HORIZON 2020
Coordination and support actions

Development of a multi-stakeholder dialogue platform and Think tank to promote innovation with Nature-based Solutions

WP4 - Establishment of the ThinkNature multi-stakeholder innovation platform for NBS

Deliverable 4.3
Report on Dialogue Steering Statement for climate change adaptation and mitigation

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Executive summary

Report on Dialogue Steering Statement Papers and Dialogue Outcomes for adaptation and mitigation to climate change summarises the outcomes and work within the domain of NBS for adaptation and mitigation to climate change.

The literature review allowed to establish state of the art showing NBS' benefits, especially concerning large-scale renaturation projects for CCAM. More broadly, it underlines a significant impact on the development and urban models of territories. Thanks to this review and this analysis, some specific subjects were chosen to constitute a scientific and expert community around NBS, launch a dialogue, and improve knowledge around NBS for CCAM.

The stake and the objective are to get feedback from different pieces of knowledge, case studies across Europe, recommendations and lessons from lived experiences to favor the use of NBS and ultimately encourage the renaturation of territories because the only big scale and holistic projects can contribute mainly to CCAM. The benefits are not only to face climate change but also to improve urban quality and create a new model of cities.

This deliverable comes back to the methodology chosen to design the second day of the Paris Forum of April 2019, centered on NBS for CCAM. The choice of the topics is the result of a thorough state of the art. The plenary sessions are briefly summarized to provide an overview of the day's topic.

The design of the parallel sessions is done to foster dialogue between a diversity of stakeholders. Each parallel session is reported to draw lessons and elaborate recommendations for implementation.

Link to the presentations: https://platform.think-nature.eu/
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Introduction

The stakes to face climate change, combined with the context of increasing urbanization, call for considering the possibilities of adaptation and urban mitigation to environmental issues while ensuring the urban quality of the metropolises that have become the primary environment for people.

In this perspective, nature, and more specifically, Nature-Based Solutions (NBS), offer prospects for resilience and improvement of the urban quality of urban spaces. This question involves a new urban paradigm which relies on nature-culture reconciliation. This recomposition nature-city supposes and relies on a new apprehension of the relations between humans, nature, and city.

Reconciling the place of nature with the development of cities and inhabited environments emerges as a lever for designing urban environments more resilient. Nature is not limited to the idea of a city of nature, a symbol of the antithesis of the technological artefact.

Nature and NBS can constitute a new way of thinking about more resilient cities to face climatic hazards, but also to answer to the challenges raised by metropolisation. Nature is then considered in its global sense; “One nature.” Urban nature doesn’t only refer to vegetation, wildlife or artificial nature. It refers to the four main categories of natural elements: water, land/soil, air, and fire/energy.

Nature-based solutions are more or less innovative according to historical strategies for adapting human societies to their natural environment and their hazards. They are based on an eco-systemic approach, the observation and mobilization of the understanding of nature to adapt inhabited environments and reduce vulnerability to climate issues and events. For us, NBS constitute the first step to rethink the nature of urban spaces. They question the scientific and political horizons since they impose, suppose, require redesigning the anthropic vision of nature in its relation to inhabited, constructed spaces; the city.

The objective of this forum is to cross the interdisciplinary scientific viewpoints with those of engineers and urban policy stakeholders to understand the levers and the possibilities for considering nature (NBS) as a vector of urban resilience, improvement of urban quality, and well-being.
Methodology

1.1 State of the art on NBS for CCAM

Climate change constitutes a great challenge for today societies, especially in urban areas which are currently not ready to face the significant events related to this phenomenon: heat stress, floods, pollution peaks. To deal with risks related to climate change, two strategies are often underlined, mitigation and adaptation:

- **Mitigation** contributes to stabilizing the concentrations of greenhouse gases in the atmosphere to a level that limits dangers for the climatic systems. OECD states that it includes the reduction or limitation of greenhouse gas and the protection of carbon sinks (Ademe).
- **Adaptation** actions that limit the negative impacts of climate change and provide additional co-benefits. Such actions, according to the OECD, are related to: our ways of organizing - The localization of our activities - The technics we employ (Ademe).

Thus, NBS for mitigation are meant to reduce greenhouse gas emissions whereas in NBS for adaptation, the goal is to preserve services that are necessary for human life to make less harmful the adverse effects of climate change.

More and more, natural elements, nature, are seriously considered to support urban areas in becoming more resilient and coping better with the hazards to come. Nature indeed provides a significant number of ecosystem services, and as such, they should be maintained, restored and used sustainably to foster climate change adaptation and mitigation (Bundesamt fur Naturschutz, ecologic) More than that, NBS could be seen as pertaining to a broader strategy of renaturation.

NBS cover a diversity of measures: protection and expansion of forest areas to capture gaseous pollutants, planting windbreaks for soil conservation, protection of urban green spaces, green roofs, green walls (Pauleit et al, 2017) but also participate to the creation of sustainable urban drainage systems (Davis, Naumann, 2017)

NBS bring multiple benefits when they are implemented and contribute to resilience in many different ways: besides making more efficient carbon capitation, drainage systems, and improving air quality and atmosphere for example, they are likely to have positive collateral effects: improvement of quality of life, construction of more durable and adapted infrastructures, improvement of social capital and creation of social bond in urban spaces, improvement of health (physical and mental), creation of new jobs, improvement of urban quality, involvement of people in local territories, public savings on the long run, improvement of the aesthetic aspect of an area, biodiversity.

Accordingly, they are said to be multifunctional as they are designed to serve not only one goal, but several: they bring multiple benefits in different field of analysis: environmental, social, economic, cultural, urbanism. Hence, they need to be thought as a whole, holistically, to be taken in all their dimensions and bring all the elements into dialogue and implement in the best way (Haase, 2017).
Thinking about NBS holistically it allows us to understand the interdependencies between the various dimensions and fields, and permits complex thinking to take into account all the fundamental concepts, enter into a dialogic process to assess the wanted and unwanted impacts before putting in place any measure. Complex thinking is necessary to deal with uncertainty, mistake, and risk (Morin, 2014). It is necessary, because the multiple benefits they are likely to bring may be coupled with unwanted effect, disservices. Then, trade-offs need to be examined thoroughly (Rodriguez et al, 2006)

NBS also refer to more participatory approaches in an attempt to foster co-design, co-creation, and co-management. As they cross different fields of expertise, coordination, and communication between different stakeholders is paramount, and as the changes occur on occupied territories, locals are also often a part of the project. As they involve natural elements, imply a long-term perspective and different relevant scales, they cut across traditional jurisdictions (Lascoumes, 2018)

In order to go deeper, 4 case studies involving NBS are presented as good practices:

❖ **Room for the Waal**

A national program to deal with the risk of flood in the Netherlands and enhance urban quality:
- Involving different institutions and people (minister, water company, national directorship, inhabitants)
- Diversion of roads, widening of the river bed, destruction of existing structures

❖ **Eco quartier Clichy Batignolles**

Renaturation project including:
- Biodiversity and natural milieu
- Soil maintenance
- Water maintenance

❖ **BENE program (Berlin)**

Berlin land’s Senate had the will to integrate a strong environmental and climate dimension to urban development. Such a task is carried out by the B.&S; (advice and service on the environment) through different measures:
- Developing a number and the quality of green spaces
- Connecting green spaces
- Improve the environmental urban quality
- Develop measures of ecological compensation
- Improve green infrastructures

Source: Paris.fr
- Raising awareness among the population

Grüner Ring Leipzig

The association which gathers 13 municipalities fosters sustainable urban development through different measures:
- Wetland creations
- Offering more shadowed places
- Preventing air pollution
- Water retention systems

These 4 examples have been presented in the Paris Forum.

1.2 Plenary sessions: giving a general background

Before focusing on topics chosen after having analysed the literature on NBS for CCAM, the two plenary sessions aimed to give a global framework for the understanding of the parallel sessions of the second day of the Forum. They intend to provide general guidelines around the possible implementation of NBS, they envision long-term and wide-scale changes for societies. Speakers highlight the necessary shift of trajectories in our economic and social models as well as in our relation to nature itself.

The two sessions were composed as follows:

Nature for urban adaptation and mitigation to climate change

Adaptation to climate change, ecological issues, urban quality and well-being

The topics raised during those two sessions can be understood as prerequisites to implement further and develop NBS.
1.2.1 Nature for urban adaptation and mitigation to climate change

To adapt and mitigate climate change, it is paramount to change the current relationship between human and nature. Taking nature into account and integrate it as a part of our lives is likely to bring more respect towards the environment. Nature, NBS can contribute to urban adaptation and mitigation to climate change, but the actions related need to be more than punctual ones.

On the whole, nature can contribute to CCAM in many ways:

- Carbon storage
- Cooling effect
- Filtration of air and water
- Provision of cooler places during heat waves
- Better quality of life
- Better management of floods

It supposes to be able to reconnect with nature and considering as an integral part of our lives.

In this session, the philosopher Chris Younès, the biologist Gilles Boeuf and the Geocologist Sandra Naumann stressed the importance of nature to the resilience of beings, the necessary connectivity of different NBS and the articulation of scales, and nature as a great source of inspiration.

Conceptual notions to keep in mind when elaborating action plans:

- Thinking the whole
- Nature to be taken seriously (as a part of our own living)
- Thinking of the essentials
- Thinking the metamorphosis (ways of life, standards...)
- Trans-local, global (planetary awareness) sensitive to local peculiarities
- Shared narrative

Practical lessons:

- Isolated NBS are not enough: thinking the scales and build in interrelation
- Give up the silo thinking: connecting the disciplines
- New governances needed more adapted to the scales

1.2.2 Adaptation to climate change, ecological issues, urban quality and well-being

Nature and NBS can constitute a new way of thinking about more resilient cities to face climatic hazards, but also to answer to the challenges raised by metropolisation. Nature is then considered in its global sense; “One nature”. The objective of this session was to think adaptation to climate change and ecological issues according to urban quality and well-being.

Enric Pol, Environmental Psychologist, Nathalie Blanc, Geographer and Luc Schuiten, Architect designer, are giving their views on urban quality, the inclusion and participation of the locals to NBS projects, the importance to have a sensitive
experience of nature as it contributes to wellbeing, reduction of stress, the need to link nature-based solutions, or renaturation projects to social considerations.

Three key messages were delivered during this session:

- The importance to reconnect users to nature by experience and innovation
- The necessity to redefine political and society models (as well as economic models)
- The necessity to valorize and connect the systems.

During this session, some barriers and uptakes were underlined and contribute to define and locate NBS in a new paradigm, different from the current one which has failed with ecological concerns.

Uptakes:

- Growing awareness on climate change. A good opportunity to activate citizens and politicians.
- Collective action around neighborhoods issues. A growing demand for urban quality.
- Nature is inspiring and has a lot to offer.

Barriers (and limits):

- Current economic system (despite some evolutions, still not a priority on the agenda)
- Gentrification
- Our current ways of life (high consumption, relation to nature...)

These general ideas set the scene for more specific topics related to climate change adaptation and mitigation and the potential implementation of NBS.

### 1.3 Topics chosen related to CCAM

Following a state of the art composed of a literature review and case studies, as well as interviews with researchers and experts on nature and CCAM, we oriented our choice for the parallel sessions’ topics. These parallel sessions can be understood as an in depth look on a more specific topic, to illustrate the plenary sessions in more concrete terms.

To explore the topic of climate change adaptation and mitigation in urban areas, which are the principal inhabited areas, we intend to focus in each session on a specific matter: the first series of sessions concerns more specifically human and urban resilience whereas the second series of sessions is more centred on nature as a potential vector of adaptation and mitigation in urban areas.
1.3.1 First round of parallel sessions: can nature enhance urban resilience?

To begin with, a first session depicts broadly how nature, natural elements, vegetation can contribute to improve human resilience (nature having a restorative effect, contributing to stress reduction, allowing areas to gather and communicate) as well as urban resilience through strategies contributing to adapt the city to potential risks of floods and heat stress.

To go deeper in the analysis, two special focuses are developed:
- **Green housing** as a way to build more sustainable cities (in social, environmental and urban ways)
- **Giving room to nature and landscape** and learn how to live with them and the risks they imply instead of trying to avoid natural risks such as floods by artificial means. The idea is to show a different way to deal with nature: welcoming it as a part of our urban life and live according to the rhythm it imposes, and adapting our human organizations in accordance to its very principles.

1.3.2 Second round of parallel sessions: can (re)naturation contribute to urban climate change adaptation and mitigation?

Three main topics are developed to show in what ways renaturation, and naturation, can contribute to adapt and mitigate urban climate change.

To remind,
- **Mitigation** contributes to stabilize the concentrations of greenhouse gas in the atmosphere to a level that limits dangers for the climatic systems. OECD states that it includes the reduction or limitation of greenhouse gas and the protection of carbon sinks... ¹
- **Adaptation** contributes to limit the negative impacts of climate change and maximize the benefits. Such actions, according to the OECD, are related to:
  - The localization of our activities
  - The technics we employ.²

A focus on **biodiversity** is needed, for we forget too often how connected to climate this issue is. Biodiversity is indeed at the core of ecosystem functioning and services, and is a factor that needs to be taken into account and examined carefully when implementing NBS.

Biodiversity is a feature that embodies quite well the multi-beneficial aspect of NBS: for example, while providing benefits such as cooling a place or stocking carbon, green walls are also likely to be a source of biodiversity (under conditions, right choice of species...)

Then, we chose to concentrate on **urban forests** as a means to adapt to the effects of climate change and mitigate climate change. This session is thus designed to show which benefits urban forests, trees lines, vegetation, are likely to bring: stocking carbon, cooling places in case of heat stress... and to explore under which conditions

¹ ADEME https://www.ademe.fr/expertises/changement-climatique-energie/quoi-parle-t/lattenuation-ladaptation
² Ibidem
such urban forests are relevant and bring positive effects for cities and city dwellers, and the way cities or private companies take on this topic.

Adaptation to climate change implies focusing on urban quality: adaptation is about facing the risks related to climate change but also means reinventing the city and bringing in urban quality. Indeed, a resilient city is also a city where people can rest, restore themselves through quality spaces. How to shape a living city and take advantage of currently abandoned spaces to recreate life, biodiversity, and better atmosphere? How to ally with nature to allow urban dwellers to feel well and consider the places theirs?

1.4 Designing parallel sessions

Each session is composed of a moderator and three speakers: an expert, a policy member and a scientist.

The moderator's role is to introduce the central questions which are raised and answered during the session, and to facilitate the dialogue between the speakers and the audience.

The three speakers are invited to present their views and possible answers on the session’s topic in 15 minutes.

After the presentations, 45 minutes are dedicated to questions and dialogue. A time is left for each speaker to answer potential questions, and the remaining time is allocated for dialogue and debate. The moderator is in charge of the animation and will lead the debate thanks to 3 sub questions prepared in advance and the reactions of the public. The idea is to initiate a discussion / debate between the three speakers themselves and with the public as well, to foster knowledge and experience sharing. In some sessions, the audience was split in groups
Dialogue Steering Actions for Climate Change Adaptation and Mitigation

In this part, the minutes of each parallel session is delivered, summarizing the speakers’ presentations, the main points raised during the dialogue, and the principal conclusions given.

1.5 Can nature support quality of life and resilience?

1.5.1 Designing Dialogue

Quality of life refers to the set of conditions contributing to make our lives pleasant and valuable. According to the WHO (1995), it also refers to the degree of happiness or satisfaction experienced by an individual or group, specifically with regard to health and its domains. From our recent research we have learnt that contact with nature may have both a direct effect on health as well as acts as a facilitator of healthy behaviour. We have found evidence suggesting direct and indirect impacts on the health effects of NBS. A number of research studies demonstrate that green areas as well as other green/blue solutions foster physical and mental health not just through providing opportunities for exercise, but also fostering meaningful and constructive social contacts or mutual knowledge (Kaiser et al., 2013), what might enhance perceptions of neighbourhood quality (Hidalgo & Hernandez, 2001). Living in a green neighbourhood is linked to higher levels of self-reported health, happiness and robust predictor of overall neighbourhood satisfaction. Furthermore, exposure and closeness to urban green spaces are related to lower levels of stress (Hartig & Kahn, 2016). In general, the restorative effects of nature experiences have been studied within the framework of two major theories: Attention Restoration Theory (Kaplan & Kaplan, 1989) and Stress Reduction Theory (Ulrich et al., 1991), focused on the recovery of intrapersonal resources that have diminished due to adaptation to environmental demands, stressors and challenging tasks. Exposure to nature triggers positive reactions involving both physiological and emotional changes which facilitate psycho-physiological stress recovery.

Cities are facing a series of social and environmental challenges that go from the reduction of the most negative impacts of climate change to manage inadequate infrastructure for addressing these challenges. Climate resilience is necessary in order to help cities in adapting to climate change, but also in planning to make this adaptation not considering the impacts as side issues, but as part of a comprehensive plan which considers locally adapted projects into every aspect of the urban development (land use planning, transport, or housing decisions). Our own research on NBS is evidencing knowledge gaps, barriers, and opportunities for action. NBS aim to address a series of environmental challenges, through specific objectives and actions. Each action has an associated set of expected impacts, that require a set of indicators associated with climate resilience for targeted quantification of benefits. Some of them have been implemented on urban green infrastructure projects and tended to be focused on climate change adaptation or mitigation. Adaptation focused on temperature reduction and providing urban comfort zones for urban communities, using ground level greenspace and trees (Demuzere et al., 2014), or...
green walls and green roofs (Baro et al., 2015). More holistically, implementation of a climate resilience strategy was also considered as a very useful indicator for measuring change (Bosch et al., 2017).

### 1.5.2 Summary of presentations

- Some proof of the positive impact of NBS on health (Kaiser & al, 2013) and facilitate healthy behaviors (resilience?)
- Enhance perception of neighborhood quality (quality of life) (Hidalgo & Hernandez, 2001)

**Major Theories to face climate change in urban environment:**
- Restoration theory (Kaplan & Kaplan, 1989)
- Stress Reduction theory (Ulrich & al, 1991)

Define the need to mitigate the impact of climate change with transition to sustainability by encouraging policies, to maximize the effects from NBS in terms of wellbeing, cohesion, safety and adaptation.

One key aspect is to change our habits to sustainable lifestyle.

**GLAMMURS project to explore sustainable lifestyles.**

**GLAMMURS: Co-production of Knowledge to sustainable lifestyle.**

Urban context needs a change in our way to use natural resources.

**Question arise:** How can we promote an upscaling of practices and sustainable lifestyles and transform economies in a sustainable direction.

It engages stakeholders and scientist to create knowledge through their interactions.

**Session**

*Paris Resilience Strategy: The Oasis Schoolyards*

**Multiples pillars to adapt the city to climate change**

- **1 Paris as an inclusive and cohesive city that builds on the strength of Parisian residents to become more resilient.**

First solution that is based on the social way to cope with climate change. With goals attainable by solidarity: create conditions that encourage kindness among neighbors and inclusion at the neighborhood level.
2 Paris a city build and developed to meet the challenges of the next century

Second solution based on the infrastructure and its adaptation to inexorable climate change, with solution based on promoting resilient urbanism in a dense city or design infrastructure that creates multiple benefits.

3 Paris a city which mobilizes its collective intelligence, adapts its operations and cooperate with the surrounding territories

The transition to climate change will only be possible with cooperation with the surrounding territories.

Oasis Schoolyards project

Goal: transform schoolyards into « cool island » to cope with the global warming expected.

It’s a technical and social adaptation. Utilization of new materials and techniques and cool islands develop social cohesion.

Session Morgane Colombert

There was a big evolution in the way humans create buildings. Originally, were used available and local materials. New construction processes and new technologies have conducted to a globalization of the modern architecture, making our city’s more vulnerable to temperature change and heatwaves.

On a long-term approach we need to process urban transformation and changes in our lifestyles to produce a “good climate change”. Paris’s commitment is growing more project to cope with climate change.

Adaptation to climate change by the authorities is done by a four-step framework (Agrawala & al, 2011; Moser & Ekstrom, 2010).

- Detect the problem and recognize the risk
- Understanding the risk
- Planning
- Managing

What we know? what research can bring?

Center on a city and building scale it is possible to reduce heat release, manage ventilation, protect from direct sunlight, cool the environment.

We must not expect everything from the science/accept that our action and their impact is not visible at first/integrate uncertainty/No reproducibility solutions (local reflection is needed).

1.5.3 Conclusions

This session brings some response to the general question with theoretical points showing the impact of NBS on quality of life in health-related aspects.
and our way to cope with specific change in our manner to approach NBS in the city and the way we think its construction.

Specific application of how we can use NBS in a city is given with the example of Oasis schoolyards, showing a way to adapt buildings (especially a one frequented by a vulnerable population).

Opening to other questions?

This session brought question about how to adapt our everyday life and way of organizing the city to cope with global and inevitable climate change. It may open questions about how do we prevent ourselves to more change? In this session a key element presented by the different session is the inevitable aspect of climate change, and our need to cope with the already ongoing transformations. Effect of NBS on our overall health and some concrete example of application can give us some way to think about to future concrete application of NBS in the city and how we can expand NBS to other types of buildings.

1.6 Can green housing quality encourage to resilience?

1.6.1 Designing Dialogue

“Green housing” defines a type of housing designed to be environment-friendly and sustainable. It provides high performance features in a resource efficient manner to minimize the negative impact of the built environment. Thus, it aims e.g. at decreasing the energy, water and building materials consumption, at improving the indoor air quality, at producing less waste, but also at using sustainable resources which will provide comfort and well-being of the inhabitants. Thus, the benefits are both environmental, economic, urban and societal.

The purpose of this session is to question if the quality of green housing can encourage the development of resilient cities, both at the building and urban scale, for example through the implementation of specific policies. It will explore as well how NBS could be combined with grey construction technologies and how this combination could be a way to improve resilience. Urban, social, environmental, climatic and economic parameter will be taken into account.

The speakers brought together for this session will first present state-of-the-art technologies and innovations in green housing. Maeva Sabre, climatologist at CSTB, will present her results on façade and green roof to improve building and urban resilience. The engineer Alain Maugard, expert in the sector of construction and QUALIBAT president, will introduce positive energy buildings and explain how cities can become a vector of resilience and biodiversity especially through NBS. The architect Frederic Bell, from the Colombia University and formerly from the Municipality of New York, will expose the Design and Construction Excellence program of the City of New York and its ambition to develop NBS.

1.6.2 Summary of presentations
New York City has 4 “values” in its projects: Sustainability, Resilience, Social equity, Health. The idea of resilience is especially strong since hurricane Sandy in 2012. NY has launched several related NBS projects since then. There was also a specific focus on improving the quality of housing, especially because of NY’s quite old building stock. The New York City Housing Authority (NYCHA), the largest landlord in NY, is in charge of this programme.

Hurricane Sandy revealed the dangers of nature and the unsuitability of some housing buildings, such as the Baruch Houses that host +/- 60,000 inhabitants. Most of it has been flooded after Sandy. Large surfaces appeared to be really not adapted and retained water during long periods (playgrounds, paved areas, parking lots, ...). Six years later, reparation still have to be done.

NYCHA understood the need to change its approach in future construction projects. It started introducing NBS and new measures. For example, a rule imposed to include green or blue solutions during roofs repairs, or to explain why such solutions were not possible (unfortunately, a majority of projects chose to explain “why not”). NYCHA also launched projects which consisted in elevating equipment or structures, to protect them from flooding. They designed as well emergency post-disaster housing, that could be quickly build after the event.

provides some examples of these projects:

- Re-use of former industrial sites in Manhattan’s East Side and Long Island City.
- Sport structures and recreational area built in zones exposed to flooding: citizen can still use these areas and no damage would be cause if flooded.
- Via Verde (housing): buildings of different heights, connected by bridges and stairs, with roof gardens, to provide a recreational-green area. Flagship project pushed by the mayor.
- ...

presents the European GROOF project (Greenhouses to reduce CO₂ on rooftop, 09/2017-08/2021), funded under the EU Interreg programme (North West Europe) and that gathers 11 partners from 5 countries (Luxemburg, Belgium, Germany, France, Spain). It aims at facilitating the emergence of greenhouses on rooftop on the market by supporting their implementation. Thanks to specific technologies, those greenhouses will enable to:

- Recover the heat generated but not consumed by a building for the production of plants and vegetables (through ventilation systems or other ways)
- Recover human CO₂ to feed vegetables
- Reduce CO₂ emission due to transport, by producing vegetables locally

Such a rooftop project presents a certain number of issues:

- Security: for the building and for the inhabitants
- Performances: such as energy, water, comfort... (will they be satisfying?)
- Compliance with regulations/standards, which can be numerous
- Which innovative technologies will be necessary?
- How to ensure the usage and services

For this project, the communication was a very important aspect. It is crucial to explain the idea and impacts to the inhabitants and public authorities. Also, the project included a reflection on the long-term approach: what happens after the project, and how to ensure that the greenhouse survives with all performances maintained.

The first phase of the project consisted in learning from existing urban farms and from a state of the art. The second phase consists in identifying early adopters across North West Europe. The call is currently opened. In a first step, 10 projects will be kept. After a socio-economical, structural, plants selections, energetic performances analysis of the initial projects, 4 of them will be kept and supported. The third phase is to build 4 pilots or rooftop greenhouses and to monitor them in order to carry out, during a final step, an evaluation of CO₂ performances. All of these experiences and knowledge will be summarized in two guidelines one for experts and one for none experts.

Engineers can now show that nature in cities can reduce temperatures by 0.5-2°C and that it improves the air quality. Also, too much impermeabilization of grounds in cities increases risks of floods and decreases the water quality (rain water drains bad minerals and components). The nature can counterbalance that, especially through the implementation of rooftops.

provided a historical perspective on the presence of nature in cities:
- from the Roman empire to the Renaissance, cities were purely mineral. Towns were limited and nature stayed outside. A reason was that people in cities were a minority compared to people living in rural areas.
- during the Classical/Baroque period, a new vision of architecture emerged with the “jardins à la française” (gardens that are fully designed and shaped). Humans consider that they should master nature and shape it how they want, just like with minerals.
- during the 19th century emerge the English gardens/parks. Nature becomes a less organised and comes into towns, but still in low proportions. Not in Paris though, due to Haussmann’s works.
- during the 20th and 21st centuries, the urban population grows and starts complaining about the lack of nature in towns. This will of the population comes in opposition to planners, who tend to keep building and adding concrete/minerals in towns.
- nowadays, the construction sector is changing its habits. There is no separation between nature and buildings, solutions mixing the two appear. This is a major change.

Nature, with different species, now appears on walls, gardens, roofs, etc. The city tends to welcome more biodiversity than rural fields, where agriculture wants destroy species to prefer monoculture (which actually make cities’ honey better than honey in monocultural fields areas). Also, with urban agriculture, it is quite a revolution not to have only decorative nature in cities, but also food producing nature.
In occidental countries, more than 90% of population is urban. We can oppose urbans-born people and the ones that became urban. The urban-borns have always lived in towns. Now, they want to be reintroduced into nature, to know nature, not in a sense of domination but of humility. If we want people to stay in towns, we will have to introduce enough nature (question of “intensity”). These urban people also foster the consumption of organic/local/quality food/ancient species, unlike the rural areas. In this sense, it is the urban people who promote biodiversity.

Therefore, does not oppose nature and cities. Cities are not “all bad”, buildings adopt new clean materials, etc. We are in a period of reinvention and creativity, with drastic changes in our relation with nature. But different species (animals and plants) might develop in cities and outside cities.

1.6.3 Discussion Topics

How can we claim surface for these NBS and installations that we want in cities?
- Several persons mention the we should remove cars from cities and claim road and parking lots surface
- there are already many initiatives (bike lanes, taxes on cars for ex in NY, make parking extremely difficult or expensive, ....). The idea is to push people to find alternatives.
- if we manage to produce food inside cities, we will reduce transportation of goods in cities and therefore gain space (in addition re the reduction of CO² emission, etc.)

What economical model can we follow?
- : the economic costs do not reflect the real costs on nature. We need other taxes, such as the “carbon tax”. This tax is implemented in nordic countries, but it is much harder to implement in France for example. We must really think of how to create a real economic model of NBS. E.g. organic food is bought by richer people in cities, which is unequitable. But the expansion of this consumption might lower prices, and finally all social classes might be able to buy them.

Are we seeing a new model of cities arrive, with archipelagos instead of one “old” center?
- : we must organize suburban areas differently indeed. Multi-center must appear to enable the development of sustainable cities.

1.6.4 Conclusions

Three key messages to take away:
- We see an evolution of construction and planning practices, that aim to create more resilient cities. Practices adapt to the effects of climate
change, while taking into account the quality of housing and the well-being of inhabitants.

- Examples prove that NBS and green housing can be a common answer to all the previous goals.

- Cities and nature are not necessarily opposed. Urban citizens want more and more nature in their cities, they welcome NBS and cities tend to foster biodiversity.

The main barriers and uptakes identified were:

- NBS and green housing still have to find their economic model. Without a better access to financing, it will not be possible to develop such project at a larger scale.

- But apart from rooftops, there is little space available in cities for new larger NBS projects, green buildings, green urban features, etc. Cities must make surface available for their green restructuration.

1.7 Can nature and landscape contribute to resilience?

1.7.1 Designing Dialogue

Landscapes are very varied and are interconnecting sometimes complex human and natural elements, the resilience of which is being tested by the new challenges emanating from climate change. In this session, a scientist, an expert and a policy-maker explored the importance and the challenges linked to a multidisciplinary approach with examples cases from coastal, urban and riparian landscapes. During the session, the participants discussed the resilience of these landscapes and how it can be enhanced with Nature-Based Solutions (NBS). In-depth understanding of the risks and responses in each situation is essential to identify optimal solutions, as well as to assess the role of NBS in these solutions and how they contribute to the landscape’s resilience when integrated and implemented through holistic and their effective policies.

Answer to the session’s question: can nature and landscape contribute to resilience?

Yes, nature and landscape can contribute to resilience under certain conditions. During the Session, the speakers and participants highlighted that transforming problems to be tackled, such as reduction of significant risks, into opportunities for additional improvement for the local quality of life. They illustrated that in the process of thinking globally (strategies for climate change adaptation, energy transition and environmental transition) and acting locally in a sustainable way (to contribute to the local economic, social, cultural development and quality of life), it is essential to establish a structured dialogue between the local administrations, private and economic stakeholders. However, the main difficulties include the
management of multidisciplinarity (especially the interdisciplinary understanding, trust building and effective cooperation) and facilitation of stakeholders' involvement.

With this local involvement and multidisciplinary approach properly managed, knowledge and best practices can be exchanged and lead to commonly designed policies/solutions that protect, valorise and sustainably develop the regional and local identities as well as their heritage and landscape values. Co-creation and co-design of the projects by the local municipalities and stakeholders, allow to gather local collective knowledge, increase the project’s multiple added-value to society and improve its acceptance base. The necessary knowledge to design and implement optimal nature-based solution involves expert knowledge (from multiple disciplines) as well as the collective local knowledge (that needs to be valorised and translated into clear requirements).

1.7.2 Summary of presentations

Room for the Waal
Between the cities of Nijmegen and Lent, the Waal river makes a sharp bend. The winter bed is very narrow at this point in the river. During extreme high-water levels, like the extreme flooding of 1993 and 1995, the location acts as a bottleneck. The River Waal is too narrow to drain away large volumes of water. The problem is especially acute near the city of Nijmegen, where the river is trapped in a narrow winter bed between the dykes. In order to be able to drain away high water, the river needed more space at this point.

Together with the municipality of Nijmegen and its residents, Rijkswaterstaat decided to implement the project Room for the Waal that planned to move the dyke at Lent 350 meters land inwards, dredge an ancillary channel in the flood plain to help drain the river during extremely high water. This in turn creates better flood protection for the area behind the dyke. Repositioning a dyke is a very radical but also effective and sustainable measure to better protect the watershed against floods. With the island and the ancillary channel, Nijmegen has been given an entirely new landscape with new opportunities for recreation and new urban development.

One of the main challenges was to get the locals on board. The City of Nijmegen involved them from the beginning in the design phase and the collective local knowledge proved crucial in finding the optimal solution as well as in reviving the local cultural heritage.

Key Messages:
• transform problems (significant flooding risks) into opportunities (besides solving the immediate problem(s), the project can be an opportunity to improve the local quality of life);
- by **co-creating and co-designing** the projects with local stakeholders, municipalities gather the collective local knowledge and can significantly improve the project’s acceptance base;
- and effectively bring **multiple added-value to society** (protected area with new recreation facilities and a revival of the past ‘water culture’);

**French Regional Nature Parks and climate change: Understanding the issues, acting and building shared solutions**

*A regional nature park* is an inhabited rural area or peri-urban area, recognised at a national level for its **high heritage and landscape value** and organised in a concerted project of sustainable development to protect and valorise this heritage.

When they are created for a renewable period of fifteen years (duration of a national charter), regional nature parks enter a process of construction and arbitration between development and preservation, conservation and creation, experimentation and maintenance.

For nearly 20 years, the French Regional Nature Parks network has been working with the local stakeholders of its 53 territories to find solutions for climate change control and adaptation strategies as well as energy and environmental transition.

For these parks, combining exceptional natural spaces and urbanisation with strong environmental and heritage quality, the issue of resilience is almost existential!

With regard to climate change, this dimension is particularly sensitive for coastal territories such as the Camargue or the Gulf of Morbihan. In these territories, climate change is perceptible by all through a disruption of the coastline and a need to rethink the way in which the territory functions in all its activities.

In order to adapt to climate change, Parks establish a multidisciplinary team to deal with the all subjects without omitting the various issues. Over the past ten years, there has been a real awareness among the population and companies of the notion of quality of life, preservation of the planet and collective responsibility in adapting to the climate and in the fight against this change.

The way forward for the Regional Nature Parks of France is to work locally on climate adaptation plans that lead to more qualitative lifestyles by promoting knowledge, sharing and the development of shared solutions, and make it possible to pursue the Parks’ non-standard mission.

**Key Messages**:
- the charter recognising regional nature parcs in France is in fact a **process** for rural areas with remarkable landscape features to develop more sustainably;
- by establishing a **structured dialogue** between the local stakeholders, the process attempts to tackle major global challenges (strategies for climate change adaptation, energy transition and environmental transition) and to contribute to the local economic, social, cultural development and quality of life;
• with the local involvement, knowledge and best practices are exchanged and deliver commonly designed land use plans to protect, valorise and sustainably develop the regional identity and its high heritage and landscape values.

The positive effects of natural environments on Humans
The effects of contact with nature on health are now well documented in psychology and four factors can explain the positive relationship between contact with nature and health (de Vries, 2010):

1° the improvement of air quality (by the absorption of atmospheric contaminants by vegetation);
2° stimulation of physical activity (walking, cycling, outdoor activities);
3° the facilitation of social cohesion (people living near green spaces feel less lonely and feel less isolated);
4° restoring stress or mental fatigue.

Nature has restorative effects on some individuals (Ryan et al., 2010).

1° Reductions in stress;
2° increases in focus and concentration;
3° enhanced academic performance;
4° increases in vitality.

Contact with natural environments, such as natural parks, gardens, forests, beaches, urban parks, but also green plants on the edge of a window, view of trees, etc., allow reduce the need, and make it temporarily useless, to deploy sustained, directed or selective attention, and thus to allow the humans to rest.

The qualities of living environments that leave room for the nature favour the harmony between people and their environment, and help the inhabitants, the walkers, the townsmen to cope with an excess of stimuli related to urban life.

Encouraging harmonious links between person and environment is the goal in the design of living environments, taking into account the essential role of restorative environments. A healthy society needs to tackle the inequalities in access to these environments, both in terms of the health and well-being of individuals and in terms of quality of life.

Key Messages:
• science has demonstrated the positive effects of contact with nature on human health and well-being;
• by taking into account the restorative role of nature and encouraging harmony between person-environment in the design of living environments, more individual needs can be met;
• by tackling inequalities in access to nature, the mental resilience of the urban population can be significantly improved.

1.7.3 Discussion Topics

In the audience, there were academics, consultants, researchers, city officials and industry representatives who raised the following discussion points:

1° How did the speakers manage the process of stakeholder involvement leading to effective co-creation?

By giving time and attention, organising regular meeting and establishing a project team, including the willing local stakeholders, the City of Nijmegen managed to
obtain local popular knowledge that was unknown to them. By integrating this knowledge in the project design, this led to effective co-creation and shared solutions.

The Regional Nature Parcs’ approach established a communication platform where experts and locals can meet exchange and improve their design.

2° How has your project contributed to resilience?

By designing and implementing a solution that accepted Nature’s constraints (give the river more room when needed) and by making nature more acceptable (reviving the water recreational activities and culture), the City of Nijmegen significantly improved the local quality of life and the physical, natural and psychological resilience of the City.

Resilience is an inherent characteristic of the Regional Nature Parcs and new strategies and opportunities can be foreseen to develop or create new local economic activities (e.g. tourism, eco-tourism). For the Camargue, sea level rise may cause more flooded area, but this creates new and valuable landscape. The Morbihan Gulf is very dynamic and is expected to adapt naturally to climate change. Don’t fight nature, accept it.

3° Was the interest in natural capital integrated in your project?

How to deal with different aspects of resilience?

Resilience is a human capacity and an ecological characteristic. With regard to Climate Change, there is also a clear political dimension that needs to be activated in order to adapt. Adaptation to climate change needs concerted action; because individuals cannot properly respond on their own to this ‘unnatural phenomenon’. (This was more of a statement than a question: highlighting the need for concerted policies regarding Climate Change Adaptation). During the discussion, however, it was reminded that financing comes from various sources, including public (international, European, national, regional, local) and private (companies, crowd funding).

Co-designing and co-creating can stimulate co-financing, however, does this also imply co-responsibility?

1.7.4 Conclusions

Key Messages:

- When considering the possible solutions to specific issues, it is essential to transform problems (e.g. significant flooding risks) into opportunities (to increase added value and improve the local quality of life); this can be achieved through co-creation and co-design of the projects by the local municipalities and stakeholders, gathering the collective local knowledge and improving the project’s acceptance base, while effectively bringing multiple added-value to society (e.g. protected area with new recreation facilities and a revival of the past local culture);
- establishing a structured dialogue between the local administrations, private and economic stakeholders, is a key step in the process of thinking global (strategies for climate change adaptation, energy transition and environmental transition)
and acting local in a sustainable way (to contribute to the local economic, social, cultural development and quality of life); with the local involvement, knowledge and best practices are exchanged and lead to the delivery of commonly designed land use plans that protect, valorise and sustainably develop the regional and local identities as well as their heritage and landscape values.

- science has demonstrated the positive effects of contact with nature on human health and well-being; by taking into account the restorative role of nature and encouraging a harmonious relationship between the individual person and nature in the design of living environments. Smart design of urban nature can satisfy more of the goals and needs of each individual; however, it is essential to tackle the inequalities in access to nature in order to stimulate resilience against stress.

**Barriers and uptakes identified:**

1° Management of **multidisciplinary cooperation** for the implementation of innovative solutions (e.g. NBS):
   - difficulty of inter-disciplinary exchanges between very different professional or occupational cultures (languages, jargons, capacity to express opinions, ...),
   - difficulty to access and understand the local collective knowledge,
   - once the understanding issues are solved, there is a trust building phase that is a prerequisite to cooperation,
   - the time necessary to get through each phase (understanding-trust-building-cooperation) can be quite long,

2° Access to finance. The requirements on anticipated outcomes of funded research projects restrict access to funding
   - it is often required to know the end results of the project/research in order to obtain the financing,

this is a particularly crucial issue for NBS which, like in the case of the French Regional Nature Parcs, are the experimental laboratories where the outcomes are not necessarily known before 5, 10 or even 15 years later.

**Key lessons / recommendations for action (local governments, SME’s, academic research, community partners)**

**Policy**

- transform problems to be tackled (e.g. significant risks) into opportunities for improvement (local quality of life);
- in the process of thinking global (strategies for climate change adaptation, energy transition and environmental transition) and acting local in a sustainable way (to contribute to the local economic, social, cultural development and quality of life), it is essential to establish a **structured dialogue** between the local administrations, private and economic stakeholders;
- with the local involvement, knowledge and best practices are exchanged and lead to **commonly designed policies/solutions** that protect, valorise and sustainably develop the regional and local identities as well as their heritage and landscape values.
- when designing living environments, including urban landscapes, it is essential to take into account the restorative role of nature and tackling the inequalities in access to nature, in order to encourage harmonious links between person and environment and significantly increase the local resilience.

**Projects**
• co-creation and co-design of the projects by the local municipalities and stakeholders, allow to gather local collective knowledge, improve the project’s acceptance base and effectively bring multiple added-value to society (e.g. protected area with new recreation facilities);
• the involvement of multiple disciplines in the design and implementation of innovative solutions (such as NBS) needs to be properly managed! There are three essential phases 1° understanding each other, 2° trusting each other and 3° cooperating with each other, and the time necessary to go through each phase can be quite long;
• the necessary knowledge to design and implement optimal nature-based solution involves expert knowledge (from multiple disciplines) as well as the collective local knowledge (that needs to be valorised and translated into clear requirements);

**Research**

• NBS have a significant component of knowledge building, it is essential that research funding programmes recognise this uncertainty and consider adapting their requirements (sometimes too narrow with regard to the expected results/outcomes) to fund a broader range of controlled experimentation and knowledge building.

Because the process of interdisciplinary understanding (1-2 years) and trust building (1-2 years) can take up a significant amount of time before achieving effective cooperation, it is essential to find out whether this process can be accelerated? If yes, can the method be applied to all multidisciplinary projects funded by the EU research funds?

1.8 How could biodiversity and ecosystem be a factor of climate change adaptation and mitigation?

1.8.1 Designing Dialogue

Nature-based solutions for urban well-being and climate change adaptation and mitigation:
What role for biodiversity and ecosystem services?

Nature-based solutions (NBS), ecosystem services and biodiversity have an intricate role to play in cities’ climate change adaptation and mitigation strategies. Simultaneously, NBS can deliver improvements in the quality of life in urban areas, i.e. physical, psychological and social well-being of its citizens. Such diverse benefits make NBS a potentially powerful tool for local authorities in responding to climate changes, while delivering valuable co-benefits. The very diversity of these benefits, as well as the trade-offs inherent to the design and management of NBS have called for local authorities around the world to explore new approaches to bringing nature in cities, with a purpose. But does any NBS, any “greening” imply greater urban resilience and well-being? How does biodiversity affect the performance and sustainability of NBS in the context of climate change adaptation, mitigation? And
for urban well-being? How can local authorities take advantage of biodiversity and ecosystem services in support of NBS?

This session gathers perspectives from ecology, psychology, practice and local authorities to explore the role of biodiversity for sustainable and resilient NBS, under the prism of climate change adaptation and mitigation in cities and urban well-being. It seeks to exchange with the wider session audience, building on initial perspectives from

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Key questions to guide this sessions’ discussion:
- What evidence is there of biodiversity and NBS supporting successful climate adaptation, mitigation and greater human wellbeing in cities?
- What opportunities are there for local authorities and urban planners to manage biodiversity for more sustainable, resilient and/or efficient NBS?
- What are the current limitations and challenges in introducing more biodiversity in support of NBS in cities?

1.8.2 Summary of presentations

: a perspective form ecology and practice

Building on examples from projects he is engaged with in the Paris area, and drawing from experience in other cities in France, gave a brief overview of the declining state of biodiversity in the Paris Region and potential negative relationship observed between plant species richness and the use of pesticides.

Most importantly, Marc built on an ongoing project looking at 36 green roofs in the Paris Regions that he is working on (GROOVEs (Green ROOfs Verified Ecosystem Services) to show how NBS must be designed by and for biodiversity to be sustainable. Overall examples of non-biodiverse green roofs or walls that have little to do with the local (biodiversity) context end up being an expensive artificial device with high human maintenance needs, despite potentially having nice aesthetics at first. Inversely, biodiverse green roofs or walls that account for local species can better deliver cooling and pollination services, while being cheaper and requiring few maintenance interventions.

To the question “are nature-based solutions expensive?”, raised the example of water management infrastructure installation costs, with a grey infrastructure (installing pipes for water evacuation) costing up to 583 € per cubic meter, while an intensely managed green space serving this purpose can bring costs down to 231 € per cubic meter and even down to 75 € per cubic meter with a diverse, largely unmanaged green space.

Through the GROOVEs project, further showed how all green roofs are not equivalent also in terms of performance. Green roofs with non-local species and very shallow soil foundations (i.e. green carpets), which for the majority of Parisian green roofs, tend to deliver much more poorly on aspects such as supporting local pollinators, or simply cooling and water retention services. This seems to be directly
linked to the richness of plant species on these roofs and also to key variables such as substrate depth.

**perspective from psychology and well-being**

Building on experience of on-going work at the city level and on comparisons between European cities part of the on-going Nature4Cities project, Ghozlane introduced preliminary results on the link between biodiversity, NBS and well-being in urban areas. Well-being is understood as physical well-being, psychological health and social well-being.

NBS offer potential for mitigating negative impacts of climate change on social, physical and psychological well-being in cities. Heat waves, flooding and droughts have negative economic, social and health impacts and NBS can help in addressing these. However, studies of urban biodiversity and well-being lead to varying conclusions: while some link increased species richness (especially plants) to well-being, others find a more positive relationship with intermediate levels of species’ richness, compared to high or low, and others find no evidence of a consistent relationship between species’ richness and psychological well-being, but do find a positive relationship with the perceived level of species’ richness.

Preliminary results from studies in Nantes and comparisons between European cities part of the Nature4Cities project show that the amount of trees, the perceived amount of birds and connectedness to nature were identified as predictors of environmental quality of life related to biodiversity. Interviews with city inhabitants also showed the most NBS forms are spontaneously cited and associated with both positive and negative impacts, ranging from reduction of heat waves, pollution, noise, stress and increased social interactions and physical activity, to related annoyances (dead leaves, etc.), increased feelings of insecurity, less space for buildings and traffic and perceived costs for the community. Analysis of preliminary results in this study support biodiversity as a crucial element of urban landscapes and well-being, suggesting it can be employed to improve urban quality of life. This does come however with questions linked to social acceptability of urban biodiversity and NBS related to perceived benefits, liabilities and costs.

**a perspective from local to global governance**

In a context of multiscale challenges linked to urbanization worldwide and loss of biodiversity hotspots, needs for subnational action to address these yet limited resources to do so, Sunandan introduced how service provision and infrastructure development need to be better articulated to create a shift towards self-perpetuating positive feedback loops. This includes investing in nature-based solutions with the dual purposes of improved service provision and improved management and conservation of ecosystems. Yet it requires changes in approaches across spectrum of stakeholders and closely interconnected areas, such as perceptions and understanding of nature, biodiversity and ecosystems, approaches to planning and development, and creating a socio-economic case for investing in nature. The five ICLEI pathways towards low emission, nature-based, equitable, resilient and circular development are a framework designed to create such systemic change in cities.
also discussed how lessons from the E.U. need to serve rapidly urbanizing regions around the world, and provided examples of a number of initiatives in international cities, ranging from the co-creation of a thematic atlas on nature in cities in Tanzania, to an inter-regional compensation scheme based on flows of ecosystem services in Brazil and how vertical integration in India, i.e. dialogues and institutional collaboration, allowed unlocking resources for restoration of water bodies, mangrove conservation in Kochi for flood control. Sunandan also raised an observation on how the matter of what scale considered is key when looking at the feedback loops between service provision and conservation.

Takeaway messages from intervention relate to the need for multiscale action and advocacy based on effective partnerships, citing the need to rethink infrastructure development in relation to service provision, to create movements (e.g. CitiesWithNature) and to work through the post-2020 global biodiversity framework. This also involves working across boundaries and aligning priorities and interests across scales. Yet overall, a key game-changer in achieving such systemic change lies in political will and courage to do so.

Summary doodle courtesy of Daisy:

![Daisy's Summary Doodle]

1.8.3 Discussion Topics

Main discussion points raised on the links between biodiversity and well being with participants:
- **Costs of NBS**: discussions arose around how these need to account for maintenance costs, and in a fairly case-to-case basis as costs do vary significantly depending on the biodiverse type of NBS. Costs from extensive to intensive management were also deemed to vary widely, which raised the point that biodiversity protection areas often imply less management and related costs. The temporal scale at which these are considered, especially when comparing with grey infrastructure, was also touched upon.
Some safeguards however need to be put in place to avoid disqualification of monetized benefits and costs which can be disputed.

- **The matter of scale:** the question raised by presenters around the consideration of scale as a key variable when assessing benefits of NBS led to a discussion on how to assess what is appropriate connectivity of e.g. green roofs and spaces, and methods and prospective projects to do this.

- **Linking biodiversity health and well being:** participants discussed the intricacies of doing so, and identified the need to define the concept as a key step to manage complexity. When looking at this relationship, multifactorial phenomena imply a high degree of complexity, while defining and using the concepts (e.g. what human well-being? Psychological? Physical, Social?) and variables to achieve these help address this complexity.

- **Urban resilience, NBS and the role of biodiversity:** the point that biodiversity should be considered a toolbox to accommodate to future, unknown changes was raised and gained significant support from participants who recognized a link between species’ richness and the preservation of production capacities of ecosystems.

- **To what extent the perceived link of biodiversity to improved well-being is of significance:** though this link is well documented, it is important to keep in mind that there are negative aspects perceived on biodiversity, and that these should be considered in terms of improving the social acceptability of NBS in cities.

- **Demonstrating these impacts beyond urban areas:** examples of positive relationships outside urban areas were discussed, for instance the sustained productivity of rural ecosystems in the face of climatic shocks (improved resistance and recovery/resilience), based on examples across plantations and rainforests, and looking at the resilience also to pest invasions.

Specific discussion on the limitations and barriers to bringing more biodiversity in cities with participants:

- **Perceptions of biodiversity:** The issue of biodiversity being sometimes poorly perceived was raised several times. This includes association with species such as rats and pigeons, or mosquitoes when discussing water management solutions. Participants discussed the need to address such issues with solutions and examples, as well as raising the general understanding of what biodiversity is, advocating about the benefits of diverse nature.

- **Evolution of NBS:** participants raised the idea that NBS need to be looked at on a longer-term perspective also to anticipate how these will evolve over time, and ensure that these evolve properly (e.g. looking at soils, maintenance, etc.).

- **Competition between multiple uses:** the issue of competing uses in urban environments was discussed. This is an urban planning-related issue, and called upon the need to think about approaches that respond to these challenges, e.g. permeable pavement, but also nature-based behaviors e.g. nature-based mobility.
Overall, a point about fostering connections to nature was largely discussed with room, both looking at negative examples (e.g. studies showing people recognize better company logos than biodiversity, or how “blackberry” - i.e. the phone, replaced the original meaning on a number of cases in a study of young people’s perceptions of nature), and also at positive examples, discussing the role of Citizen Science programs in helping people recognize biodiversity (e.g. “les sauvages de ma rue”, a citizen science photographic survey of pollinators in Paris) and learn about the impacts of connectedness, which can be measured in psychology. Original examples, such as the allocation of email addresses to contact individual trees in Melbourne, were raised.

1.8.4 Conclusions

- NBS need to be planned for at the appropriate scales of time and space, i.e. looking at costs and benefits on appropriate geographical scales, including in terms of governance and planning approaches (e.g. ecosystem flows), and also on appropriate temporal scales, to allow for full life-cycle analyses and comparisons with other types of infrastructures.
- NBS need to engage across scales/levels of governance and also across disciplines and sectors.
- The case for linking biodiversity and wellbeing is deemed to be strong, yet to be effective negative associations need to be considered and accounted for (e.g. for social acceptability of solutions).
- A similar point relates to accounting and trying to find solutions that tackle competition between land use, e.g. through innovative multiple use solutions.
- NBS need build on and account for biodiversity locally, in order to ensure the resilience of these solutions and of the cities in the face of future, unknown change.
- The perception of nature, its benefits and disadvantages are key and can be developed through innovative and inclusive approaches, e.g. citizen science raising awareness about biodiversity itself and its role in the bigger picture.

Three key messages to take away:

- Biodiversity is not an option in NBS, but a central asset. NBS need to integrate biodiversity in their design to be sustainable, including in the face of future, unknown changes.
- Perceptions of biodiversity need to be addressed and accompanied (e.g. through citizen science) to ensure social acceptability of NBS. Recognizing and addressing perceived or actual negative impacts of bringing more biodiversity in cities through NBS is also key.
- Approaches to NBS need to cross sectorial, temporal and spacial scales to effectively deliver solutions.
1.9 Can urban forests support cities to climate change adaptation and mitigation?

1.9.1 Designing Dialogue

Urban forests are likely to contribute to climate change adaptation and mitigation as they provide several ecological services such as enhancement of air quality, sequestration of carbon dioxide... The benefits of forests and trees in cities are going to be discussed in this session through three different points of view.

Key questions for the discussion:

- What are the main benefits to Climate Change for cities?
- What are the main challenges to develop urban forests?
- How can stakeholders speed up the evolutions? What should be the roles of scientists, policy makers, private sector to involve greater awareness and to develop NBS?

1.9.2 Summary of presentations

Paris has had an important tree heritage, since Baron Haussmann (300,000 trees in two woods, to which 100,000 trees are added in the city).

Paris faces 2 current challenges: climate change & biodiversity.

Policy of City of Paris has been launched to reinforce nature in the city and revegetation.

Greening Paris

- with new parks:
  - this policy aims to increase the number of green spaces open to the public. Objective: +30 ha by 2020.

- with urban agriculture:
  - a growing vegetalisation in buildings, roofs, walls. Objective of vegetalised roofs reached in 2018 (100 ha of greens roofs and walls).

- with the local community:
  - Setting up of « vegetalising license » (i.e. : « permis de végétaliser ») in 2015. Offering flower boxes, offering the Parisians the possibility of vegetalising around the bottom of the trees.

- with more trees:
  - Offering of planting one or several trees: « Des arbres dans mon jardin » (i.e.: « trees in my garden »). Allows planting trees in private areas. Objective of investing beyond the municipal domaine in the territory. With a duty of maintainance according environmentally friendly ways.
Urban forest - Development of participative plantation of young plants. They are planted in neglected zones with the Miyawaki method.

**Role of trees in the adaptation to climate change**
2018: launch of a study that aims to bring answers to the physiological behaviour of trees in the urban environment: trees which are subject to meteorological conditions that are becoming harder.
- most resistant species?
- Species that bring the best living conditions to the town (e.g.: loss of leaves)?
- practices to improve their resistance when faced with a period of drought?

Follow-up which allows us to have the first precise elements on development conditions in the Parisian region.

### MNHN - How can urban forests help adapt to climate change?

**I. What are urban forests?**

On the one hand, suburban forests are « real » forests located near cities. Examples of suburban alluvial forests: Strasbourg (3 suburban forests, protected as nature reserves). Or Paris (2 suburban forests: « Bois de Boulogne » and « Bois de Vincennes »), ancient forests, forest soils

On the other hand, urban forests: « new » forests, resulting from dense plantation of trees in urban areas, with dense canopy, but sometimes reduced forest soils.

**II. Urban forests & ecological services**

Urban forests can complete different roles:
- regulating services, i.e. benefits from regulation of ecosystem process
- provisioning services, i.e. benefits from ecosystems
- cultural services, i.e. nonmaterial benefits from ecosystems
- supporting services, necessary for the production of all other ecosystem services

They are likely to bring ecological services especially interesting for cities:
- carbon storage and its contribution to slowing down of the increase of the CO2
- Absorption and reduction of air pollutions
- Mitigation of intra-urban heat islands
- Preservation or increase of biodiversity
- Well-being and health of human populations

However, an attention needs to be paid to the potential disservices they can bring:
- Spatial constraints and cost of tree management
- Emissions of Biogenic Volatil Organic Compounds
- Allergies due to pollen

Different levels of evaluation of ecological services of trees & urban forests:
- Trees
- Street (street ecosystem)
- City (increased urban forest canopy can reduce the urban heat island, reduce urban particulate pollution, reduce runoff and increase infiltration)

3 complementary levels that interact.

III. Highlight

➔ Storing and sequestering carbon & mitigating global warming:
   ▪ Photosynthesis (\(-\rightarrow\) absorption of atmospheric CO2) \(-\rightarrow\) sequestration of carbon by trees (vegetable biomass) during its growth to maturity.
   ▪ Then it emits carbon (during its senescence phase).
     ‣ Research of ADEME: 72 million trees in French urban areas, 1.3 million tons of dry matter of woody biomass.

➔ Absorption and reduction of air pollution:
  o studies conducted in Strasbourg (Thesis: Selmi, 2014).
    ‣ Application of the i-Tree Eco Model, (developed by the US Forest Service).
    ‣ Studies on different species and seasons.
    ‣ Comparison atmospheric emissions / pollution elimination.

To suppress pollution, we need to suppress its sources. Trees help but it is not its first purpose.
Trees can also have a role that will not always be positive. Positive effect can be questioned by the slowdown in air circulation and the diffusion of pollutants in cities by trees

➔ Heat island effect:
City centers have higher temperature, « domes of heat »

  ‣ We notice a difference between the maximum temperature in the center of Paris and the periphery, especially the woods (4°C, observed August 2013).
  ‣ Project « VegDUD » (2007-2014) was conducted, coordinated by « Plantes & Cité » : role of tree alignment (2 rows of 9m), up to 4°C less than a tree-free street.

IV. Biodiversity

In Paris, 2900 wild species which participate to green and blue structure. Different components of this urban biodiversity

  ▪ A « domestic » biodiversity: commensal species to human, introduced for ornamental or ecosystem services
  ▪ A « naturalised » biodiversity: introduced species that reproduce spontaneously in the urban environment
An « indigenous » biodiversity: native species in the region, present spontaneously in the urban environment

What are the stakes of this urban biodiversity? Nature or society?

- Contribution to the preservation of threatened species?
- Green and blue frame elements: first contact with citizens with a biodiversity that can bring them to a more natural nature
- Awareness and education of urban dwellers to the diversity of life

» Human well-being services and human health:
  - Studies on the interests of population in relation to urban forests: interest for wooded urban areas (Trees promote social bonds, increase property value up to 15%, make people happier)

Disservices, drawbacks and constraints of trees in cities:

- Spatial constraints and cost of tree management
  - Trees can be a constraint to town planning (e.g. carparks)
    - Constraint for parking lots
  - Their management has a cost for local councils
  - Constraints linked to tree bases: space available at the base of the tree is important for their water supply
  - Damage due to cars
  - All trees emit BVOC (= Biogenic Volatile Organic Compounds), but very variable rates according to species. Combined with nitrogen oxides (NOx) produced by cars, they lead to the production of Ozone (Calfapietra et al., 2013 ; Curtis et al., 2014). When the NOx emission is high (high pollution), a low BVOC emission will permit to limit the production of Ozone.
  - Allergies caused by pollen grains (Very variable allergenic character of trees according to species. It also varies according to dates of blooming.) birch trees have a high allergenic character, oak trees have a low one.

Thus comes the necessity to increase the positive effects and decrease the negative ones

- « I-tree » program (USDA) contains index values for 1,600 species (0-10 scale), allows users to select appropriate species according to (1) air pollution removal, (2) air temperature reduction, (3) carbon storage, (4) pollen allergenicity, (5), wind reduction, (6) stream flow reduction.
- Similar tool in France, « SESAME », used in Metz, taking into account : (1) air quality, (2) climate mitigation, (3) biodiversity, (4) landscape, (5) adaptation to local climate, (6) allergy, (6) physical constraints
- City of Paris : Parisian database created, tool « Parisdata » created to follow all the trees of the city.
- City of Lyon (2000) : « Charte de l’Arbre » (i.e. : « tree charter ») to address climate change. 30,000 trees planted since 2003 and another 40,000 trees by 2030.
The city of Montreal (2012), Canada: launched its “Canopy Action Plan”: 300,000 trees by 2025, in order to achieve a 25% forest cover for the city.

Note: Temporary plantations (e.g.: flower boxes) are not urban forests.

City of Bologna

The city center of Bologna is problematic in terms of tree plantation. One particularity is the presence of small and medium industry.

Climate change policies and commitments: PAES, convenant of Mayor, 2005. And Mayors Adapt, 2014.

Adaptation plan to climate change:

- Stresses the city vulnerability. Drought, Water shortages, Urban area waste, flooding and extreme rain events. One axe of adaptation plan: heat waves and urban areas.
- Objective of the adaptation plan: increase the number of trees in the city.
- + 5000 trees. Not only replacing old ones, but adding trees as well. Hence the creation of GAIA project.

GAIA project: many experts in the organization, but a link is missing.

GAIA Objective: more trees, and also partnerships with public companies.

- Developing a model of environmental governance
- Decrease firms carbon footprints
- Co-responsability on the territory

GAIA Model:

- Calculate the number of trees needed to be bought to compensate local company emissions.
- Select the trees the most adapted to urban area. Which ones stock more pollutants. Spatial problems have to be taken into account.
- Selection of 24 species, taking into account environmental reglementation, characteristics of the trees (VOC emission, ozone, pollutant gaz, particle absorption)
- Analyzing their allergenic potential.

Identification of connected activities: among others, social responsability of the company.

Example: form in the toolkit: calculation that allows to achieve a balance. The cost of a tree is evaluated. 200€ per tree, between the planting and maintenance (not excessive).

Areas selection:

- Taking into consideration ecological value, social value, co-financing, CO2 absorption capacity, visibility value.
- It started with 31 public gardens, 2713 trees. Rather residential areas near streets and industrial areas.
About the implementation of the project: online access to the number of trees planted by zone.

- **Administrative process**: main problem linked with the subject: public-private partnership
- Not as easy as « i have a public space, i give you money, i plant a tree »
- Enormous amount of administrative procedures to follow in order to have the funds
- Setting up of an agreement with 4 protocols: the new need is organisation.
  - Ratification of the protocol by some companies, so as to regulate their carbone missions: it can be in relation to printing, transportation, employees...

**RADICI (roots) project**: allows citizens to plant trees in public spaces. Crowdfunding project that was born in GAIA, in order to plant new trees in Bologna. Commitment of 1400 citizens for the campaign (3000€ for 10 trees). Problem: difficulty with crowdfunding if you employ people.

**ROCK project**: In private space, case of the university place, former car park. New project aiming to make a green area out of it. 3000€ as well, but not enough to cover the costs. Platform aiming to commit people to participate.

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Topotec1, Berlin

Presentation of the Tegel Airport project: not yet finished, sort of case study. Closure planned for 2021, evaluation so as to see what will become of this airport. Idea to create a technological industry park, with one of the technical universities of Berlin.

The idea is to conserve the former airport and to set up a university here. The creation of a conception manual « the free urban tech republic of Tegel » was done, and gave the general program aiming at giving an identity to the site. Idea to give it another look than a business park.

The idea was not to have a uniform whole, it was rather to give a particular character to each district. Idea to transform the surfaces, see what can be kept...

One of the stake is to plant trees more adapted to the climate, naturally present on the area. It is considered as an experimental zone, for what is called « climatic trees », adapted to the climatic conditions of the town (linked to climate change). Also, there was a will to select heat-adapted trees with different flowering colors, different heights, different looks, so as to have an assortment of different looking trees.

Attention paid to the hardiness of the tree. Easier to replace a sick tree (with the idea of the assortment).

Focus on the main road: a mixture of trees that are not used to be placed next to each other. We can create new interesting situations, a sort of urban forest. During the process, certain trees have been withdrawn, others fell sick. Idea of creating a picture of the park, differentiating height, width. Impossibility to work only with local plants, due to the fact that some can be used in a forest but not in the street.
1.9.3 Discussion Topics

Questions about the governance and financing of such projects:

Independently of traditions, sharing of the stakes, with cross-financing ways (collectivities and private financing). The stakes must not only rely on public authorities, but also involve different stakeholders of the territory including the inhabitants of a zone. Need for a coherent whole.

A need for crossed financing (public, privat)

Questions more focused on the city of Paris:

Overcoming constraints in general (cf parkinglots) Paris: competition between parking spots and trees.

Ambitious Parisian policy on city investment, would like to cover investment, and offer tree planting in private areas. Idea that each construction operation offers an increasing place to tree planting. As for citizen participation, two points: license to vegetalize the tree bases esthetically and participative budgeting.

1.9.4 Conclusions

Trees provide a lot of ecosystem services in cities. In particular, they support cities to climate change adaptation and mitigation and provide well-being for people. They have also some constraints and drawbacks, that must be minimised by a choice of appropriate tree species.

In order to have more pleasant cities, it seems desirable to significantly increase the importance of urban trees and forests in European cities, following the example of North American cities (Montreal, New York, etc.). We now have to plant the urban forests of the second half of the 21st century, which will help our children to face climate change!

1.10 Can ecological urbanism create urban quality and atmosphere?

1.10.1 Designing Dialogue

This session focuses on the potential of ecological urban planning, urban quality and the atmosphere for climate change adaptation and mitigation in cities. We raise the question of the relationship between urban nature, quality of life, well-being and the sensory landscape and their consideration in political strategies. Through this approach to ecological urban planning, it will be a question of paying attention to the living experience in Nature-based Solutions. The three interventions will propose an invitation to immerse oneself in the uses in renaturation projects. More precisely, it will be a question of capturing the ordinary and daily practices of the inhabitants in the urban, social and sensitive forms produced by ecological urban planning. This approach makes it possible to present the spatial characteristics of the places
produced and to better understand the capacity of the inhabitants to feel and appropriate the renaturation projects. How do the inhabitants practice these spontaneous or planned developments? How are the aesthetic characteristics of the various situations of daily life taken into account by users? How can renaturation projects promote and train urban opportunities in contemporary metropolitan areas? The second challenge of the session, related to the living experience and allowing to identify urban qualities and atmospheres in renaturation projects, is the opening to the plurisensory. In the projects presented, attention will be paid to the sensory dimensions of the living. How are sight, hearing, touch, smell and even the pleasures of taste integrated into renaturation projects? How is climatic, visual and sound comfort defined, or even sought in developments defining ecological urban planning? How are these sensory flows perceived by the living and how can they make a sensitive environment habitable and hospitable?

This approach to renaturation through urban qualities and atmospheres will be addressed according to environmental, landscape, social and economic dimensions. Through the three interventions, different forms of interdisciplinarity, or even transversality of disciplines, will be discussed. This approach thus invites us to identify and cross-reference measured and observed data, from the conceived to the lived, from the measurable and the immeasurable, from the tangible to the intangible. The projects presented will examine the consideration of these data at all scales of the territory, from the smallest vegetated area in a urban environment to the largest metropolitan corridor. Based on examples of gardens on the edge of road and rail infrastructure, Magali Paris will present the link between land use planning, gardeners’ practices and the urban environments produced. André Butz will present one of the programs of the Climate Change Adaptation through Renaturation (BENE) program in Berlin. Finally, Jérôme Defrance will present the benefits of vegetation on the acoustic atmosphere and their integration into urbanized fabrics.

1.10.2 Summary of presentations

Magali Paris: Roadside allotment gardens, well-tempered territories?

8-year research on roadside allotments.

Questions: do they have landscape qualities? What is their fauna flora biodiversity? Are the soil, the air and the crops polluted?

The study used a pluridisciplinary methodology to answer those question, following 3 axis:

- atmosphere (sound recordings, ethnographic observations, interviews with gardeners...)
- ecology (fauna and flora quantitative inventory - biological and ecological analysis...)
- pollution (soil, air and plants characterization)

The 3 types of gardens highlighted:

- island gardens (surrounded by roads, railways...)
- home gardens (surrounded by dwellings)
- park gardens (in public parks)
Different figures of gardeners highlighted (which produce different levels of biodiversity inside the gardens observed)
- productivist (low biodiversity)
- productivist but hedonist, meaning that the garden beauty is taken into account (medium biodiversity)
- lazy gardener (high biodiversity)
- Ecosophe: a gardener considering his/her garden in a bigger system. (environment)

The research also allowed to determine the levels of pollution present inside these allotment gardens, depending on the proximity of the roads...


The objective of those researches is to enounce criteria of planning from field studies and scenarios of garden transformation. It is about conceiving road allotments, and more broadly the city, including these agricultural place installed in those interstices.

**Berlin Program for sustainable development.**

BENE is a program promoting environmental and climate protection. The authority in charge is the Berlin Senate Department for the Environment, Transport and Climate protection. The duration of the program is from 2014 to 2020 (approval phase) and 2023 (implementation phase)

The two components of the program:
- **Climate** (promotion of 1) energy efficiency and renewable energies in enterprises 2) in public institutions 3) environment and energy management systems 4) sustainable mobility 5) research, study)
- **Environment** (Nature in neighborhoods / reducing environmental impacts in neighborhoods)

Several examples which are parts of the program were detailed, such as:
- **Energy efficiency:** a school refurbishment: energy efficiency as a goal. Idea to create an additional wooden facade. Between the 2 facades, the air present created a new isolation. Not only efficient, such a device is also cheap.
- **Research:** Creation of a closed loop organic material recycling system (carbonization of plant residuals into biochar) This is efficient in terms of: carbon storage - creation of energy, replacing the fossil fuels...
- Nature in neighbourhoods: pocket parks, innovative water management, playgrounds...

The promotion of green measures also contains a social dimension: focus on areas with high unemployment rate, low income households, lack of green areas, air pollution...

**Urban soundscape improvement by use of vegetation**

Main idea: potential use of NBS to improve urban soundscape.

**Overview on noise:**

- Longstanding evidence of noise as a burden, it is often related to public health issue. Noise has thus a **social cost**.
- A regulatory framework developed in the 90s in France: Royal Law on Noise Control / Environment noise directive in 2002.  
- The preservation of quiet areas then became a public issue.

**How can NBS contribute to the enhancement of the urban soundscape?**

**Prerequisites:**

- Green is different from quiet
- Quieter does not always mean a better soundscape (need for life: example of Sondgo in South Korea: quite but also empty and not lively)

That said, noise abatement may be possible through:

- Strip of trees
- Greening of buildings (in a courtyard gain of 4dBa) > especially efficient when the greening surface is at the bottom, which is most of the time impossible in the streets because of the stores.
- Vegetated noise barriers: main absorption due to substrate and not vegetation itself.

1. Example of low barriers to lower transportation noises: vegetated substrate around tramways, simulations: other variables to take into account > sight for the conductor of the tramway, accessibility for users etc. some situations can’t meet these other challenges.

Research for combined solutions (green facades to prevent reflections associated to greenroofs, low noise road surface and low barriers...)

To conclude, NBS can’t be the unique answer to sound nuisances. NBS are just one piece of the puzzle to reduce acoustic nuisances.
In some cases, the prototypes measured can diminish nuisances from 5 to 15 dbA. Now it is necessary to integrate and design such prototypes to integrate them in cities.

1.10.3 Discussion Topics

- **The reception of projects** and the local culture:

  The Berlin plan involved the reconversion of cemeteries into public parks... such a program would be impossible to implement in a country with a longstanding catholic tradition for instance.

- **The facility to implement** related to the local context:

  Berlin is already a green city for a long time. (for 30 years, promotion of the environmental protection)

- Actors participating in the realization of projects:

  Specific system in Germany
  Magali Paris: the city but also resource people which bind public actors and citizens.

- Stereotypes on pollution

  Noise disturbances can’t be solved only with vegetation (vegetation in city =/= calm city)

1.10.4 Conclusions

Ecological urbanism is then likely to bring some positive effects into the city: urban quality, better atmosphere, through a series of actions related to our human senses: hearing, smell, view...

Though, nature and vegetation do not automatically lead to better urban quality, and do not necessarily improve existing situations: some key lessons need to be kept in mind:

- NBS need to be thought according to different scales (building, neighbourhood, city).

- To settle NBS in the territory, a diversity of stakeholders is needed (public, locals, people working with associations...)

- Though, some tensions may appear between urban planning and renaturation (vegetation project for noise abatement may be in conflict with urban planning)
Plan and recommendations for action

Is nature, and NBS able to be a part a CCAM strategy? Can they be relevant to contribute to CCAM?

Considering the literature, as well as the wide community of experts, policy makers, scientists involved on the subject (example of the Paris Forum), NBS and nature have a serious potential to help mitigate and adapt to climate change. They are taken more and more seriously as a possible vector of resilience for the times to come.

To remind, mitigation and adaptation are two distinct processes: mitigation aims to stabilize the concentrations of greenhouse gas in the atmosphere, while adaptation is about the limitation of negative impacts of climate change and implies a change in our modes of organization notably.

NBS can be a way to achieve mitigation (example of trees which capture carbon), but are to be considered in a larger specter: promoting NBS for adaptation too is more far reaching because it implies reshaping our urban models and starting a real movement of urban and territorial renaturation. Renaturing would foster adaptation and mitigation as well as urban quality, life quality and well-being.

The current situation of climate change gives an unprecedented opportunity to go towards a new economic and development model.

From all the interventions during this second day of the Paris Forum, it is possible to list recommendations:

Defining NBS and renaturation: a holistic and multifaceted tool

One NBS alone is not relevant to contribute to CCAM: the multiplicity of urban projects involving NBS, on the contrary, are relevant. The systemic aspect of nature and the necessary interconnections

- Connectivity of NBS, launching multiscale measures to think the whole
- Urban planning towards more quality in city, taking into account all our senses: smell, hearing, view, touching, taste
- Inspire from Nature (biomimicry)
- Thinking projects with a view towards renaturation for: adaptation/mitigation/social cohesion. Implies to create spaces for gathering
Not opposing cities with nature: building a new urban paradigm with nature at its core.

Collaborative and participative governance

- Involving citizens in the projects: making locals the carer and owner of their own milieux (Andrea Voskens)
- Develop collective modes of action (Nathalie Blanc)
- Make different kinds of stakeholders working together: biologists, scientists, policy makers, technicians, locals
- Create the relevant administrative structures to finance and lead NBS projects (Andre Butz, BENE project)
- Fostering crossed or private financing models: convince stakeholders of all sorts to commit into NBS implementation
- Co-design and co-creation

Improving knowledge and feedback

- Pursuing the exchanges of knowledge through online platforms, forums, seminars...
- Involving project management and project ownership at the core of the project, and fostering communication and exchanges.
- Improve knowledge around NBS among experts and citizens
References

ADEME  https://www.ademe.fr/expertises/changement-climatique-energie/quoi-parle-t/lattenuation-ladaptation

Davis and Naumann, “Making the case for sustainable urban drainage systems as a NBS to urban flooding” in Kabisch et al, Nature-Based solutions to climate change adaptation in urban areas, Springer, 2017

Haase, Urban Wetlands and riparian forests as Nature-Based Solution for climate change adaptation in cities and their surroundings, in Kabisch et al, Nature-Based solutions to climate change adaptation in urban areas, Springer, 2017


Pauleit et al, Four Shades of Green, in Kabisch et al, Nature-Based solutions to climate change adaptation in urban areas, Springer, 2017

Rodriguez et al, Trade-offs across space, time and ecosystem services, Ecology and Society 11, 2006