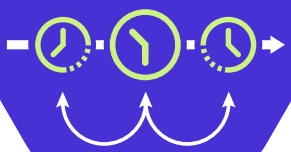
Temporal Injustices



Spatial Injustices

Flora, Fauna & Habitat Non-inclusivess

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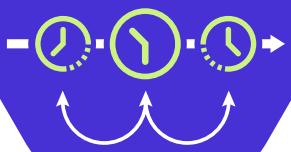
Temporal Injustices



Spatial Injustices

Flora, Fauna & Habitat Non-inclusivess

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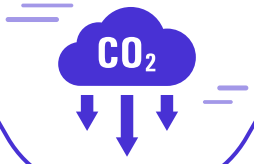
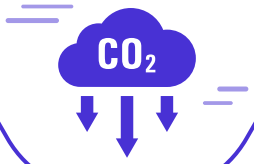
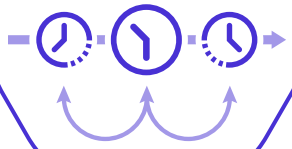
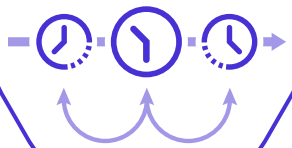
(In-)justice set of tokens

JUST NATURE

.....	Carbon Justices 	Thermal Justices 	Air-quality Justices 
.....	Carbon Justices 	Thermal Justices 	Air-quality Justices 
.....	Flora, Fauna & Habitat Inclusivess 	Spatial Justices 	Temporal Justices 
.....	Flora, Fauna & Habitat Inclusivess 	Spatial Justices 	Temporal Justices 
.....	.....	.....	.....

Group inclusiveness set of tokens

Children & babies

Children & babies

High income groups

High income groups

Young people

Young people

Important ecosystems

Important ecosystems

Elderly people

Elderly people

Pregnant women

Pregnant women

People with migrant background

People with migrant background

People with pre- & underlying diseases

People with pre- & underlying diseases

Low income groups

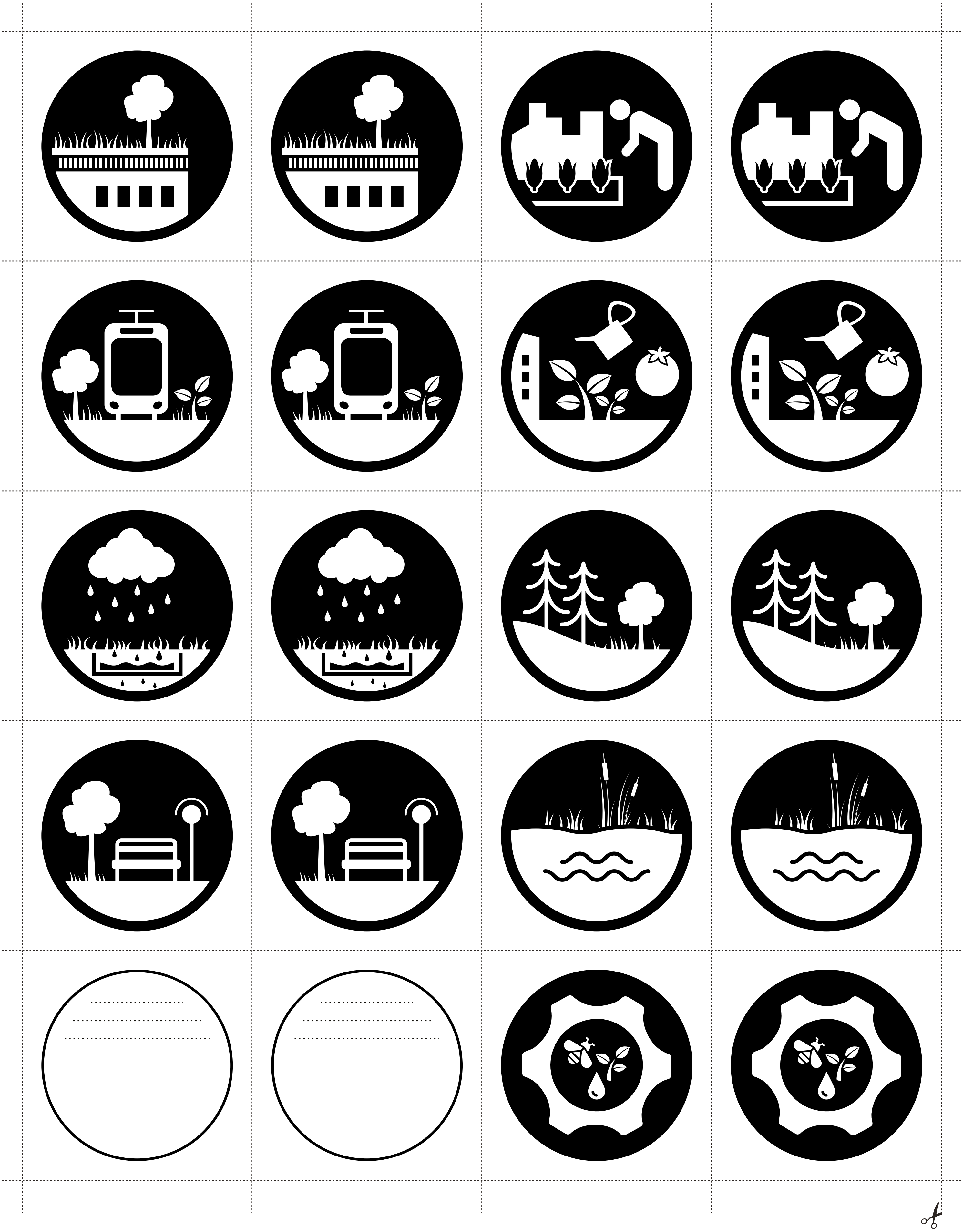
Low income groups

People with disabilities

People with disabilities

Group inclusiveness set of tokens

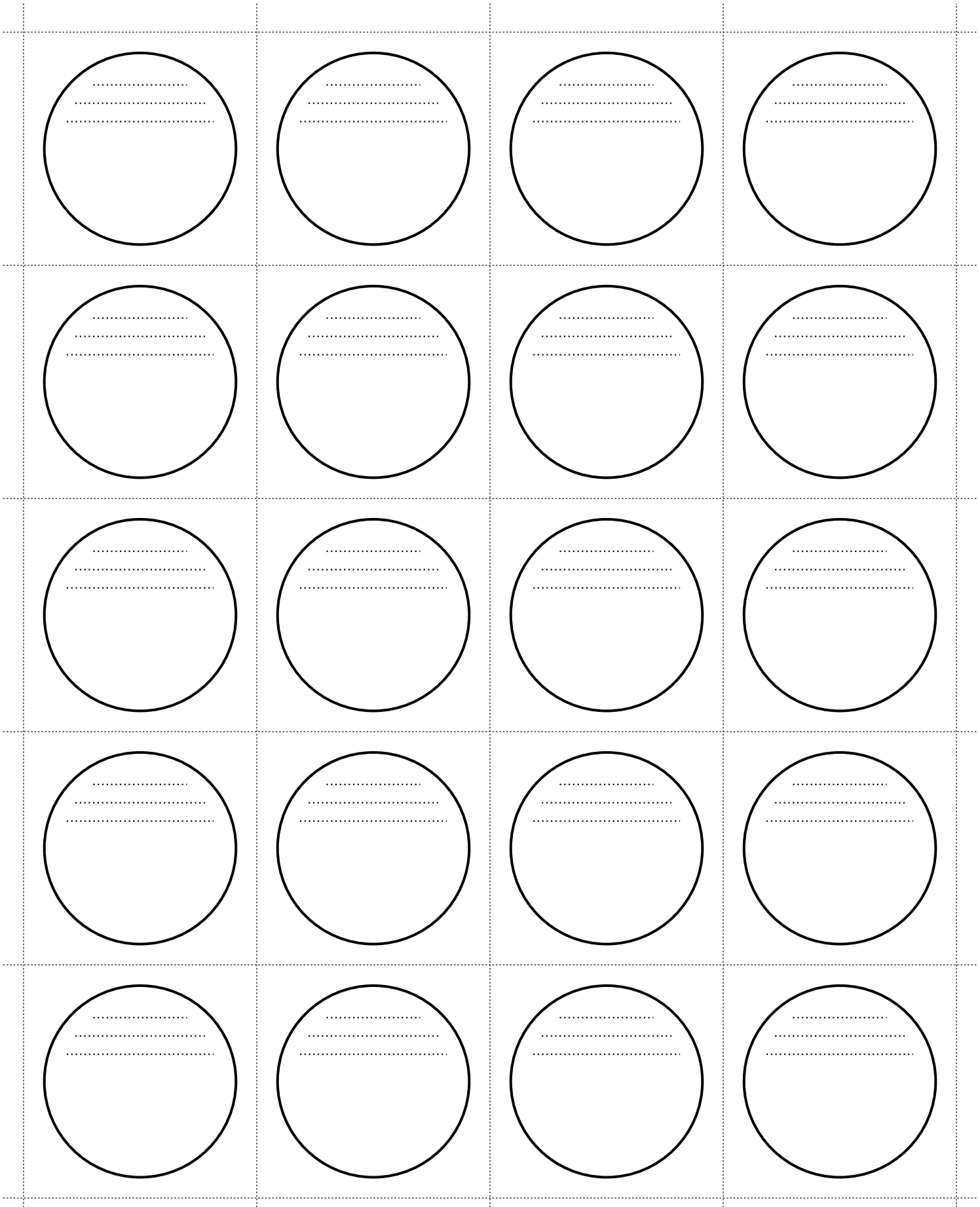
NbS set of tokens



NbS set of tokens

Allotment and Community gardens e.g. Community garden	**Allotment and Community gardens** e.g. Community garden	**Building green** e.g. Green wall Green roof	**Building green** e.g. Green wall Green roof
Urban agriculture e.g. Arable land Horticulture	**Urban agriculture** e.g. Arable land Horticulture	**Urban Green Space connected to grey infrastructure** e.g. Tree alley and street trees, hedges House garden	**Urban Green Space connected to grey infrastructure** e.g. Tree alley and street trees, hedges House garden
Natural, Semi-natural and Ruderal areas e.g. Forest Abandoned, ruderal and derelict area	**Natural, Semi-natural and Ruderal areas** e.g. Forest Abandoned, ruderal and derelict areas	**Sustainable drainage systems** e.g. Swales Basins Riverbank green	**Sustainable drainage systems** e.g. Swales Basins Riverbank green
Green/Blue spaces e.g. Lake River Wetland, bog, fen, marsh	**Green/Blue spaces** e.g. Lake River Wetland, bog, fen, marsh	**Parks and recreation** e.g. Urban park Cemetery and churchyard	**Parks and recreation** e.g. Urban park Cemetery and churchyard
Technical e.g. Mobile vegetable garden Re-naturing/adapting existing infrastructure (unsealing surfaces, reprogramming areas under bridges, etc.)	**Technical** e.g. Mobile vegetable garden Re-naturing/adapting existing infrastructure (unsealing surfaces, reprogramming areas under bridges, etc.)		

NbS set of tokens



3 INSPIRATION CARDS

NOTE: to be printed in A4 format, two-sided and cut-out

NBS CATEGORY

Building green

NBS MEASURE

Green Roofs

ACTION HIERARCHY

New

IMPLEMENTATION SCALE

Building

CRITICAL PRINCIPLES

- Multifunctionality
- Connectedness

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Building green

NBS MEASURE

Green Walls

ACTION HIERARCHY

New

IMPLEMENTATION SCALE

Building / Neighborhood

CRITICAL PRINCIPLES

- Connectedness
- Responding

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Building green

Inspiration for Green Walls

Photos: The Tree Office - Trädkontoret / Johan Östberg

Description: This set of measures include ground-based climbing plants for ornamental (and sometimes food production) purposes, facade-bound green wall which are plants growing in facade-bound substrate, e.g. containers or textile-systems.

JUST—
NATURE

NBS CATEGORY

Building green

Inspiration for Green Roofs

Photos: The Tree Office - Trädkontoret / Johan Östberg

Description: These measures include three main types of vegetated roofs: extensive (roof vegetation on thin substrate with little or no irrigation and management), intensive (thick substrate with irrigation and management), and semi-intensive (with moderate substrate depths).

JUST—
NATURE

NBS CATEGORY

Urban Green Space connected to grey infrastructure

NBS MEASURE

House gardens

ACTION HIERARCHY

Manage / New

IMPLEMENTATION SCALE

Building

CRITICAL PRINCIPLES

Connectedness | Diversity

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Urban Green Space connected to grey infrastructure

NBS MEASURE

Green Pavements

ACTION HIERARCHY

Manage / New

IMPLEMENTATION SCALE

Building / Neighborhood

CRITICAL PRINCIPLES

Multifunctionality | Connectedness

JUSTICE POTENTIAL

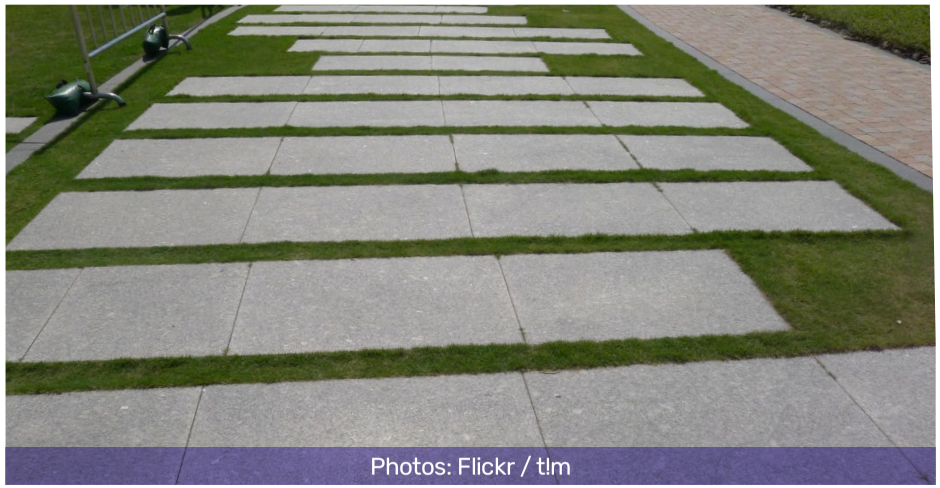
- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Urban Green Space connected to grey infrastructure

Inspiration for Green Pavements



Photos: Flickr / t!m

Photos: Flickr / Nanda Sluijsmans

Description: Urban surfaces designed for incorporating vegetation and permeable materials; they include permeable pavements, porous pavements, grass or vegetation pavers.

NBS CATEGORY

Urban Green Space connected to grey infrastructure

Inspiration for House gardens

Photo: Wikimedia Commons / Jorge Royan

Photo: PxHere

Description: Areas in immediate vicinity of private houses cultivated mainly for ornamental purposes and/or non-commercial food production.

JUST—
NATURE

NBS CATEGORY

Sustainable drainage systems

NBS MEASURE

Vegetated swales and rain gardens

ACTION HIERARCHY

Manage / New

IMPLEMENTATION SCALE

Building / Neighborhood

CRITICAL PRINCIPLES

- Multifunctionality
- Diversity

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Urban Green Space connected to grey infrastructure

NBS MEASURE

Tree alley and street trees

ACTION HIERARCHY

Manage / New

IMPLEMENTATION SCALE

Building / Neighborhood

CRITICAL PRINCIPLES

- Connectedness
- Diversity

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Urban Green Space connected to grey infrastructure

Inspiration for Tree alley and street trees

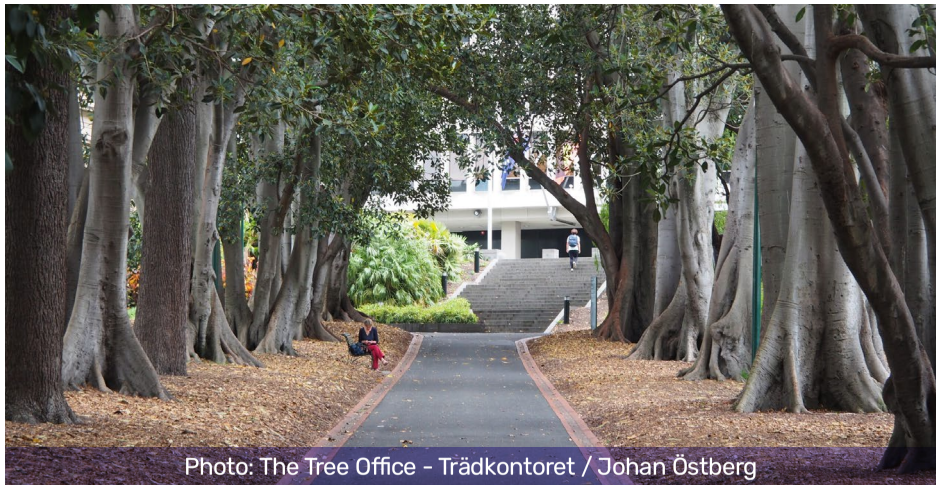


Photo: The Tree Office - Trädkontoret / Johan Östberg

Photo: The Tree Office - Trädkontoret / Gustav Nässlander

Description: This set of measures include trees planted along roads and paths either solitary or in rows. Hedges along roads or paths, non-tree, mostly shrubby or grassy verges along roads or other built or natural element.

NBS CATEGORY

Sustainable drainage systems

Inspiration for Vegetated swales and rain gardens

Photo: Flickr / Chesapeake Bay Program

Photo: Wikimedia Commons / Oregon Convention Center

Brief description of the NbS measure: densely vegetated ground depressions with a variety of trees, shrubs, and grasses to collect stormwater from adjacent impervious surfaces.

NBS CATEGORY

Allotment and community gardens

NBS MEASURE

Community gardens

ACTION HIERARCHY

Manage / New

IMPLEMENTATION SCALE

Building / Neighborhood

CRITICAL PRINCIPLES

- Accessibility
- Responding

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Parks and recreation

NBS MEASURE

Urban parks

Large, pocket parks, tiny forests

ACTION HIERARCHY

Protect / Manage / Restore

IMPLEMENTATION SCALE

Neighborhood / City

CRITICAL PRINCIPLES

- Accessibility
- Responding

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS

NBS CATEGORY

Parks and recreation

Inspiration for Urban parks

Photo: The Tree Office - Trädkontoret / Johan Östberg

Photo: The Tree Office - Trädkontoret / Elin Rowicki

Description: These measures include large public parks for recreational use as well as pocket and small publicly accessible parks, or historical parks and gardens with high heritage value.

NBS CATEGORY

Allotment and community gardens

Inspiration for Community gardens

Photo: lacucinaitaliana.it / Matteo Zarbo

Photo: Flickr / Onnola

Description: These measures include allotment, which are small, cultivated parcels intended for non-commercial food production and recreation, and community gardens i.e. areas, collectively gardened by a community for food and recreation.

NBS CATEGORY

Natural, Semi-natural and Ruderal areas

NBS MEASURE

Forests and shrubland

ACTION HIERARCHY

Protect / Manage / Restore

IMPLEMENTATION SCALE

City

CRITICAL PRINCIPLES

- Connectedness
- Diversity

JUSTICE POTENTIAL

- High
- Existing
- Not clear

Air-quality, Thermal, Carbon, Flora, Fauna & Habitat, Spatial, Temporal

GROUP INCLUSIVENESS

- Important ecosystems
- High income

NBS CATEGORY

Urban agriculture

NBS MEASURE

Arable land, grassland and orchard

ACTION HIERARCHY

Protect / Manage / Restore

IMPLEMENTATION SCALE

City

CRITICAL PRINCIPLES

- Diversity
- Accessibility

JUSTICE POTENTIAL

- High
- Existing
- Not clear

Air-quality, Thermal, Carbon, Flora, Fauna & Habitat, Spatial, Temporal

GROUP INCLUSIVENESS

- Low income
- Important ecosystems

NBS CATEGORY

Urban agriculture

Inspiration for Arable land, grassland and orchard

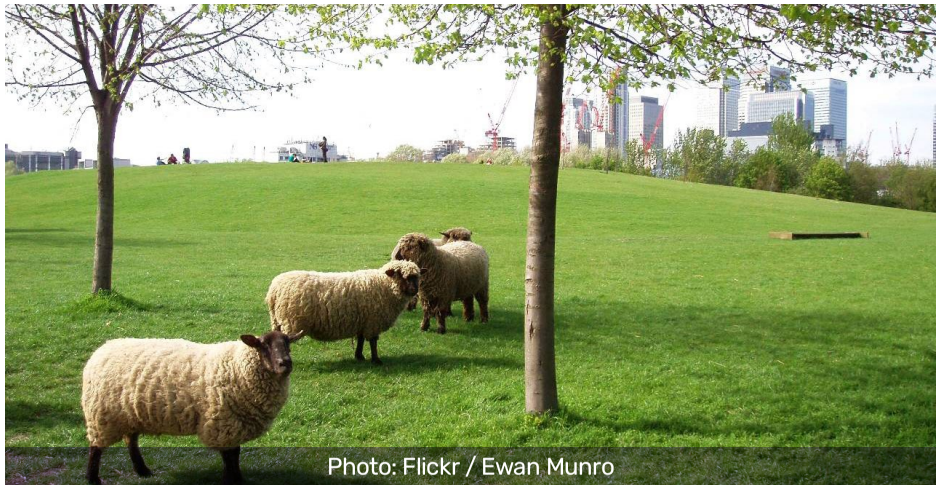


Photo: Flickr / Ewan Munro

Photo: Flickr / U.S. Department of Agriculture

Description: Regularly ploughed arable land for crop production. Grassland includes pastures or meadows. Tree meadow/meadow orchard include fruit and nut trees, mixed agricultural and fruit or biofuel production.

NBS CATEGORY

Natural, Semi-natural and Ruderal areas

Inspiration for Forests and shrubland

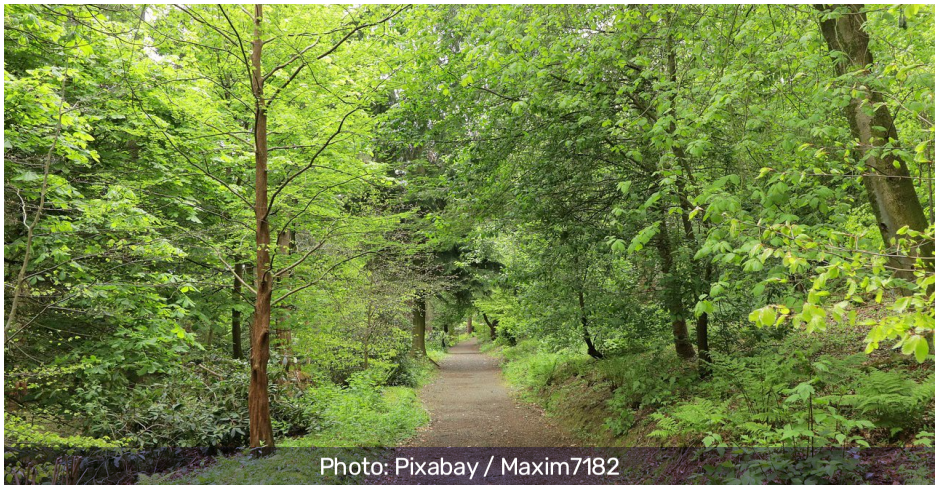


Photo: Pixabay / Maxim7182

Photo: Flickr / Miquel Fabre

Description: These measures include urban forests and shrublands protection, management and restoration initiatives.

NBS CATEGORY

Green/Blue spaces

NBS MEASURE

Wetland, bog, fen, marsh

ACTION HIERARCHY

Protect / Manage / Restore

IMPLEMENTATION SCALE

City

CRITICAL PRINCIPLES

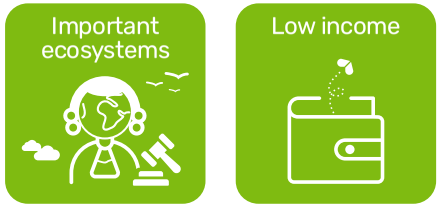
Multifunctionality

Diversity

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS



NBS CATEGORY

Sustainable drainage systems

NBS MEASURE

Channel re-naturing

ACTION HIERARCHY

Manage

IMPLEMENTATION SCALE

Neighborhood / City

CRITICAL PRINCIPLES

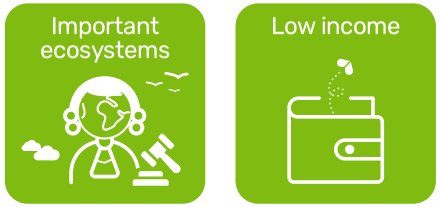
Multifunctionality

Responding

JUSTICE POTENTIAL

- High
- Existing
- Not clear

GROUP INCLUSIVENESS



NBS CATEGORY

Sustainable drainage systems

Inspiration for Channel re-naturing

Photo: Pxhere / SuperD

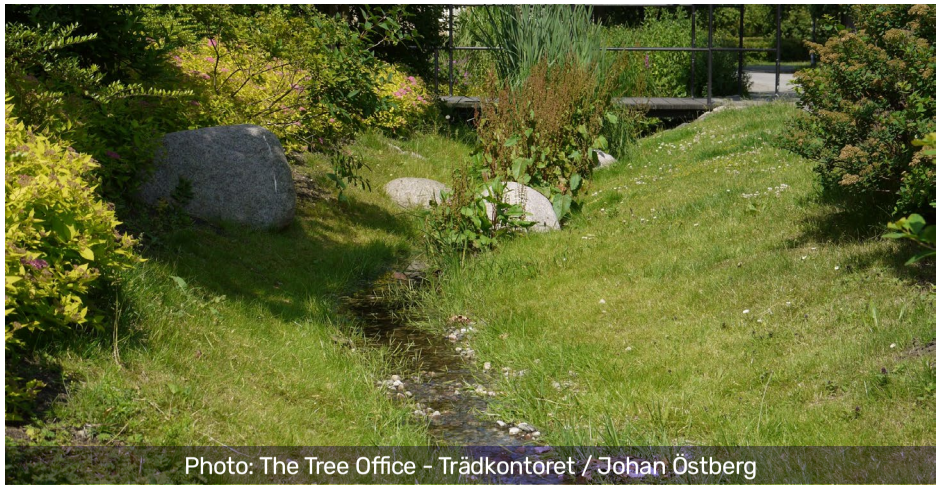


Photo: The Tree Office - Trädkontoret / Johan Östberg

Description: Channel re-naturing measures involve restoring natural features to waterways, such as daylighting buried streams, removing concrete embankments, and reintroducing native vegetation to promote ecological health and biodiversity.

NBS CATEGORY

Green/Blue spaces

Inspiration for Wetland, bog, fen, marsh

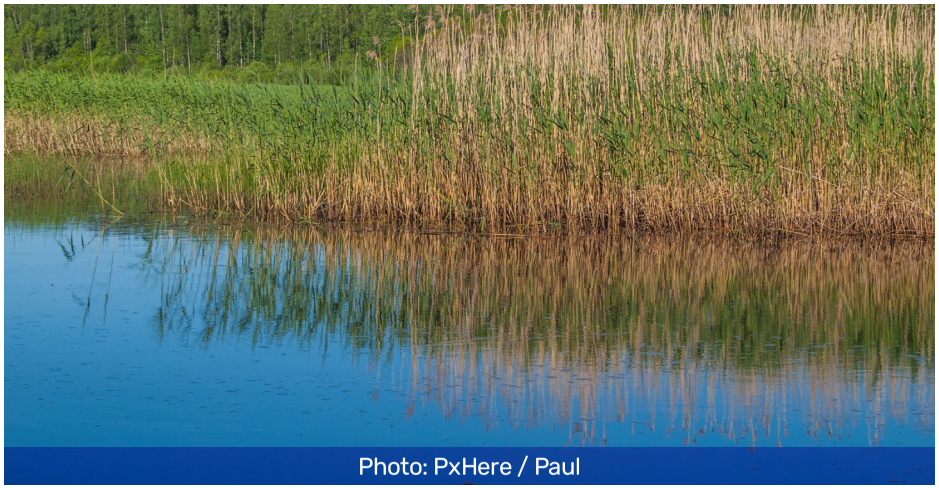


Photo: PxHere / Paul

Photo: PxHere / Doviva

Description: Areas with soil permanently or periodically saturated with water and characteristic flora and fauna.

NBS CATEGORY

Technical

NBS MEASURE

Mobile vegetable gardens, temporary solutions

ACTION HIERARCHY

New

IMPLEMENTATION SCALE

Neighborhood

CRITICAL PRINCIPLES

Multifunctionality

Responding

JUSTICE POTENTIAL

High

Existing

Not clear

Air-quality

Thermal

Carbon

Flora, Fauna & Habitat

Spatial

Temporal

GROUP INCLUSIVENESS

Low income

With migrant background

NBS CATEGORY

Green/Blue spaces

NBS MEASURE

Rivers, lakes, ponds

ACTION HIERARCHY

Protect / Manage / Restore

IMPLEMENTATION SCALE

City

CRITICAL PRINCIPLES

Multifunctionality

Responding

JUSTICE POTENTIAL

High

Existing

Not clear

Air-quality

Thermal

Carbon

Flora, Fauna & Habitat

Spatial

Temporal

GROUP INCLUSIVENESS

Important ecosystems

High income

NBS CATEGORY

Green/Blue spaces

Inspiration for Rivers, lakes, ponds

Photo: Flickr / Vítor Ribeiro

Photo: Flickr / Lienhard Schulz

Description: These measures include lakes and ponds (natural and artificial) river and stream (including streams and temporary water courses, artificial/managed or natural).

NBS CATEGORY

Technical

Inspiration for Mobile vegetable gardens, temporary solutions

Photo: Wikimedia Commons / Jocian

Photo: Flickr / Dennis Sylvester Hurd

Description: Modular and moveable solutions for growing food and plants. They can be assembled and moved by users in order to customize open public and private spaces according to their desires.

NBS CATEGORY

NBS MEASURE

ACTION HIERARCHY

IMPLEMENTATION SCALE

CRITICAL PRINCIPLES

JUSTICE POTENTIAL

- (H) High
- (E) Existing
- (N) Not clear

Air-quality

Thermal

Carbon

Flora, Fauna & Habitat

Spatial

Temporal

GROUP INCLUSIVENESS

NBS CATEGORY

NBS MEASURE

ACTION HIERARCHY

IMPLEMENTATION SCALE

CRITICAL PRINCIPLES

JUSTICE POTENTIAL

- (H) High
- (E) Existing
- (N) Not clear

Air-quality

Thermal

Carbon

Flora, Fauna & Habitat

Spatial

Temporal

GROUP INCLUSIVENESS

JUSTNature - Inspiration cards

4 ADDITIONAL INSIGHTS ON INSPIRATION CARDS

NOTE: to be printed in A4 format

NBS CATEGORY
Building green

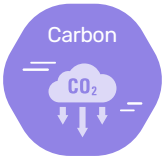
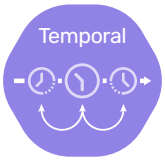
NBS MEASURE
Green Roofs

CRITICAL PRINCIPLES

Multifunctionality	Attention should be paid that the focus is not put on individual benefits (e.g. water retention) but the multiple benefits green roofs can provide, for biodiversity, reducing energy consumption as well as improving human well-being.
Connectedness	The highest impact of green roofs is achieved when such solutions are implemented in combination with other NbS and scaled up at wider scales ('connectedness by critical mass').

JUSTICE POTENTIAL

● High ● Existing ● Not clear

	Studies on air quality reported that green roofs reduce CO, CO_2, SO_2, and NO_2 while increasing the concentrations of volatile organic compounds (VOCs). Rooftop vegetation can indirectly influence air quality affecting air temperature and humidity. Intensive green roofs have a higher purification potential.
	Rooftop vegetation contribute to temperature reduction and mitigation of the UHI through evapotranspiration. It can be effective passive technique for reducing the heating and cooling energy and improving indoor comfort conditions at building scale.
	The direct contribution for carbon sequestration is shown to be much lower compared to other kind of urban vegetation. However, the indirect impact in mitigating GHG emissions at building level have consequences on reducing the long-term fossil fuel consumption.
	Extensive and semi-intensive green roofs in particular offer the opportunity to provide food and shelter for insects, birds and other animals, including plants to attract pollinators. Plant layering to provide different layers for bird nesting and insect protection.
	Intensive green roof and roof gardens that are accessible to people, can provide benefits for health and well-being, providing communal and recreational spaces promoting social interaction and social cohesion.
	Green roofs generally have a longer lifespan compared to conventional roofs (ranging from 30 to 40 years compared to around 20 years), due mainly to the reduction of exposure of the roof membrane in green roof systems.[1]

RELEVANT GROUPS

Groups more vulnerable to heat stress (e.g. **elderly, pregnant women, babies**). Pay attention to lack of accessibility (e.g. **people with disabilities**).

NBS CATEGORY
Building green

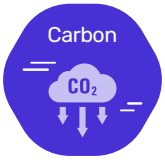
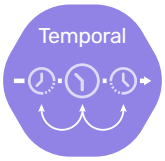
NBS MEASURE
Green Walls

CRITICAL PRINCIPLES

Connectedness	Large scale implementation of green walls and facades is critical to produce the related benefits.
Responding	Green facades should be designed to complement architectural styles and highlight specific cultural elements, contributing to the overall aesthetic and identity of the area. Use of climbing plants can be key.

JUSTICE POTENTIAL

High Existing Not clear

	Green walls capture pollutants from nearby emissions sources; according to the literature, green walls are more effective in capturing PM rather than gas pollutants. Active Green Walls (AGW) can involve an active transfer of PM10, not only for gravitational and diffuse deposition, but using a form of mechanical air transfer.
	Depending on local climate conditions, typology and building characteristics, green walls contribute to reducing the heating and cooling energy and improving indoor comfort conditions at building scale. Green façades are more beneficial during daytime, when more people are outdoors and can require less water use.[2]
	Green walls and green facades offer a great potential to indirectly mitigate GHG emissions at building level, saving energy and consequently reducing the long-term fossil fuels consumptions (e.g.[3]).
	The role of green walls in urban wildlife corridors remains questionable due to limited patch size, distinct habitat quality at the building scale.[4] However, extended green facades can offer some important habitats for bird species and insects.
	The benefits provided (e.g. improvements of air quality and reduced thermal stress) improve community well-being contributing to creating healthier and more comfortable living environments for nearby residents (e.g.[5]).
	The lifespan of green walls and green facades is dependent on the correct management and maintenance, and requires solutions planned in relation to the specific climatic and buildings conditions. There are examples where vine family species formed 100 years old facades, put under protection (e.g. city of Vienna).

RELEVANT GROUPS

Population's sectors that tend to be more vulnerable to heat and profit from green walls and facades close to streets when walking (e.g. **elderly, pregnant women, babies**).

NBS CATEGORY
Urban Green Space connected to grey infrastructure

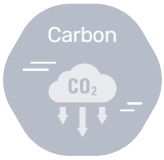
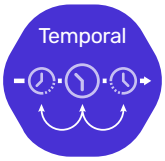
NBS MEASURE
Green Pavements

CRITICAL PRINCIPLES

Multifunctionality	Multifunctionality should be considered in relation to not only the functionality but also the aesthetic value of permeable pavements.
Connectedness	Large scale implementation of permeable surfaces is critical to produce the related benefits.

JUSTICE POTENTIAL

High · Existing · Not clear

	Studies show a reduction in smog exceedance related to cool strategies e.g. green pavements.
	Green pavements decrease heat absorbed and can lower surface temperatures. According to EPA (2012) for every 10% rise in solar reflectance, there's a potential reduction of 4°C in surface temperatures.[6]
	Permeable pavements have a minimal impact on carbon storage; however, they can facilitate the development of street trees as carbon-neutral strategies.
	Pavements with a high level of permeability can contribute to promote urban biodiversity. Especially permeability and soil availability influence plant distribution on pavements and sandy pavements can host a more diverse species pool.
	Green pavements provide storm water management, reducing surface runoff and controlling infiltration. The reduction of pollutants, temperatures and water runoff improves the public health and well-being.[6]
	Permeable paving solutions offer very positive performance in comparison with traditional asphalt surfaces, especially in runoff reduction and water quality improvement. Permeable pavements have been found to effectively respond to intense precipitation events, making them a suitable solution in terms of climate change adaptation.[7]

RELEVANT GROUPS

Due to the benefits provided against extreme weather events, which often have greater consequences on the most economically and socially vulnerable groups (e.g. **low-income groups, people with migration background, elderly**), consider according neighborhoods.

NBS CATEGORY
Urban Green Space connected to grey infrastructure

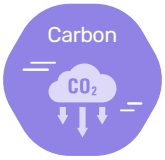
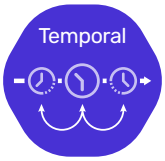
NBS MEASURE
House gardens

CRITICAL PRINCIPLES

Connectedness	Connectivity amongst gardens is essential for impacts on biodiversity as well as for the gained benefits from multiple solutions and larger initiatives.
Diversity	Critical for house gardens is the diversification of cultivated plants and the creation of a variety of habitats.

JUSTICE POTENTIAL

High · Existing · Not clear

	Domestic gardens may have only a minor role in helping mitigate point pollutant sources. No direct evidence exists of the role of domestic gardens to have an impact in removing air pollutants.[8]
	At garden level, vegetation can affect the energy consumption of buildings, but its broader impact on air temperatures in the urban environment is not fully understood.[8]
	Carbon sequestration potential of residential yards, if scaled up at city level might provide significant contribution to climate change mitigation; focus should be on encourage tree planting and ensure growing conditions.[9]
	House gardens can play an important role for enhancing biodiversity, especially in diversification of cultivated plants.[10] Initiatives to maintain connectivity amongst gardens and promote habitat heterogeneity should be taken.[11]
	House gardens can have an important role in creating a high-quality living environment, having the potential to transform neighbourhood green spaces the integrate multiple benefits while providing recreation opportunities.
	The results demonstrate that greening private gardens can generate impact on water run-off and catchment in cities in the order of 5–10%, reaching picks up to 20% in certain cases.[12]

RELEVANT GROUPS

This NbS tends to be more common among **high-income groups** depending on availability of spaces and financial resources. Gentrification issues need to be taken into due consideration when implementing such type of nature-based solutions. **Important ecosystems** can considerably benefit from house garden solutions.

NBS CATEGORY
Urban Green Space connected to grey infrastructure

NBS MEASURE
Tree alley and street trees

CRITICAL PRINCIPLES

Connectedness	Connection amongst solutions is essential to ensure ecological corridors.
Diversity	Diversity of solutions is key in relation to the local conditions.

JUSTICE POTENTIAL

High · Existing · Not clear

Air-quality	Street and hedges can contribute to remove air pollution by the interception and absorption of particulate matters, especially continuous hedges in proximity to shallow and moderately deep street canyons can reduce the pedestrian exposure to traffic related emissions. Attention must be pay to local conditions (e.g. presence of canyons) that may cause an increase in air pollutants concentration.[13],[14]
Thermal	Street trees play an important role in mitigating high temperatures by shading and evapotranspiration, with a consequent decrease of UHI intensity. Tree canopy size and density, the characteristics of each different trees' species, and the local prevailing meteorological and environmental conditions affect the impact on temperatures.
Carbon	Role on carbon absorption is limited by the short life expectancy of urban trees (between 19 to 28 years).[15] Growing parameters, tree species, planting density and climate need to be considered.[16]
Flora, Fauna & Habitat	Planting new trees for biodiversity enrichment must take account some aspects such as the most adapted trees in the right places where both climate and soil are suitable for the selected specie and in order to guarantee the balance of ecosystem functions.
Spatial	**Recent research[17] found wealthier urban neighbourhoods have often greater trees abundance, emphasizing the need for a greater attention in tree planning within the different neighbourhoods in cities. Several studies (e.g.[18],[19]) also show a positive impact of urban trees on property values, with resulting possible gentrification issues to be taken into account.**
Temporal	Street tree life expectancy needs to be taken into account when planting new trees[15], moreover special management and protection is needed for old historical trees in order to preserve their value.

RELEVANT GROUPS

Consider **people with pre- and underlying diseases, children and babies, elderly** in relation to the benefits provided for more vulnerable groups regarding air pollution and heat stress. Attention to risk of only benefit more affluent neighborhood (e.g. **high-income groups**).

NBS CATEGORY

Sustainable drainage systems

NBS MEASURE

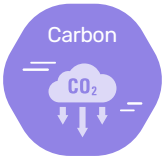
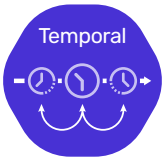
Vegetated swales and rain gardens

CRITICAL PRINCIPLES

Multifunctionality	Multifunctionality should be prioritized in relation to local circumstances and needs, ensuring to maximizes the multiple benefits provided (nature and biodiversity, water management and climate resilience).
Diversity	Diversity in types and sizes of spaces and strengthen networks of solutions is critical to meet strategic needs.

JUSTICE POTENTIAL

High Existing Not clear

	Rain gardens contain plants capable of reducing some pollutants such as nutrients and metals.
	Rain gardens can reduce the heat island effect, especially when they contain trees through the effect of shade and evaporation from leaf and stem surfaces.
	Sustainable drainage systems can lead to a reduction of carbon through sequestration from planted trees and vegetation. carbon. Indirect effects can be related to the reduced need for pumping and treating surface water and wastewater and associated carbon emissions.
	Rain gardens create small ecosystems that provide habitat for pollinators and plants, attract beneficial birds, butterflies, and insects, and contribute to preserves native vegetation.
	Rain gardens are designed to reduce runoff volumes through retention and detention processes, providing localized flood control and simultaneously enhancing water quality, providing important benefits for health and well-being.
	The important contribution of these solutions to reduce runoff volumes makes them a particularly valuable NbS when planning for long-term solutions against climate change and the increasing of extreme weather events.

RELEVANT GROUPS

Attention to be paid to **low-income groups, people with migrant background** (disadvantaged people), in relation to the benefits provided against extreme weather events that have greater consequences for the most economically and socially vulnerable groups.

NBS CATEGORY

Parks and recreation

NBS MEASURE

Urban parks

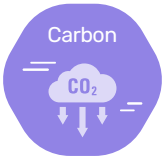
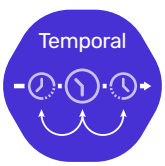
Large, pocket parks, tiny forests

CRITICAL PRINCIPLES

Accessibility	Ensure accessibility for all to public green spaces, considering needs of different groups, and matters of proximity.
Responding	Understanding the natural elements of the area, recognizing its historical and cultural significance, considering how people perceive and interact with it.

JUSTICE POTENTIAL

High · Existing · Not clear

	Vegetation with higher Leaf area index and crown diameter can reduce air flow and trap more PM near the road, mitigating the pollution concentration inside the park.[20]
	Urban parks can effectively reduce air temperatures (i.e. the so-called "park cool island" effect) especially by incorporating tree species with an elevated shading potential (i.e. high leaf area index).
	Urban trees and forests have a great capacity to store relatively high amount of carbon compared to other types of urban vegetation.
	Parks are among the most species rich types of urban green spaces. Larger parks tend to harbour a greater diversity and microhabitat heterogeneity than smaller ones.
	Distribution of urban parks and green areas can contribute to spatial justice increasing the accessibility to green spaces, improving citizens' psychological, physiological and physical well-being, fostering recreational activities and improving economic attractiveness of a neighbourhood. **Large-scale urban parks may induce environmental gentrification whereas small pocket gardens form a part of "just green enough" approach that does not trigger gentrification.[21]**
	Urban parks can constitute an important element of a city's historical heritage, and the preservation of historical trees, as well as a planning process that takes into account the lifespan of species and their adaptability to the climatic and urban conditions and the future changes is essential to ensure the provision of benefits associated with urban parks over a longer time horizon.

RELEVANT GROUPS

Pay attention to **low-income groups or people with migrant background** being more affected by gentrification phenomena sometimes occurring in relation to these NbS (flagship parks). Also consider **high-income groups** potentially having higher accessibility. Certain parks can also represent **important ecosystems**.

NBS CATEGORY

Allotment and community gardens

NBS MEASURE

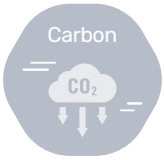
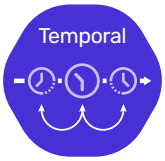
Community gardens

CRITICAL PRINCIPLES

Accessibility	Ensure accessibility to well-being and social benefits for all, especially for vulnerable population groups.
Responding	Natural, cultural and perceptual aspects are key elements to consider for such solutions, responding to local needs and values.

JUSTICE POTENTIAL

High · Existing · Not clear

	The potential for air quality regulation through plants' capacity to absorb or attract pollutants may pose a contamination risk when cultivating plants for consumption.[13] Attention must be given to minimizing potential food safety concerns, e.g. by using raised garden beds.[22]
	The role of community gardens in the reduction of thermal discomfort is questionable as usually urban vegetable gardens are non-arboreal, and exterior shading and ventilation control could be used to improve the thermal comfort in summer period.
	Urban agricultural and allotments in cities can store and sequester a consistent amount of carbon over time due to plant activity and carbon content in soils. Vegetable and herb gardens are often cut back on an annual basis, and this means carbon released, reducing the carbon sequestration potential of such solutions.
	Urban allotments can promote habitat for diverse plant species, both ornamental and cultivated, while these can sometimes include non-native and invasive species.[23]
	**Community gardens are important societal meeting places that can contribute to recreation, health, and well-being as well as social cohesion[23] while providing source of food for citizens. Potential of community gardens is shown in relation to subjective well-being and mental health.[24]**
	Gardening is an important cultural contribution for future generations. They can contribute to respond and adapt to physical and socio-economic challenges and facilitate climate change adaptation in urban communities.[23]

RELEVANT GROUPS

Elderly, low-income groups or people with migrant background might benefits from such solutions, however, inclusive engagement and consideration of potential gentrification issues is key.

NBS CATEGORY
Urban agriculture

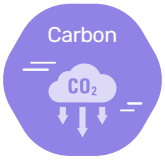
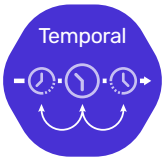
NBS MEASURE
Arable land, grassland and orchard

CRITICAL PRINCIPLES

Diversity	Agricultural practices that enhance biodiversity should be prioritized.
Accessibility	Accessibility to be guaranteed by developing and maintaining pathways and offering open road infrastructure. Consider functional accessibility.

JUSTICE POTENTIAL

High · Existing · Not clear

	The potential for air quality regulation through plants' capacity to absorb or attract pollutants may pose a contamination risk when cultivating plants for consumption.[13]
	Some urban agriculture solutions might provide benefits in term of climate regulation however trade-offs might exist between microclimate regulation and food production.[25]
	**Urban agriculture could potentially reduce greenhouse gas emissions. Pivotal role is played by the soil organic carbon (SOC) stocks on soil. Agricultural practices have a strong impact on several ecosystem functions and particular importance should be given to sustainable field practices, particularly to increase SOC stocks.**
	**Urban meadows** represent cost-effective solutions that provide benefits for biodiversity.[26] Orchard perennial character and multi-strata habitat may contribute to a high level of biodiversity; however pesticide use has a negative impact on pollinators. There might be trade-offs between food production and biodiversity.
	**Peri-urban agriculture** (UPA) is connected to a series of co-benefits supporting economy, social inclusion, and biodiversity.[25] An important role is related to the aesthetic and cultural values.[27]
	UPA supports food resilience after natural disasters, potentially enhancing both the quantity and quality of food available, not only increasing access to food but also promoting healthier diets regardless of income level.[25]

RELEVANT GROUPS

Attention to be paid to **low-income groups**, as offering important access to local food and material resources (provisioning ecosystem services). Extensively managed areas potentially **important ecosystems**.

NBS CATEGORY

Natural, Semi-natural and Ruderal areas

NBS MEASURE

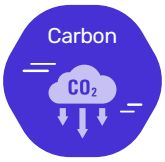
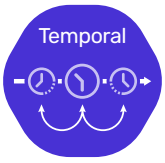
Forests and shrubland

CRITICAL PRINCIPLES

Connectedness	Urban forest initiatives and management practices should prioritize connectivity among various solutions to ensure their effectiveness in biodiversity conservation.
Diversity	Management practices to preserve and promote the diversity of urban forests are critical and should focus on increasing biodiversity in all aspects of urban forests solutions.

JUSTICE POTENTIAL

● High ● Existing ● Not clear

	Urban trees mitigate atmospheric pollution by absorbing pollutants through leaf stomata or the plant's surface. Research show that tree coverage and pollutants concentrations significantly impact the efficiency of pollutant removal[28] and suggest that street trees can be particularly efficient in pollutants-concentrated areas, emphasizing the need for proper spacing to avoid trapping of pollutants at street level.[29]
	Urban trees decrease daytime surface temperatures due to the combined effect of shading and evapotranspiration.[30]
	Forests sequester CO_2 based on plant photosynthetic capacity, which is influenced by tree species, age, health, weather, and environmental factors. Selecting species with substantial growth potential, providing optimal growing conditions is key to maximize carbon sequestration in urban forests. Additionally, protecting intact forests is more efficient for carbon storage compared to restoring habitats, as restoration may take over a decade to fully establish carbon cycling, and may not fully restore carbon storage potential.
	Sustainable forest management practices in urban and suburban environments is key to enhance wildlife populations and communities and properly managed spaces can maintain or also increase multiple wildlife populations.[30]
	Limiting localized air pollution, reducing surface heating and thermal discomfort, offering opportunities for communities to become more connected with environmental surroundings. **Studies suggest that urban trees may be disproportionately low in poor and minority urban communities, meaning that these communities are potentially being deprived of public environmental benefits.[31]**
	Reducing surface heating and hydrologic impacts and ameliorate air quality, urban forests have can help impede the impacts of climate change improving both human and wildlife health in metropolitan areas.[30]

RELEVANT GROUPS

Attention should be paid to stewards of **important ecosystems**, and their inclusion in activating NbS (e.g. sustainable forest management). Also consider aspects of biodiversity luxury effect, i.e. **high-income** neighborhoods especially benefiting from areas of high biodiversity value or forest ecosystems close by.

NBS CATEGORY
Sustainable drainage systems

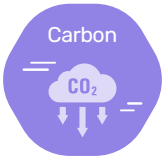
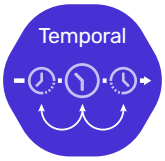
NBS MEASURE
Channel re-naturing

CRITICAL PRINCIPLES

Multifunctionality	Ensuring the solutions is designed in a way to provide multiple benefits such as increasing biodiversity, water management and climate resilience.
Responding	Taking into account aspects of local landscape character and key characteristics as well as the design of the solutions in relation to the practical functions required of the landscape.

JUSTICE POTENTIAL

High Existing Not clear

	River stream renaturation can decrease air pollution.
	Specific forms of river and stream renaturation such as riparian corridors including trees, stabilize water temperature and reduce ambient temperatures in adjacent neighborhoods.[32]
	Depending on the type of vegetation and management practices riverbank vegetation can contribute to store carbon.
	Rivers, stream and riparian corridor restoration projects are excellent way to enhance biodiversity. The corridors provide food, shelter, nesting and breeding areas for wildlife and serve as safe conduits for the movement of biota within the city and to the larger patches in the regional landscape mosaic.
	Renaturation of river and stream help slow the river flow and thus reduce river floods by creating water retention and infiltration capacity in the river system. Can be suitable for active recreation and as areas for contemplation, enhancing human experience in cities and delivering important public health benefits. Opportunities for social interaction, and improve connection between people the nature.
	High potential exists in terms of long-term benefits provided through such solutions, in increasing resilience to extreme events which are expected to be exacerbated by future climate change.

RELEVANT GROUPS

Attention should be paid to stewards of **important ecosystems**, and their inclusion in activating NbS (e,g, recreation pressure). In addition, attention should be paid to safeguarding accessibility to the benefits (e.g. cooling effect) by **low-income groups** and paying attention to risks of gentrification.

NBS CATEGORY
Green/Blue spaces

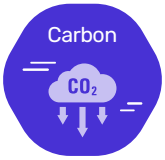
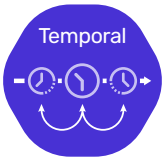
NBS MEASURE
Wetland, bog, fen, marsh

CRITICAL PRINCIPLES

Multifunctionality	Multifunctionality should be promoted to increase the resilience of such ecosystems while planning such solutions to provide social and aesthetic values.
Diversity	Management practices to preserve and promote the diversity of such ecosystems are critical.

JUSTICE POTENTIAL

High Existing Not clear

	Water bodies have a role in absorption and minimization of PM, with wider water surface area positively correlated with reduction of pollutants.[33]
	Wetlands have a substantial role in temperature regulation. The cooling effect is significantly influenced by the shape and size of the wetland, its hydrological connections, the surrounding built areas, and the integration of wetlands with vegetation.
	Wetlands have a critical role in GHG mitigation, playing a critical role in the carbon cycle and, due to their capacities to limit the availability of oxygen to soil microbes and decomposition of organic matter.
	Wetland ecosystems are habitat of an immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish and mammals. Dead plant leaves and stems form small detritus which provide nourishment for many small aquatic insects, shellfish and small fish that are food for larger predatory fish (e.g. birds and mammals).
	These measures provide important societal benefits, including natural water quality improvement, flood protection, shoreline erosion control, opportunities for recreation and aesthetic appreciation and natural products.
	Wetlands have a substantial role in temperature regulation. The cooling effect is significantly influenced by the shape and size of the wetland, its hydrological connections, the surrounding built areas, and the integration of wetlands with vegetation.

RELEVANT GROUPS

Attention should be paid to stewards of **important ecosystems**, and their inclusion in activating NbS (e.g. water rights). In addition, the activation can offer potential provision benefits to **low-income groups**.

NBS CATEGORY
Green/Blue spaces

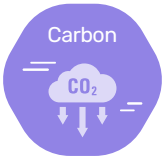
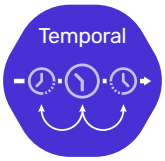
NBS MEASURE
Rivers, lakes, ponds

CRITICAL PRINCIPLES

Multifunctionality	Multifunctionality should be promoted to increase the resilience of such ecosystems while providing social and aesthetic values.
Responding	Taking into account aspects of local landscape character and key characteristics as well as the design of the solutions in relation to the practical functions required of the landscape.

JUSTICE POTENTIAL

High · Existing · Not clear

	Water bodies have a role in absorption and minimization of PM, with wider water surface area positively correlated with reduction of pollutants.[33]
	Recent research[34] shows the critical role of water bodies thermal capacity; however efficient solutions should consider a series of elements such as the position of the water bodies, their orientation in relation to prevailing winds to optimize the distribution of cool air, and the water temperature modification.
	Temperate ponds may be important sinks and sources of greenhouse gases.[35]
	Recent research indicates that ponds play a crucial role in regional biodiversity, acting as interconnected habitat patches and facilitating species movement and that, despite urbanization stressors, aquatic biodiversity in cities persists. **However, trade-offs might occur in relation to the several ecosystem services provided by urban ponds, with conflicting priorities among hydrological, geochemical, ecological, aesthetic, and cultural considerations.**
	Water bodies such as rivers, streams, canals provide many benefits for population, reducing temperatures, serving as recreational space, fishing grounds, and as a water management hotspot. Beside the important ecosystem services provided, ornamental ponds in parks and gardens are also proved important in relation to their aesthetic value.[36]
	**Water bodies as freshwater ecosystems perform vital ecological functions and provide essential environmental services. They can control urban flooding, support biodiversity, recharge groundwater aquifers and provide recreational and aesthetic space to the residents. Challenges of urban water management include flooding and extreme weather events, which will increase in severity because of climate change.**

RELEVANT GROUPS

Such spaces can represent **important ecosystems**, with defined needs (e.g. water. Attention needs to be paid to their high environmental amenity value, thus often predominantly accessible to **high-income groups**.

NBS CATEGORY
Technical

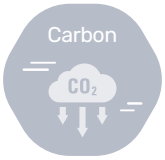
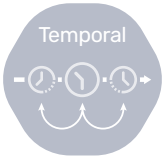
NBS MEASURE
Mobile vegetable gardens, temporary solutions

CRITICAL PRINCIPLES

Multifunctionality	Such solutions offer a great opportunity to provide multiple benefits being configured according to needs in terms of social and health and well-being.
Responding	Taking into account aspects of local landscape character and key characteristics as well as the design of the solutions in relation to the practical functions required of the landscape.

JUSTICE POTENTIAL

High Existing Not clear

	Temporary NbS as for instance floating gardens, provide benefits for water quality and air pollution.
	These measures can also be beneficial in terms of microclimate regulations, especially when including trees that provide shape and evapotranspiration.
	No particular potential is associated in terms of carbon storage and sequestration due to the temporary nature of such solutions.
	Such measures can provide key additional habitat for a diverse range of water based, insect and bird species within urban areas.
	NbS such as modular and movable solutions can be designed for food production, improving local food markets and increasing availability to healthy local food; they allow for a dynamic space through movable benches according to the needs (e.g. from sunny spots to shadow) and offer opportunity for social interaction in the public spaces. These solutions can assume different configurations according to users' preferences and space's needs and can cover surfaces of different kind and size.
	No particular potential is associated in terms of temporal justice due to the temporary nature of such solutions.

RELEVANT GROUPS

Attention needs to be paid that these solutions do not predominantly affect neighborhoods with **low-income groups or people with migration background**, and to the detriment of securing, maintaining or restoring permanent solutions.

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5 OTHER TEMPLATES FOR INTERACTIVE SESSIONS

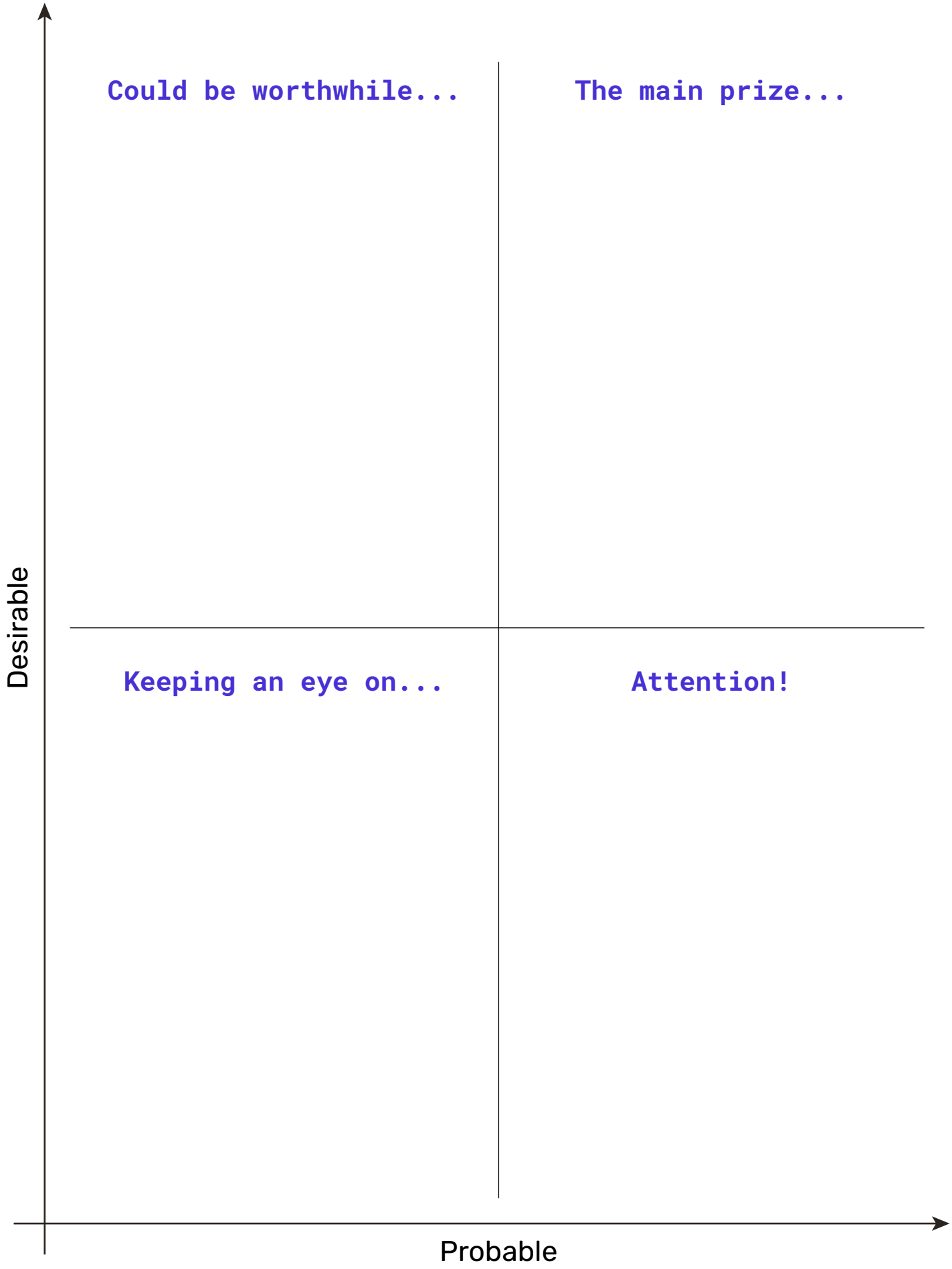
NOTE: to be printed in A2 or A3 format

Profile template

	PROFILES	KEY (IN-)JUSTICES	SOCIOECONOMIC CHARACTERISTICS	SUITABLE NBS
Area 1	.....	.....	.....	.....
Area 2	.....	.....	.....	.....
Area 3	.....	.....	.....	.....
Area 4	.....	.....	.....	.....
Area 5	.....	.....	.....	.....
Area 6	.....	.....	.....	.....

Fold here

Evaluation matrix



Scenario template

SCENARIO

N° .....

Name .....

Climate hazards

Impact on urban ecosystems

Impact on society

Low carbon | High air quality NbS

Timeline template