Politecnico di Torino

Master Thesis in

Architecture for the Sustainable Project

The participatory approaches in Nature Based Solutions projects

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SUMMARY

LIST OF FIGURES AND TABLES

LIST OF CONTRACTIONS AND DEFINITIONS

Contraction	*Meaning*	*Definition*
CC	Climate Change	a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels. (*Oxford languages, 2022*)
GBI/UGI	Green and Blue infrastructures/ Urban green infrastructure	are a type of NBS that refers specifically to the strategically managed network of natural and semi-natural ecosystems within urban boundaries. UGI provides a range of ecological and socio-economic benefits (Raymond et al., 2017) and, if correctly managed, contributes to solutions for numerous challenges such as air and noise pollution, heat waves, flooding and concerns regarding public wellbeing (*Maes et al., 2019*).
NBS	Nature Based Solutions	Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. (*European Commission, 2022*)
GI	Gray infrastructure	refers to build structures and mechanical equipment, such as reservoirs, embankments, pipes, pumps, water treatment plants, and canals. These engineered solutions are embedded within watersheds or coastal ecosystems whose hydrological and environmental attributes profoundly affect the performance of the grey infrastructure. (*World Bank and World Resources Institute,2019)*
SuDS	Sustainable urban drainage system	are drainage systems that are considered to be environmentally beneficial, causing minimal or no long-term detrimental damage. They are often regarded as a sequence of management practices, control structures and strategies designed to efficiently and sustainably drain surface water while minimising pollution and managing the impact on water quality of local water bodies. (*www.susdrain.org, 2022*)
CCM	Climate Change	consists of actions to limit global warming and its related effects. This is mainly reductions in human emissions of greenhouse gases (GHGs). It is one of the ways to respond to

	Mitigation	climate change, along with adaptation. The main challenges in this field are to reduce fossil fuels emission (which cause CO2 and GHGs) and achieve changes in agriculture (reduce GHGs), transport, forest management, waste management, buildings and industrial systems. (https://en.wikipedia.org/wiki/Climate_change_mitigation, 2022)
CCA	Climate Change Adaptation	is the process of adjusting to the current or expected effects of climate change. It is one of the ways to respond to climate change, along with mitigation. For humans, adaptation aims to moderate or avoid harm, and exploit opportunities; for natural systems, humans may intervene to the elp adjustment. (https://en.wikipedia.org/wiki/Climate_change_adaptation, 2022)
DRR	Disaster Risk Reduction	Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. (https://www.undrr.org/terminology/disaster-risk-reduction, 2022)
Eco-DRR	Ecosystem-based disaster risk reduction	is based on disaster risk reduction (DRR) and the purpose of Eco-DRR is to prevent and reduce disasters by utilizing ecosystems as buffer zones and buffers for dangerous natural phenomena (https://en.wikipedia.org/wiki/Ecosystem-based_disaster_risk_reduction, 2022)
SDGs	Sustainable Development goals	are a collection of 17 interlinked global goals designed to be a "*shared blueprint for peace and prosperity for people and the planet*". The SDGs were set up in 2015 by the United Nations. (https://en.wikipedia.org/wiki/Sustainable_Development_Goals, 2022)
R&I	Research and innovation	Is a program of the European Union towards research and innovation strategies.
EbA/ EbAp	Ecosystem-based adaptation	is a strategy for adapting to climate change that harnesses nature-based solutions and ecosystem services. (https://www.unep.org/2022)
NWRM	Natural Water Retention Measures	support Green Infrastructure by contributing to integrated goals dealing with nature and biodiversity conservation and restoration, landscaping, etc. (http://nwrm.eu/, 2022)

UF	Urban forestry	is the care and management of single trees and tree populations in urban settings for the purpose of improving the urban environment. (https://en.wikipedia.org/wiki/Urban_forestry, 2022)
EE	Ecological engineering	uses ecology and engineering to predict, design, construct or restore, and manage ecosystems that integrate "human society with its natural environment for the benefit of both. (https://en.wikipedia.org/wiki/Ecological_engineering, 2022)
BMPs	Best management practices	
LID	Low-impact design	is a term used in Canada and the United States to describe a land planning and engineering design approach to manage stormwater runoff as part of green infrastructure. (https://en.wikipedia.org/wiki/Low-impact_development_(U.S._and_Canada), 2022)
WSUD	Water-sensitive urban design	is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater, and wastewater management and water supply, into urban design to minimise environmental degradation and improve aesthetic and recreational appeal. (https://en.wikipedia.org/wiki/Water-sensitive_urban_design, 2022)
ES/ ESS	Ecosystem services/ Ecosystem services solutions	The benefits that people derive from the natural environment and its processes. These benefits are anthropocentric and can be categorised as provisioning services (food, water, timber, fibre), regulating services (climate, floods, disease, wastes, water quality), cultural services (recreation, aesthetics, spirituality), and supporting services (soil formation, photosynthesis, nutrient cycling), which the health and sustenance of humankind are dependent upon. (UK Green Building Council 2021)
DNSH	Do No Significant Harm	Policy principle applied also in the Next generation EU
EEA	European Environment Agency	

PA	Participatory Approaches	The person or administration in charge of solving a problem or designing an innovation involves people who are directly concerned by the result of his or her work.
FIU	Fondazione Innovazione Urbana	is a multidisciplinary centre for research, development, co-production and communication of urban transformations at the service of the construction of the future imaginary of the city. (https://www.fondazioneinnovazioneurbana.it)
CR	Climate resilience	is referred to as the capacity to anticipate, prepare for and respond to hazardous events or trends related to climate. It is the ability of buildings, landscapes, and infrastructures to adapt to and reduce the impacts of, climate-related events, such as flooding or overheating. (UK Green Building Council 2021)

PREMISE

The first time I heard about Nature based solutions was during a university course and I thought it was an interesting concept to use natural mechanisms to manage climate change adaptation. Then, a couple of months after the exam, I took part in a summer workshop, where I had my first approach to the various techniques used for participatory co-design. It was during this workshop that it was presented to us a project for a park renovation in Prato, realized with a participatory citizen's consultation and the application of nature based technologies. I came back home with a new point of view and a new interest in certain themes. A few months later, I saw an opening position for thesis research on NBS and I contacted the DIST professors immediately.

The first thank goes then to them, my advisors, the professors Patrizia Lombardi and Sara Torabi Moghadam; for the expertise, understanding and patience they dedicated to me over this time. They, along with Chiara Genta and the DIST department, have been fundamental to this work and it is difficult to demonstrate how grateful I am.

During the period where I worked on my master thesis, I also had the possibility to collaborate in a competition for the renovation of a public park in Turin, along with the DIST department and other partners. The second thank is direct to Serena Fiorelli, from the *Biomimesis design*; her guidance during the collaboration for the *Con.Nettare* project and especially her enthusiasm have been able to lift me up even in stressful moments and I truly think I have learned a lot from this experience.

Thirdly, I have to thank the *StartPark* ideators, *Iridra Srl* and Codesign Toscana, and especially in the persons of Marco Berni and Anacleto Rizzo, for their kindness and willingness to lend us the *StartPark* gamification tool for the participatory workshop. Without them, half of this work would not have been possible.

This thesis has been a journey and I think I own part of it from every person I met along the way, for every suggestion, every note, every change and especially for making me change my mind so many times.

ABSTRACT

The master thesis confronts the theme of the research for new solutions for urban spaces, with a focus on participative and innovative solutions. The work aims to explore the participatory approaches applied to Nature Based Solution projects, their advantages and disadvantages, to better involve stakeholders in the decision-making process and promote sustainable change in urban communities. The study is conducted throw a literature review and a case study that resolved in a try-out test of a participatory tool.

Starting with a background on Climate Change, the problem statement is extended to its effects on cities and societies and the impacts on nature and people, such as the loss of natural capital and biodiversity and the increase in severity and frequency of multiple climate hazards. Cities are recognized as part of the problem and of its solution, being accountable for most GHG emissions, high density and planning problems, they require structural modifications to face Climate Change, but they could be the core of the mitigation and adaptation strategies.

The literature chapter on Nature Based Solution tries to define the concept and the societal challenges NBS can address, such as climate change mitigation, climate change adaptation ad disaster risk reduction, sustainable urbanization and biodiversity enhancement, as well as the market challenges and the ways NBS can foster the achievement of the UN Sustainable development goals for 2030. It is then given a review of the European policies and projects starting from an international policy framework to a European framework reporting the current strategies for research and innovation. It is also reported an annexe of NBS case study projects.

The literature chapter dedicated to the Participatory Approach literature starts with a definition of the types of participatory approaches evaluated and the reasons they should be used, then it moves to participatory approaches used for NBS design and the different methodologies that are being used, explaining which participatory tool has been chosen for the case study application and why. It is given a complete review of the selected tool before moving to the Methodology explanation of the process.

For the study, it was selected a case study in Torino, the regeneration of the Fioccardo park, where the participatory approach tool was experimented. The trial test was arranged to throw a workshop held with the Polytechnic master students with a codesign gamification tool to design think processes, using co-design methodologies. It is given an exhaustive description of the different phases, from the site analysis, explored in different ways, from urban policies and plan evaluation to the location and population analysis to the actual site view and photographic report. Then it moves to the simulation of the citizen engagement followed by an output analysis and overall considerations. The last chapters describe the work's results with the elaboration of a project's idea for the park and the conclusions and future development possibilities.

RIASSUNTO

La tesi di laurea affronta il tema della ricerca di nuove soluzioni per gli spazi urbani, con un focus su soluzioni partecipative e innovative. Lo scopo del lavoro è esplorare gli approcci partecipativi applicati ai progetti di Nature Based Solution, i loro vantaggi e svantaggi, al fine di coinvolgere meglio le parti interessate nel processo decisionale e promuovere un cambiamento sostenibile nelle comunità urbane. Lo studio è condotto attraverso una revisione della letteratura e con un caso di studio che si è risolto in un test di prova di uno strumento partecipativo.

Partendo dalla sfida del cambiamento climatico, la definizione del problema si estende ai suoi effetti sulle città e sulle società e agli impatti sulla natura e sulle persone, come la perdita di capitale naturale e biodiversità e l'aumento della gravità e della frequenza dei molteplici rischi climatici. Le città sono riconosciute come parte del problema e della sua soluzione, essendo responsabili della maggior parte delle emissioni di gas a effetto serra, necessitano di modifiche strutturali per far fronte ai cambiamenti climatici, ma potrebbero essere il fulcro delle strategie di mitigazione e adattamento.

Il capitolo della letteratura sulle Nature Based Solutions cerca di definire il concetto e le sfide sociali che le NBS possono affrontare, come la mitigazione dei cambiamenti climatici, l'adattamento ai cambiamenti climatici e la riduzione del rischio di catastrofi, l'urbanizzazione sostenibile e il miglioramento della biodiversità, nonché le sfide del mercato per favorire il raggiungimento degli obiettivi di sviluppo sostenibile SDGs delle Nazioni Unite per il 2030. Viene quindi fornita una rassegna delle politiche e dei progetti europei a partire da un quadro politico internazionale fino a un quadro europeo che riporti le attuali strategie in materia di ricerca e innovazione. Viene anche riportato un allegato di progetti di casi studio con NBS.

Il capitolo della letteratura sull'Approccio Partecipativo inizia con una definizione dei tipi di approcci partecipativi e delle ragioni per cui dovrebbero essere utilizzati; quindi si passa agli usi degli approcci partecipativi per la progettazione delle NBS e alle diverse metodologie utilizzate, spiegando quale strumento è stato scelto per l'applicazione del case study e perché. Viene fornita una revisione completa del gioco-strumento selezionato prima di passare alla spiegazione della metodologia di processo per il case study.

Ai fini dello studio è stato selezionato un caso studio a Torino, la rigenerazione del parco del Fioccardo, dove è stato sperimentato lo strumento dell'approccio partecipativo. Il test di prova è stato organizzato attraverso un workshop tenuto con gli studenti magistrali del Politecnico tramite uno strumento di gamification per coprogettare un parco pubblico. Viene fornita una descrizione esauriente delle diverse fasi, dall'analisi del sito, esplorata in diversi modi, alle politiche urbane e all'analisi del sito e della popolazione, con una visita sul posto e un report fotografico. Quindi si passa alla simulazione del coinvolgimento dei cittadini, seguita da un'analisi degli output e dalle considerazioni generali. Gli ultimi capitoli descrivono i risultati del lavoro con l'elaborazione di un'idea progettuale per il parco e le conclusioni con le possibilità di sviluppi futuri.

01

INTRODUCTION

1 INTRODUCTION

1.1 Background and problem statement

1.1.1 Climate change background

It has become more and more evident that our society worldwide is facing an interdependent global crisis for the effects of climate change and biodiversity loss, which have caused and will continue to cause further impacts worldwide. Climate Change cannot be denied anymore and with that, the effect human activities and societies have in the rushing development of this process.

> *"Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. [...] Across sectors and regions the most vulnerable people and systems are observed to be disproportionately affected. The rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt." (IPCC 2022)*

The IPCC 2022 report on climate change outline with very high confidence that the global warming hitting 1.5 C in 2021-2040 is going to cause unavoidable increases in severity and frequency in multiple climate hazards, exposing ecosystems and human settlements. Even more damages are expected in absence of immediate and drastic measures considering the long term period beyond 2040. Over the last years extreme weather events have started to become always more common; Extreme events such as heat waves, heavy precipitation, river floods, windstorms, landslides, droughts, forest fires, avalanches, hail and storms, have increased their number and significance all over the world, and are causing enormous damage to people, goods and natural heritage. On the other side, it cannot be denied also the impact of slow-onset events, such as coastal erosion, prolonged wet and dry periods, that can have significant negative impacts on the economy and human health and well-being (IPCC 2018, IPCC 2022).

The Climate Change problem is affecting in different measures all the countries worldwide and also all their economies. The World Economic Forum considers extreme weather, climate-related events and biodiversity loss to be among the five most imminent global risks. (European Environment Agency 2021) A global problem needs global action to be contrasted. Worldwide organizations have been trying to address climate change, examples are the Conferences of the Parties, that promoted the Paris Agreement to limit global warming to well below 2, preferably to 1.5 degrees Celsius and the UN Sustainable Development Goals for 2030[1].

At the centre of the Climate Change problems and its solutions, there are worldwide cities. The rising global population is going to also widen the relevance of the anthropogenic impact on global warming and GHG emissions; urban areas are expected in the next decades to absorb most of the world's population, making cities extremely important vehicles to fight climate change. More than half of humankind lives in cities, and more than 70 per cent of the word' population is expected to do so by 2050 (World Bank 2021), accounting for most of global GHG emissions.

1 See *2.2.1International policy framework* and *2.1.3 NBS and Sustainable Development Goals*

1.1.2 Climate change in cities and effects

Ever since the late '80s, the European Union has started a series of policies trying to address climate change focusing on the local sustainable challenges. Starting from the *Fourth Environmental Action Programme* 1988 – 1992 *Sustainable Communities*[2] have been central in the climate change adaptation process, bringing cities and towns at the centre of the problem, following the "think global, act local" trend. For the past forty years local communities have remained at the heart of efforts to address sustainable development, mobilised by a wide range of policies and initiatives to develop sustainable, smart, low carbon, resilient and eco-cities, like are the 2016 *New Urban Agenda* and *Sustainable Cities and Communities (SDG11)* goal of the UN's *Sustainable Development Goals*[3]. The EU's *Sustainable Communities* point towards the creation of a more environmental sustainable, better life quality, more digital cities, covering a wide range of topics:

> *"from housing and the inclusion of migrants and refugees in local communities, through to issues related to local economic development, poverty and the digital transition - pointing to the complexity and interwoven nature of the challenge of sustainable communities."(Wild et al. 2020)*

Between all this challenges, one of the more pressing actions required is towards climate change and biodiversity. The IPCC 1.5 Degree Special Report selects cities and urban areas as one of four critical global systems that could accelerate climate change. Land-use change resulting from urbanisation has been assessed as one of the major driver of biodiversity decline, as well as high energy consumption, waste management etc. (Wild et al. 2020) Traditional planning methods and ways of expanding the cities have brought to a system where soil consumption, water management and permeability are damaged and cities tend to have higher risks concerning extreme events like heatwaves, floods, variations in rainy periods. Rapid urbanizing areas, like are dense, lower-quality unplanned settlements, are also more exposed to urban problems. In these vulnerable areas, CC impacts are exacerbated, as these settlements are often located in high-risk areas, such as on floodplains or steep slopes. In addition, poorly maintained infrastructure, such as drainage systems, and impervious surfaces can increase the magnitude of natural hazards, such as flooding and urban heat island effects. (World Bank 2021) Cities are globally facing serious resilience challenges from climate change. Climate change is expected to increase the frequency and intensity of some natural hazards and a wider urbanization can also lead to higher exposure of people and capitals in cities, exacerbating difficulties and social inequalities in countries where life conditions already are challenging.

Climate change impact on Italian cities

To give an example of the expected impacts of Climate Change on cities it is reported in the following a report from the *CMCC, Centro Euro-Mediterraneo sui Cambiamenti Climatici*, that has conducted in 2021 an investigation on Climate Changes future effects on 6 Italian cities: Milano, Torino, Venezia, Bologna, Roma and Napoli. The Mediterranean region, and Italy with it, is considered one of the *hot spots* of climate change, with a warming that exceeds the global average increase by 20% and a reduction in rainfall in contrast to the general increase in the hydrological cycle. The last few years, for example, have already been characterized by rather high temperature increases: 2019 was the third warmest year, after 2018 and 2015, since the start of the observations (+ 1.56 °C compared to the period 1961-1990). Furthermore, eight of the ten warmest years from the '60s were recorded from 2011 onwards, with anomalies between + 1.26 °C and + 1.71 °C. The different climate models used for the analysis agree in the predictions for an increase in temperature of up to 2 °C in the period 2021-2050 (compared to 1981-2010). The main changes expected in Italy are the following: less rain but more intense with a general decrease in rainfall in the summer, and a consequent higher number of hot and dry days, and an increase in rainfall in the winter. Associated with this data, there is an increase in the territory of the maximum daily precipitation for the summer and autumn season, more marked for the scenario with high greenhouse gas emissions, with an increase in the risk of floods, weather-induced landslides, droughts and heat waves. The impacts of extremes changes vary locally and are amplified in particular in urban environments as they are characterized by high fragility, vulnerability and exposure. In the cities is found the maximum concentration of the population and it is where the most of health, society and administration services are provided.

In the following pictures are reported the specific data for the case of the city of Turin, object of the case study (See chapter *4.2 Case study*). The previsions for the city report a general increase from +4°C to +6°C for 2100 depending on the season, with a highest number of heat waves, that could be mitigated to +2°C with climate policies. The city has been reported to have 35 km^2 of riverside area exposed to flood risk, of which 29% at medium risk and 11% at high risk. (Spanoa et al. 2020; CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici 2020)

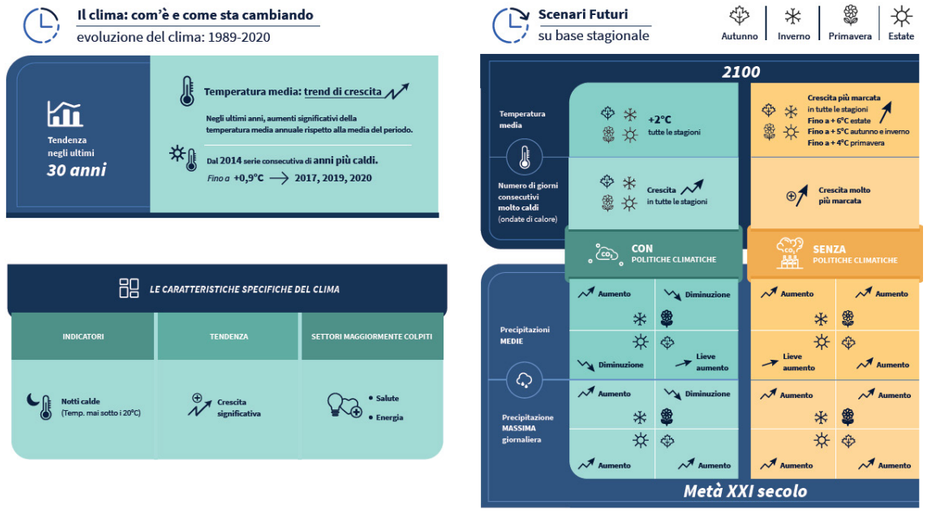


Figure 1.1 Climate Change in Turin: how it has been and how it is going to be (CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici 2020)

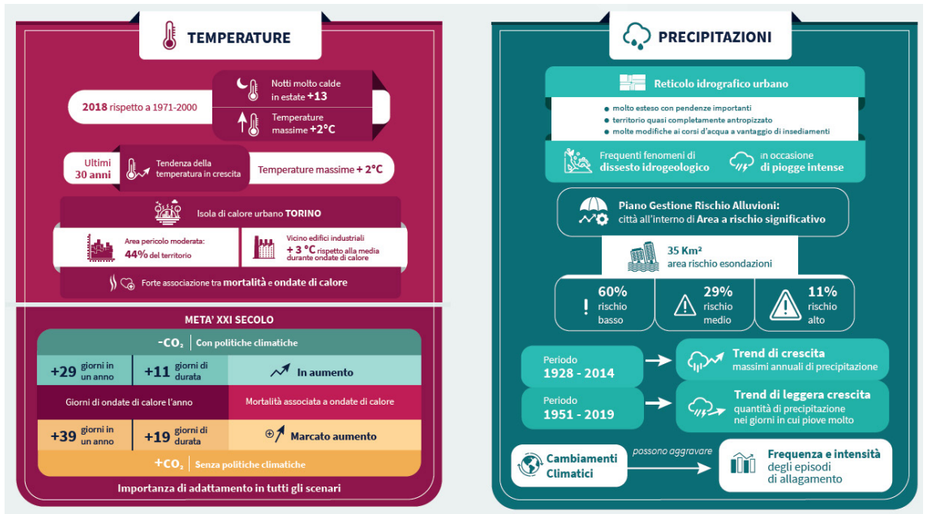


Figure 1.2 Climate Change in Turin: Temperature and raining changes (CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici 2020)

2 For more on Sustainable Communities see https://communitiesforfuture.org/

3 See 2.1.3NBS and Sustainable Development Goals and 2.2.1International policy framework

Climate change adaptation and mitigation in cities

Cities need structural modifications in transport systems, buildings and energy consumption and production to face climate change mitigation. Seventy per cent of the word' population is expected to be living in cities by 2050 and, hence the importance of developing solutions to make cities resilient to climate change. At the European local level, policies and initiatives have increasingly emphasised the pursuing of selected goals for air pollution, climate change and waste reduction, while contemporary addressing life quality. NBS have found fertile ground for this new urban sustainability challenges, as they *"promise to simultaneously address multiple goals and to provide a wide range of environmental, economic and social benefits"* (Wild et al. 2020). NBS are increasingly being seen as a means through which it is possible to generate *Sustainable Communities* and climate change resilience, whilst also attending to other challenges: biodiversity, air quality and life quality.

Urban mitigation policies

An example of how NBS are being included in urban policies is the *REBUS Renovation of public buildings and urban spaces* project, elaborated in Emilia-Romagna in collaboration with the *Polytechnic University of Milan* and the European project *REPUBLIC-MED REtroffiting PUBLIC spaces in intelligent MEDiterranean cities.* The project was part of the regional strategy towards the mitigation and adaptation to climate changes, with measures for CO2 reduction and policies towards adaptation and risks reduction. It was a formative moment for public administrators and different private technical figures with theorical and practical knowledge involved, with participatory workshops. At the end of the workshop phase, all the research and inputs were reported in a guide *Rigenerare la città con la natura* (Regenerate the city with nature and Dessì et al. 2017) focusing on public space design and NBS integration strategies, like sustainable drainage and greening solutions. The guide analyses and rates different natural and synthetic materials that could be used in public space design, as well as water elements for mitigation and drainage systems, trees and green infrastructures and also the attractiveness of public spaces, providing a series of project examples and good practices.

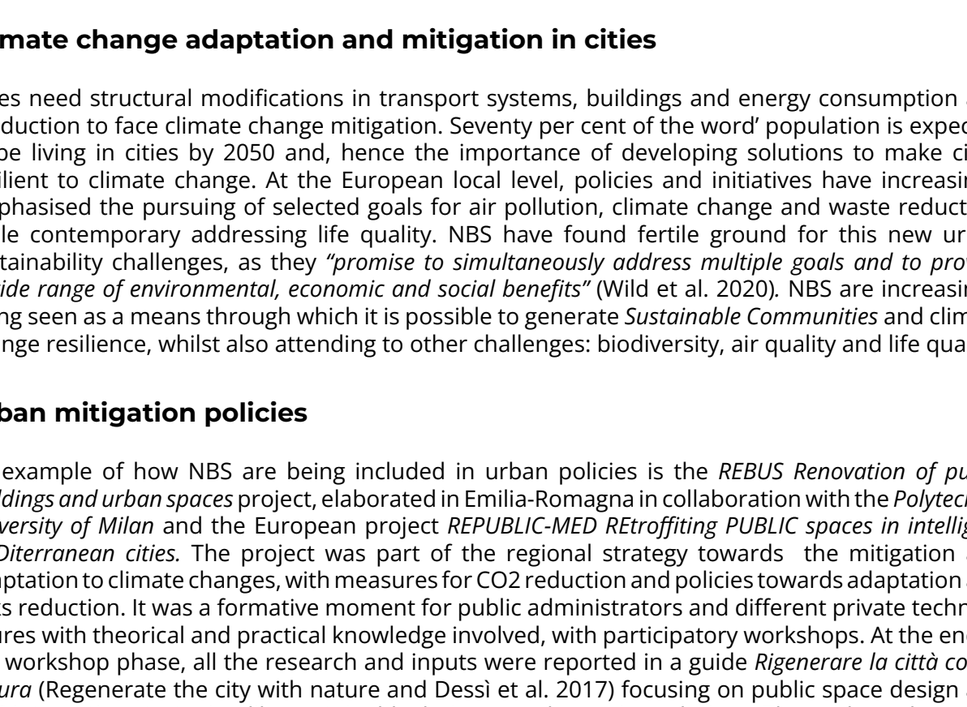


Figure 1.3 Example of the guidelines reported in the Rigenerare la città con la natura (Dessì et al. 2017)

An application of this guide and to the Emilia Romagna region's efforts in climate adaptation is the recent competition for the requalification of the Corte Vecchia square in the centre of Ferrara, where the NBS practices were suggested and required. The best project was chosen between the participants with an online voting system, allowing a participatory process for the hole citizenship. As from the city's website, greening Nature based solutions are going to play a fundamental role in making the square more liveable, with tree plantation, with the replacement of the current asphalt with a more permeable surface, the installation of underground tanks for the collection of rainwater, a green wall and the use of shading devices.

> *"Non si tratta solo di un abbattimento dell'impatto ambientale ma anzi un completo restyling per rendere la piazza un centro di aggregazione per la cittadinanza intera e i turisti che, visitando la nostra splendida città, potranno godere di un'oasi in pieno centro."*[4](Balboni Alessandro and Comune di Ferrara 2022)

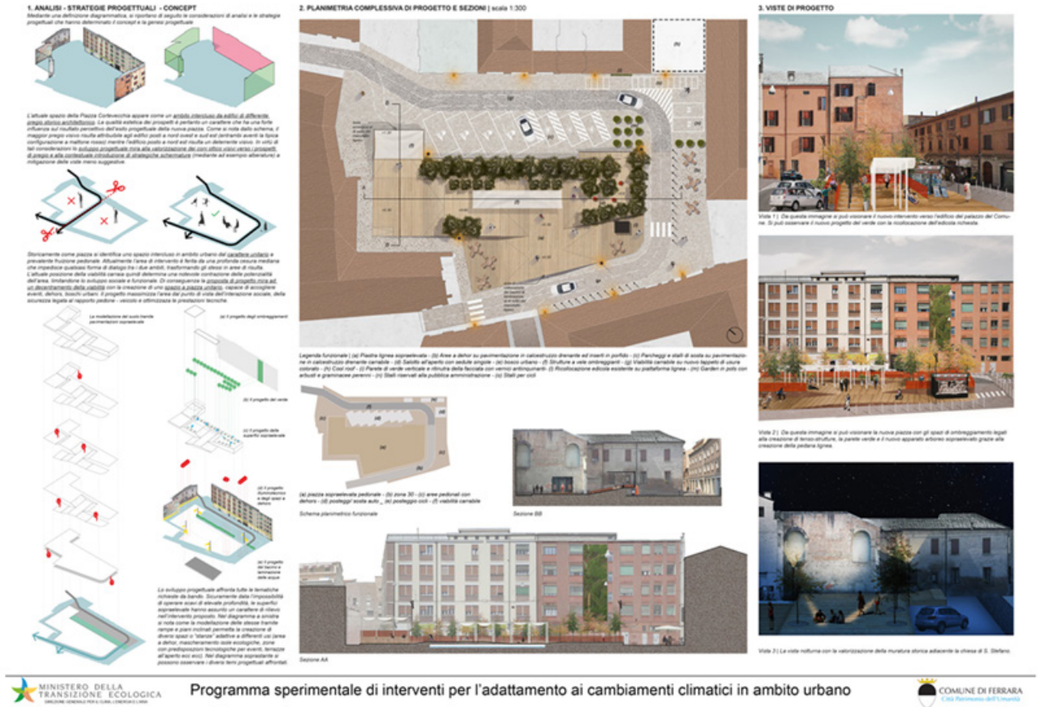


Figure 1.4 One of the projects for the Corte Vecchia square requalification (Balboni Alessandro and Comune di Ferrara 2022)

[4] Traduction: *"This is not going to be just a reduction of the environmental impact but rather a complete restyling to make the square a community place for the entire citizenship and tourists who, visiting our splendid city, will be able to enjoy an oasis in the center."*

1.2 Con.Nettare, Simbiosi competition participation

1.2.1 Intesa San Paolo Simbiosi competition

During the thesis work there was the opportunity to collaborate with the DIST department on the tender, promoted by the *Intesa San Paolo* foundation for the allocation of funds for the redevelopment of urban and naturalistic park areas in Piedmont and Lombardy. The participation, even if partial, in the design and organization of the documents for the candidacy, was an important opportunity to deal with the project of an urban regeneration using nature based solutions and also to closely follow the various steps behind the participation to a call for proposals, from the search for project partners, to meetings, to the inspection for the choice of the project area and the drafting of the project tables and more technical documents, such as the technical-illustrative report, the time schedule, the estimated metric calculation and the maintenance plan. It turned out to be an enriching opportunity from a personal point of view and job skills.

Simbiosi competition – Together with nature for the planet's future

The call, promoted by Intesa San Paolo, is part of what is defined by the UN program as the "*Decade for the Restoration of the Ecosystem*", from 2021 to 2030, considered the critical moment to really start to change course and realize the green transition. In fact, the 2030 deadline coincides both for the achievement of the SDGs, and for the European Strategy for Biodiversity and its Italian implementation, the National Strategy for Biodiversity 2030, which include a series of restoration ecology commitments and actions, aimed at improve the resilience of ecosystems through the principles of Nature-based Solutions, the creation of green infrastructures and renaturalization techniques. In the introduction to the context, the call refers to the framework of actions and policies within which it is inserted, both at the European level, such as the Green Deal, the European Climate Law and the From Farm to Fork strategy, and at the Italian national level. , National Energy and Climate plans. To complete the recent funding of the Recovery Plan, or the Next Generation EU and its national variations, National Recovery and Resilience Plans (PNRR) and the "*Agreement for the protection and enhancement of urban and extra-urban green areas*".

An important aspect on which the announcement focuses is certainly the importance of the biodiversity sample present at the Italian level and the high risk it runs of being lost forever; hence the need to protect it in coastal, humid, mountainous rural areas and to encourage it instead at the urban level. Areas particularly exposed to anthropogenic pressure such as urban and peri-urban areas, industrial and neighbouring areas, coastal regions must provide for extensive ecological restoration interventions through nature-based solutions to recover quantity and quality of soils and promote carbon storage capacity, facilitate the survival and functionality of ecosystems and maximize ecosystem services.

The Call pursues the following objectives:

1. to encourage initiatives for the re-naturalization and restitution of natural capital in urban centres
2. help protect and restore terrestrial, river and marine ecosystems, protect biodiversity, both at the habitat and at species level
3. promote the environmental improvement of agro-ecosystems and agricultural production
4. strengthen the role of natural capital in planning and territorial development strategies
5. promote models of sustainable management of environmental resources
6. promote public and individual awareness of the benefits of investing in natural capital, including its effects on the economy and society.

The application asked, in addition to illustrating the context of the intervention, also to indicate the expected benefits from an environmental, social and economic point of view, to foresee the involvement and awareness of the community, with actions, events and a communication plan of the project, to formulate a project sustainability and maintenance strategy and set up a monitoring and data collection strategy. (Fondazione Compagnia di San Paolo 2022)

Figure 1.5 Bando Simbiosi 2022 presentation slide, project's characteristics (Fondazione Compagnia di San Paolo 2022)

1.2.2 The project's partners

Circoscrizione 8 and Torino Municipality

The *circoscrizioni* are the districts of Turin; they are the 8 administrative macro-zones into which the city is divided from 2016. The 8th *Circoscrizione* is made by different neighbourhoods, San Salvario, Cavoretto, Borgo Po, Nizza Millefonti, Lingotto and Filadelfia. They have administrative powers, they can place foundlings and work as a public municipality, with a president, a council and different council members, some of which were directly involved in the project. Torino's municipality was also consulted with different contacts with the public green management office (*Area Verde e Arredo Urbano* offices) in order to coordinate the project's logistics.

Politecnico di Torino

The Politecnico di Torino (POLITO) took part to the project with the Inter-university Department of Regional & Urban Studies and Planning (DIST), allowing the professors Patrizia Lombardi and Sara Torabi Moghadam to council and supervision the project from the economic and feasibility point of view. The DIST department is the reference structure for the Politecnico di Torino and the University of Turin in the cultural areas that study the transformation and the governance processes within a territory, as considered in its physical, economic, social, political, cultural aspects and their interrelationships, in a integrated sustainability perspective. It promotes, coordinates and manages research, teaching and third mission activities aimed at the educating the change agents of tomorrows' challenges for a sustainable management of our territories. Further involvement from the university will be supplied on the evaluation and theoretical analysis of the ongoing project in case of the call's success.

Biomimesis

Biomimesis design[5] is an architect studio and Innovative start-up focused on the research and development of *Bio Campus* based on micro-housing; this housing capsule, or Pod, are designed emulating natural models like the one of the bug and are movable, allowing to adapt to different weather and situation's changes. The pods are part of a larger landscape project that aims at creating biophilic agricampus to safeguard the territory and the environment. Through "*freeDOME project*" *Biomimesis design* aims at creating a resilient community model that reduces humans' environmental impact and produce more biological and cultural diversity, for a more sustainable future. The concept of mimicking both "past cultural and biological elders on earth that have figured out how to create a sustainable world before us" is at the base of the project and it is involved from the micro to the macro scale, from the individual capsule to the community organizations and landscape area.(Serena Fiorelli 2021; 2022)

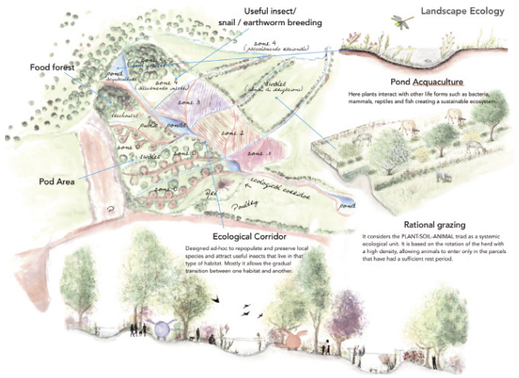


Figure 1.6 A biofilic agri-campus. Soil, plants and animals are an interdependent system and farms are based on the management of open space. The animals use the wood or meadow spaces in rotation in order to allow the soil to regenerate. (Serena Fiorelli 2021; 2022)

5 For more information we remand to the webpage www.biomimesisdesign.com (Serena Fiorelli 2022)

1. 2 Con.Nettare, Simbiosi competition

1.2.3 Con.Nettare project

The project was developed throw a close collaboration between the different partners, described before. As an assistant to the project competition, I attended different meetings with the DIST department, Torino's 8th District and *Biomimesis* start up manager, and Torino's municipality's offices. The project was intended for the landscape and urban park regeneration of the Fioccardo park in Torino, to realize with active citizen participation, using permacolture, agroecology and biodiversity enhancement. The garden redesign was developed using Nature based solutions like permaculture, agroecology, tree plantation and biodiversity enhancement, with the creation of a Bug Hotel and a vegetable and productive garden to cultivate with the collaboration of a nearby primary school. The project tried to promote citizen's activation and collective events to develop a senso of community towards the park.

The project's objectives

The aim of the project was to develop a pilot system for the ecological and social regeneration of urban territories and peri-urban areas in transition, often underused and unproductive, in a resilient, inclusive way. It also worked forward the creation of a network of active citizen with different types of activities and involvement processes. Specifically, the project intended to achieve the following objectives defined by the Sustainable Development strategies of the 2030 Agenda: favouring the re-naturalization and restitution of natural capital in urban centres, helping to protect and recover biodiversity and terrestrial ecosystems, to promote models of sustainable management of public and private environmental resources and to promote public and individual awareness of the benefits of investing in natural capital, also for its repercussions on the economy and society.

Con.Nettare project's elements of environmental sustainability:

- Soil care and regeneration with the application of the principles of Agroecology-Permaculture (zone B);
- Water management and purification with the implementation and maintenance of vegetation riparian (zone D);
- Conservation of biodiversity with the Pollinator Garden, Ecological corridor and the Bug Hotel (zones A-B-C);
- Food production with vegetable gardens and food forest in Permaculture zones (1-2-3-4 -B)
- oxygenation and air purification with herbaceous, shrub and tree plants, insects (zones A-B-CD)
- Production of shelter (trees - remote workstations - tree house -A-C)

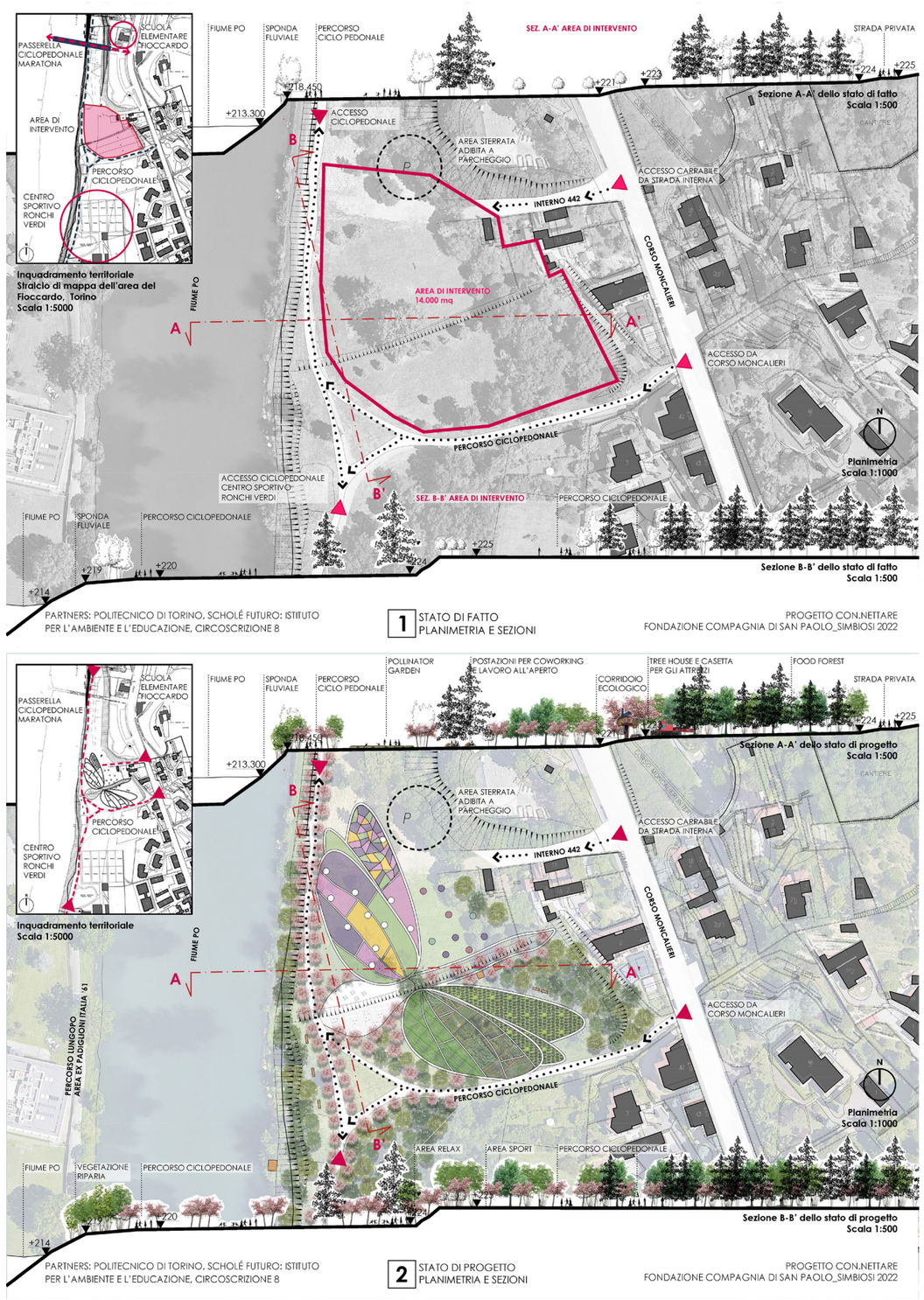
Elements of social sustainability:

- The dissemination of environmental awareness, training and active involvement of schools and citizenship in the care, management and regeneration of the common good (theoretical workshops and activities)
- The enhancement of cultural diversity and the sense of belonging to the community (group activities, community building, social permaculture)
- The increase in psychophysical well-being (+ time in the green, self-production of fresh food, walking and sports in the green, working remotely in the park, yoga and meditation, major work-life balance)

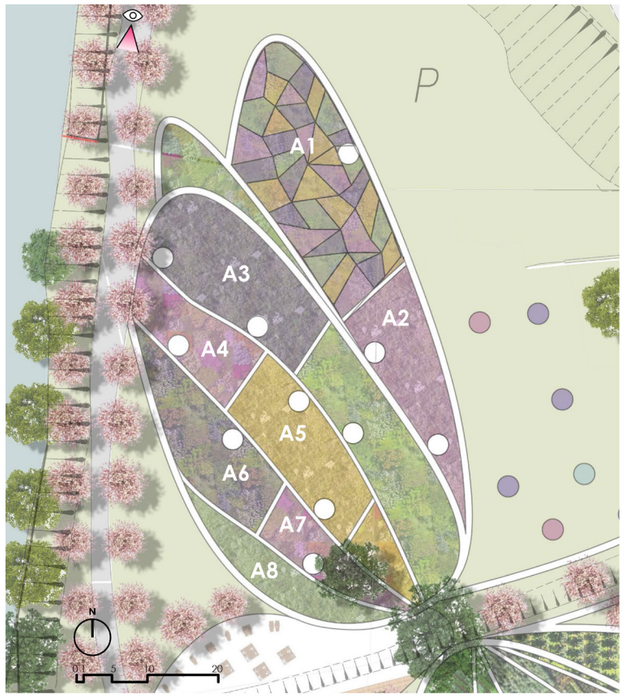
Elements of economic sustainability:

- To promote a model of sustainable management of environmental resources and the common good through management and maintenance of the site by citizens (benefit for the municipality), availability of a remote workstation, fresh food, free access to sports equipment as well as the benefits of living-working in close contact with nature (benefits for citizens).

Con.Nettare competition project



Project's plan design, graphic elaboration made by the thesis's author

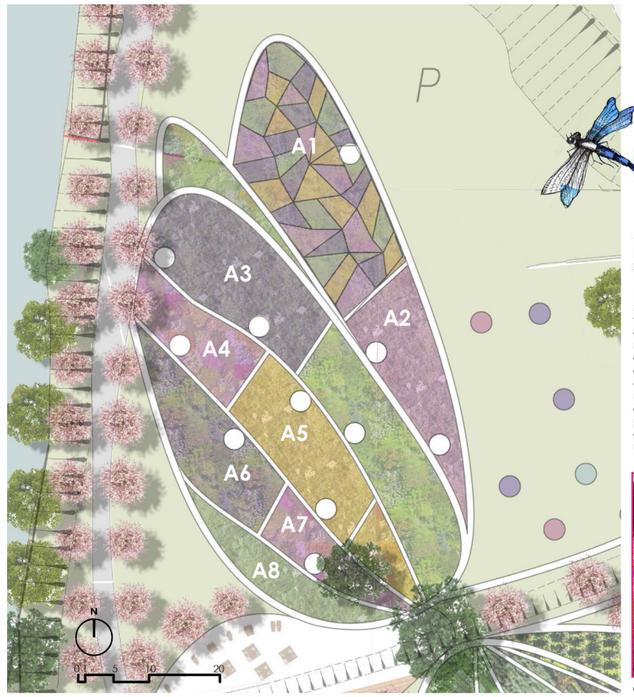


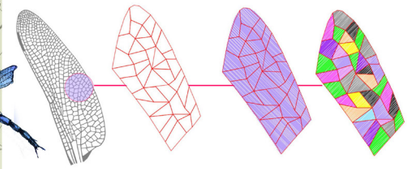
A
POLLINATOR GARDEN:
Ala A - Biodiversita' e insetti

Un giardino dedicato agli impollinatori, con numerose piante erbacee e arbustive riconosciute come mellifere o molto attrattive nei confronti degli insetti impollinatori e delle farfalle, con grande beneficio di tutto l'ambiente circostante. Una popolazione sana di impollinatori come api, farfalle, falene, uccelli e persino formiche costituisce la spina dorsale di tutta la vita nell'ambiente e dei nostri sistemi alimentari.

Collage fotografico del pollinator garden e area coworking

Group's project's plan design and specifics, output of the collaboration with Biomimesis, graphic elaboration made by the thesis's author





A1
POLLINATOR GARDEN:
Sez. Ala A1- Pattern strutturale per l'impianto

Riveste una superficie di 2.500 mq divisa in 8 porzioni distinte per varieta' di specie e degli effetti cromatici desiderati secondo la maglia strutturale delle hind wings degli insetti. Ne risulta una tavolozza di colori e profumi che crea un effetto spontaneo, immersivo e naturalistico per tutto l'anno grazie alla messa a dimora di erbe e piante perenni strutturali facili da coltivare e con necessità di bassi interventi di manutenzione.

Piante erbacee e graminacee perenni

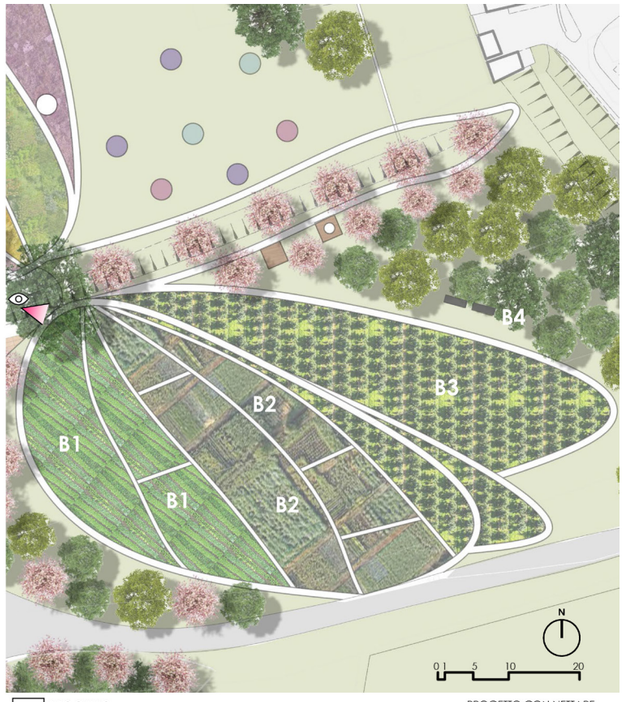
- Stipa tenuifoliae
- Salvia 'Plum'
- Aegopodium podagraria 'Variegatum
- Ophiopogon japonicus
- Echinops bannaticum 'Blue Glow'
- Viola odorata
- Santolina rosmarinifolia
- Stipa-ichu-Vaso-14cm
- Eremurus himalaicus
- Astrantia maxima

Giardino Perenne, Piet Oudolf, 2009

Collage fotografico del productive garden e della sponda riparia inverdita

B
PRODUCTIVE GARDEN:
Ala B-Permacoltura

Quest'area di progetto si sviluppa ad un dislivello di 3 mt. c.ca rispetto al Pollinator Garden. Di una superficie disponibile di c.ca 5000 mq. ne riveste 2.500 mq divisi in 4 zone + 1 integrate ma collocate a seconda della frequenza d'uso da parte dell'uomo:
- zona 0: tree-house e casetta attrezzi
- zona 1: erbe aromatiche
- zona 2: orto
- zona 3: frutteto
- zona 4: food forest con Bug Hotel



Group's project's plan design and specifics, output of the collaboration with Biomimesis, graphic elaboration made by the thesis's author

1.3 Research objectives

The aim of this thesis is to explore the participatory approaches applied to Nature Based Solution projects, their advantages and disadvantages, in order to better involve stakeholders in the decision-making process and promote sustainable change in urban communities.

Doing so, the study focuses on:

1. Nature-Based Solutions urban projects, considering their sustainability in environmental, economic and social value to produce climate adaptation and mitigation.
2. the participatory approach to design think processes, using co-design methodologies and focusing on the experimentation gamification process.

For the purpose of the study, it was selected a case study in Torino, the regeneration of the Fioccardo park, where the participatory approach was experimented. The trial test was arranged throw a workshop held with the Politecnico master students with a codesign gamification tool.

1.4 Thesis structure

1.0 The chapter forms an introduction to the thesis's work.

1.1 The first section defines the background and problem statement. (1.1.1) Climate Change is one of the biggest challenge our worldwide society is facing and is going to confront for the years to come. Human activities have a crucial role in this process that has caused some irreversible impacts to nature and people, such as the loss of natural capital and biodiversity and the increase in severity and frequency in multiple climate hazards. (1.1.2) Cities are part of the problem and the solution, being accountable for most GHG emissions, they need structural modifications to face climate change mitigation and adaptation. 70 per cent of the word' population is expected to be living in cities by 2050 and, hence the importance of developing solutions to make cities resilient to climate change. Climate Change is especially affecting cities because of their structure and historical expanding methods, and they tend to have higher risks concerning extreme events. It is given an example of the effects and urban mitigation policies.

1.2 The section summarizes the Intesa San Paolo competition experience, which I took part with the DIST department from January to April 2022. It involved a project for a urban park regeneration with NBS solutions. (1.2.1) A brief description of the context and objectives of the competition as it was presented. (1.2.2) A brief description of the project's partners and (1.2.3) The final project's output and sustainable practices.

1.3 The research objectives: Nature-Based Solutions urban projects, and the participatory approach in their development.

2.0 Chapter dedicated to Nature Based Solution literature review and policies.

2.1 The chapter describes the Nature Based Solution literature review. (2.1.1) Is starts with a definition of NBS from the European Commission and explanation of the umbrella concept. (2.1.2) Then, the explanation of the societal challenges NBS can address, such as climate change mitigation, climate change adaptation ad disaster risk reduction, the sustainable urbanization and biodiversity enhancement, as well as the market challenges and (2.1.3) the ways NBS can foster the achievement of the UN *Sustainable development goals for 2030*. (2.1.4) Later it is exploited the reasons why in this particular moment is so important to address NBS and (2.1.5) their effectiveness, trying to understand whether it is valid or not for various challenges. (2.1.6)

2.2 The chapter describes the Nature Based Solution policies and projects in the EU contest starting from (2.2.1) an international policy framework, that focuses on four important policies: the *Paris Agreement*, the *UN Agenda for sustainable development*, the *Sendai Framework for Disaster Risk Reduction* and the *New urban agenda*. (2.2.2) Than it moves to the European framework reporting the current EC policies and focusing on the *European Green Deal, the Horizon Europe, the Next Generation EU* fundings and other European strategies. (2.2.3) It is then reported a summary of the latest european effors in research development with the NBS Research & Innovation program and (2.2.3) it is further given a focus example of the ProGIreg project, currently active in Torino.

2.3 It is reported an (2.3.1) annex with four NBS urban case study projects and a (2.3.2) comparison table.

3.0 Chapter dedicated to the participatory approach literature review.

3.1 The section starts with a definition of (3.1.1) the reasons to use a participatory approach and a literature review of the types of participatory approaches evaluated, following the Arnstein's ladder of citizen participation and the Fung's democracy cube of participation. (3.1.2) Then it moves to participatory approaches uses in practice, explaining how to organize a process and giving a brief review of the case of Bologna's administration. (3.1.3) It is further give a summary of different participatory approaches examples.

3.2 The section moves on discussing the use of participatory approaches for NBS design and its advantages, giving a review of (3.2.1) European initiatives. (3.2.2) It concludes giving the reasons for the choice over one particular participatory tool that is going to be tested in the case study.

4.0 Chapter that explains the methodology that was elaborated and applied to the case study.

4.1 The section provides a step-by-step work methodology. Starting from 00 the preliminary research over literature and case studies, 01 it moves to the site analysis, then to 02 the citizen engagement part and the 03 analysis of the consultation's ideas, that are elaborated in a final 04 output forming the project's idea.

4.2 Then it is briefly presented the case study chosen for the application and the reasons for the choice.

4.3 In the section it is extensively presented the participatory tool chosen for the application, going from the (4.3.1) creation of the tool, to the (4.3.2) tool's methodology, to the (4.3.3) roles of the gamification tool and concluding with a review of (4.3.4) the tool's applications in real life.

5.0 Chapter dedicated to the application of the methodology to the case study.

5.1 The section provides for the first step of the methodology, the site analysis. it starts with a review of the climate effects and policies the city of Turin is trying to address. then with a legislative and urban planning framework, and the site specifics obtained with an empirical analysis, population's data analysis and and in situ analysis.

5.2 Then it moves to the simulation of the citizen engagement, carried out throw a workshop, that was organized with the DIST department students and professors.

5.3 Followed by a report of the workshop's ideas, that are analyzed with both quantitative and qualitative methodologies, confronting them group singularly and then drawing the (5.3.4) overall considerations and a comparison table analysis .

5.4 The section reports the work's results, elaborating (5.4.1) the project's idea and (5.4.2) a preliminary choice of indicators for an impact assessment.

6.0 Chapter for the conclusions and future developments possibilities.

02

NATURE BASED SOLUTIONS

2 NATURE BASED SOLUTIONS

2.1 Nature Based Solutions literature review

2.1.1 Nature Based Solutions definition

Recently, at European and international scale, research and innovation initiatives have been launched to address Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) challenges with non-conventional methods, with a more natural approach based on the *Do No Significant Harm* (DNSH) criteria. Nature Based Solutions are one of those; Recent studies (Faivre et al. 2017a), show they can provide multiple benefits, being able to address CCA and DRR, like conventional methods, but also secondary benefits like the ecosystems' protection, climate mitigation, human health and well-being with being cost-effective measures.

But what are Nature Based Solutions (NBS)? NBS has often been described as an umbrella concept, that represents a series of different solutions, from different sectors of study and research, with the same goal of providing multiple human benefits and building CCA and DRR. By the Europe Commission's definition, Nature Based Solutions are:

> *"Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services."* (Directorate-General for Communication 2022)

They are actions inspired by nature or mimicking it; They use the features and system processes of nature, such as its ability to store carbon and regulate water flows, to achieve expected goals, such as reduced disaster risk and a preserved environment that improves human well-being and social inclusion. The concept of NBS embodies different approaches to socioecological adaptation and resilience, with equal reliance upon social, environmental and economic domains. NBS as an

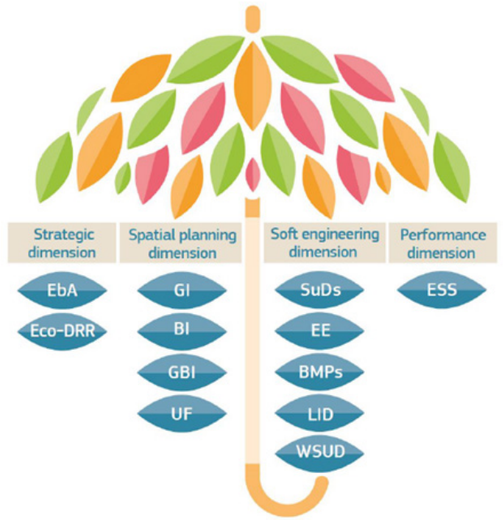


Figure 2.1 The NBS umbrella concept (European Commission. et al. 2021)

umbrella concept include all the previous concepts used to express similar ideas based on the Ecosystem-based Approaches (EbA) and Ecological approaches to Disaster Risk Reduction (Eco-DRR), solutions that try to '*build with nature and for nature*' to adapt to climate change. Following those strategical dimensions, it can be found spatial planning dimensions, such as urban forestry (UF); green, blue or green and blue infrastructure (GI, BI, GBI); soft engineering dimensions, such as Sustainable urban drainage system (SuDS), Ecological Engineering (EE), Best Management Practices (BMPs), Water-Sensitive Urban Design (WSUD) and Low-Impact Design solutions (LID); and performance dimensions as Ecosystem Services Solutions (ESS). The common denominator of NBS practices is their sustainability, which they provide as natural sustainability, with the increase of biodiversity and contributing to the CCA process; the economic sustainability, with their investment return in the prevention of extreme events and the creation of new job positions and also the social sustainability, providing resilience to the impacts of climate change and improving health quality and social cohesion.

> *"The implementation of NBS in human environments could be considered a fundamental tool capable of sustaining human life and activities over time in a way that is compatible with the planetary boundaries; [...] In other words, NBS provide an opportunity to enhance and maintain the liveability of human settlements for current and future generations."* (European Commission. et al. 2021)

Fighting climate change and preventing ecosystem degradation and biodiversity loss are highly interdependent, requiring increased coherency in terms of policy agendas and actions. Ecosystem preservation and restoration can contribute to resilience and mitigation of climate change.

Nature based solution's goals

For there is a wide spectre of concepts under the name NBS, they can have different goals and offer various solutions, requiring specific competencies. Experts with different backgrounds view NBS through various disciplinary lenses. In this sense, it also involves different approaches, and different professional figures in the making process, such as policymakers, engineers, naturalists, botanists, geologists, urban planners, landscape designers and others.

There are many and different approaches to NBS that tackle different sectors and have the capacity to simultaneously address several societal challenges:

- **Biodiversity approaches**: that try to enhance and restore biodiversity at multiple scales with Environmental approaches and Green and/or Blue infrastructures. The EU *Biodiversity strategy* and the EU *Strategy on Green Infrastructures*[6] define strategic guidelines to optimize on-site biodiversity as well as the structural and functional connectivity of natural/green-blue spaces.
- **Forest management and land use**: NBS provide sustainable forest and land management in order to use the wood and soil as a primary product without destroying the original ecosystems. The Sustainable Forest management and the Ecosystem-based management try to regulate the exploitation of natural resources.
- **Water management**: the natural water retention measures (NWRM) try to use in a more cautious and sustainable way the water resource, experimenting solutions of natural drainage, ponds and water reuse in the intent to prevent future scarcity and droughts.
- **Agriculture:** it's a crucial sector for water retention measures since most of worldwide drinkable water is used for agriculture and animal breeding. In this field guidelines are supplied by the *Common Agricultural Policy* for the EU.
- **CCA and DRR**: Ecosystem based adaptation strategies and Ecosystem-based disaster risk reduction as well as green and blue infrastructure are acknowledged to be efficient in preventing disasters as it is recognized also by the Sendai Framework for Disaster Risk Reduction[7].

- **Health and life quality**: The role of NBS in There is increasing recognition of the critical role of NBS in alleviating the burden of many common types of disease playing an important role in physical and mental health, quality of life, and social cohesion and reducing the stress factor. Moreover, NBS are being used to increase contact and interaction with natural processes, elements and ecosystems, and act as therapies. They also renew a lost sense of community and increase social cohesion.

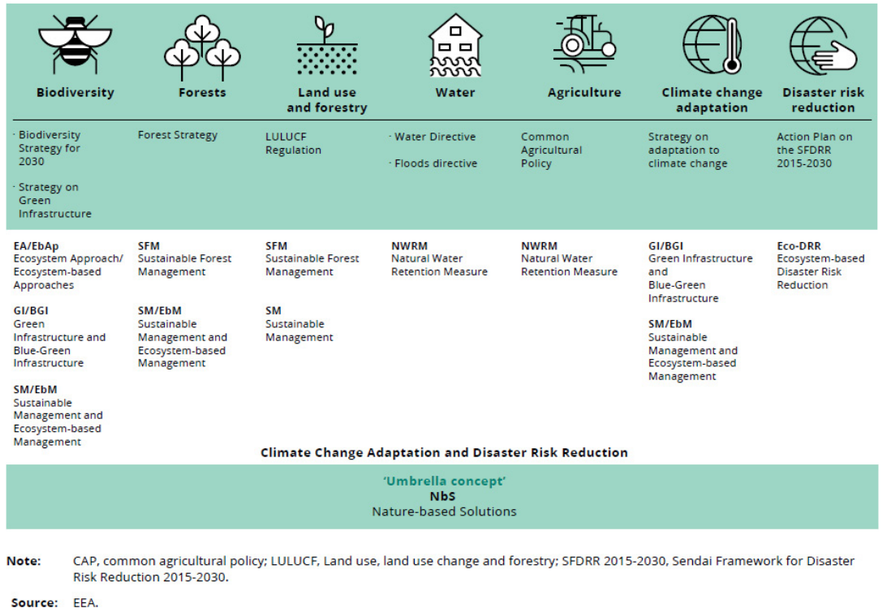


Figure 2.2 Overview of nature-based concepts to climate change adaptation and disaster risk reduction and their related EU policy sectors (European Environment Agency 2021)

6 See 2.2.2 EU Policy framework for more.

7 See *2.2.1International policy framework* for more information on the topic.

2.1.2 Nature Based Solutions challenges

NBS have become popular in policy design especially at the European level because of their capacity of addressing different societal challenges that are going to be crucial for the next decades, like reported by multiple research and investments programs, the *Green Deal* and the *Horizon* for example, that try to face this century green revolution challenge. NBS can be effective towards the role of the cities in the reduction of carbon emissions and their adaptation to climate change but also the disaster risk reduction and the economic conversion towards a green and more sustainable model. On the other hand, they mark the more demanding challenge of the fight towards biodiversity decline.

NBS for Climate Change Mitigation

NBS for climate mitigation can be helpful in different ways:

- **CO2 storage and sequestration[8]:** with those measures that conserve, restore or enhance *"forests, wetlands, grasslands and agricultural lands"* in order to either reduce CO2 emissions and store it through "reforestation, forest conservation and management, agroforestry, cropland nutrient management, conservation agriculture, coastal wetland restoration, and peatland conservation and restoration". (Wild et al. 2020) In this field NBS should be implemented in three key sectors: the management of agricultural land, the conservation and management of forest ecosystems and also urban NBS like tree planting, green corridors and GBIs. A critical example is soil erosion, which leads to a loss of topsoil, including soil organic carbon sequestration. Long-term NBS in agriculture can contribute to good soil management and provide carbon sequestration, keeping it away from the atmosphere. NBS as afforestation and rewetting peatlands, financed through CO2 certificates and public private partnerships can serve to enhance carbon storage. Another sector, that is still to define as NBS, is the restoration of sea grasses and salt marshes, which could also contribute to the storage and sequestration of carbon.
- **Energy demand reduction:** NBS like green roofs and green walls can also contribute to climate mitigation by reducing energy demand by providing thermal comfort from the scale of the building to the neighbourhood and by reducing demand for heating and cooling. They can also reduce local temperatures, providing relief from heatwaves and urban heat islands, reducing the need for air conditioning.
- **Enhancing green transport:** NBS can be used to create a conducive environment for active transport, like walking and cycling routes inserted in green corridors, to create connected green and dedicated spaces. This could contribute to the reduction of the use of cars and their associated emissions; on the othe,r side NBS could reduce the generation of embodied emissions in urban development and infrastructure provision by using alternative materials to steel and concrete.

NBS for Climate Change Adaptation and Disaster Risk Reduction

NBS are being addressed to be able, if carefully planned and managed, to address CCA and DRR. Several international and European policies, starting from the *Sendai Framework for Disaster Risk Reduction*[9], suggest them as an approach to urban and peri-urban development and management

8 For the difference between Carbon Storage: *"The absolute quantity of carbon held within a reservoir at a specific time is referred to as a carbon 'stock'. This reservoir is a component of the climate system, other than the atmosphere, which has the capacity to store, accumulate or release carbon. Oceans, soils and forests are examples of reservoirs of carbon."* and Carbon Sequestration: *"The process of increasing the carbon content of a carbon reservoir other than the atmosphere. Biological approaches to sequestration include direct removal of carbon dioxide from the atmosphere. Vegetation removes CO2 from the atmosphere through photosynthesis."* (Wild et al. 2020, chap. 3)

9 See *2.2.1International policy framework* for more information on the topic.

in buffering risks posed by natural hazards.[10] Of course the matter of the efficacy is still being discussed due to remaining knowledge gaps and lack of comprehensive evidence on the reversibility, flexibility, cost-effectiveness and feasibility and long-term sustainability of NBS as compared with grey approaches., but the premises are overall promising. NBS "can reduce the risks associated with natural and climate hazards. They can mitigate risks related to both the increasingly frequent and intense storm events associated with climate change as well as other natural hazards, like landslides and avalanches." (Commission, n.d.) For example they can reduce the number of persons and the entity of financial losses due to natural and climate hazards and mitigate risks to critical infrastructure such as grey infrastructures.

- **Enhanced flood alleviation and improved water quality.** Existing urban drainage systems are often poorly maintained or designed for under capacity and unable to deal with extreme events like waterbombs and storms. NBS can help reducing the risk and the entity of damage for floodings upon society by the restoration of watersheds, wetlands, woodlands, riverbanks and floodplains. This kind of solutions tries to delay the downstream passage of flood flow, enhancing rainfall infiltration into the soil and increasing flood storage capacity with ponds and accumulations systems, the reducing extent and speed of water runoff. GBIs are excellent examples, often integrating NBS with the existing grey infrastructure.
- **Coastal protection to deal with sea level rise and storm risk**: Restoring and enhancing natural habitats, such as saltmarshes, dunes and reclaimed coastal allow natural processes, such as coastal sedimentation, that have often been shown to provide cost-effective solutions compared to hard engineering options. Such habitats can also provide wider benefits, for example to tourism and biodiversity conservation.
- **Heat stress due to heatwaves:** the greening of urban areas can be very effective in reducing the surface temperature and heatwaves. NBS as green corridors, urban tree plantation, green infrastructures, green walls and roofs can deliver great benefits especially to older people and their health.
- **Floods and droughts prevention in agricultural habitats:** NBS measures like agroforestry and crop diversification, buffer strips and hedgerows, improved water retention methods and meadows could be important measures in the fight against climate change allowing to prevent and adapt to extreme events. Also management measures like crop rotation, low till agriculture and green cover could be helpful.
- **Forest plantation and management:** ecosystem-based forest management and reforestation measures, as well as afforestation, carefully planned forestation in riparian buffers are known to have important effects on preventing landslides and floods consequences, reducing runoff and stabilizing the declivous terrains. These measures also have an impact on industrialized and urban environments for reducing heatwaves and helping climate mitigation.

NBS for enhancing sustainable urbanisation

NBS are explicitly named in numerous policy instruments, including those outlined in the UN SDGs and the New Urban Agenda[11]. Decision-makers, governors and local administrators at urban and multiple levels are looking to NBS to develop a Climate Change strategy[12]. Most of NBS projects and research have actually been experimented in urban contexts, proving wide data on the subject. NBS are especially brought to attention towards the UN goal for Sustainable Cities and Communities (SDG11) and the making of *Sustainable Communities,* which have been a EU central goal since the '90, with a wide range of policies and initiatives to develop sustainable, smart, low carbon, resilient eco-cities. At the local level, they try to pursue goals for air pollution reduction, climate change mitigation, waste reduction, and the improvement of the quality of life. NBS are increasingly being seen as a

10 Rif. (European Environment Agency 2021, chap. 1,3) (European Commission. et al. 2021, chap. 4)

11 See paragraphs 2.1.3 NBS and Sustainable Development Goals and 2.2.1 International policy framework.

12 Rif. (Wendling et al. 2021), (European Commission. et al. 2021, chap. 4) and (Wild et al. 2020, chap. 5,8,9)

means through which it is possible to generate sustainable communities whilst also attending to other challenges.

Regarding the city's environment NBS can be helpful towards specific calls such as:

- **Green Space Management:** is referring to the planning and maintenance of green and blue infrastructure in urban areas, which is widely experimented, to help with the water management problem in urban contexts. NBS can enhance the quantity, quality and accessibility of public green spaces, in particular, supporting the increased liveability of urban and peri-urban areas through increased receptiveness of public green space for all citizens, increased total proportion of green space within built areas and improved quality of GBI spaces.
- **Air quality**: NBS based on the creation, enhancement or restoration of ecosystems in urban areas play a relevant role in removing air pollutants and carbon dioxide, reducing air temperatures and increasing the ambient oxygen concentration. Are reported reduced exceedances of air quality limits in the proximity of the nature-based solution, including airborne particulate matter (PM2.5, PM10), ground-level ozone, nitrogen and sulphur dioxides, carbon monoxide and polycyclic aromatic hydrocarbons.
- **Place Regeneration:** NBS as a systemic tool support regeneration of the built environment by enhancing the quantity and quality of green space, fostering people-nature connections and by contributing to reductions in our environmental footprint. Different initiatives in this field include the reclaim of derelict land for pocket parks, enhancing the place identity among citizens and increasing the recreational and aesthetic value of public green spaces.
- **Participatory Planning and Governance:** Urban environmental transformation as a process requires open collaborative governance and can be good occasions for participatory planning. NBS can support the openness of participatory processes, with increased proportion of citizens involved in these processes. The participatory processes can push a sense of empowerment among citizens, contributing to higher trust in decision-makers and in decision-making procedures.
- **Supporting social learning regarding ecosystems and their functions**: NBS solutions in cities, especially if participatively planned, can foster pro-environmental behaviour among citizens of all age, spreading knowledge for sustainable urban transformation. In experimented projects they can create the good condition s for environmental education opportunities. NBS often offer opportunities for citizen involvement in stewardship actions, like community gardening and tree planting, intergenerational learning and collective decision-making.
- **Health and Wellbeing**: different research exhibit that time spent in a natural environment promotes mental and physical health and reduces the disease burden by providing psychological relaxation and stress alleviation, enhancing immune function, stimulating social cohesion, supporting physical activity, and reducing exposure to air pollutants, noise and excessive heat. NBS can be useful in the spread of such practices like increased physical activity, leading to reduced obesity and reduced cardiovascular diseases, improved mental health and reduced chronic stress, reduced lung diseases and overall mortality by improving air quality.
- **Social Justice and Social Cohesion:** all of this mentioned benefits NBS have also have the side effect of enhancing social cohesion among typically excluded social groups and support social justice by providing equal access to neighbourhood green spaces.

NBS for restoring and preserving degraded ecosystems

Biological diversity is increasingly threatened by human activities. In Europe, great pressure comes from for example agricultural intensification, grey infrastructure expansion, pollution of brownfield sites, hydrological modifications to water bodies and the intensification of forestry practices that threaten the health of ecosystems. In current policy debates at the EU and global levels, is emerging

a connecting link throw climate change and biodiversity policies, including their respective targets and actions. Also, the COVID-19 crisis in 2020 has highlighted the possibility that the destruction of ecosystems may contribute to outbreaks of infectious diseases, requiring new attention on the subject to prevent new outbreaks. In this field NBS are recognised for their potential[13] to contribute to both, as they benefit and are based on biodiversity, while also delivering multiple benefits, such are:

- **Biodiversity Enhancement:** Biodiversity loss and ecosystem collapse are among the greatest threats our society faces in the near term. The implementation of NBS can increase biodiversity and yield benefits such as reduced fragmentation and increased connectivity of natural areas, increased number of native species, including pollinators, and increased species diversity of both flora and fauna, even in urban areas.
- **NBS can increase the resilience of increasingly fragile nature reserves threatened by climate change.** The multifunctional character makes NBS a powerful tool to increase much needed public and private sector investment in biodiversity conservation efforts, even if in many cases biodiversity is viewed as a co-benefit of the NBS rather than the primary objective.
- **Creation of new and restoration of degraded ecosystems as part of the GI network:** the GBI, GI and green corridors can help to connect different natural parks and areas in urban and rural areas throughout Europe, providing healthy habitats for species and their natural migration.
- **Place Regeneration:** NBS support the regeneration of the built environment, in some cases by reclaiming derelict land, especially in urban areas for green space. If well planned, they can also enhance biodiversity and increase the value of public green spaces.
- **NBS can enable sustainable agriculture production systems.** Nature-based farming practices could provide win-win scenarios, (i.e. simultaneously addressing climate change mitigation and adaptation, biodiversity protection and soil and water management objectives). These kinds of measures would be financially favourable in the long term but need strong investment in the short period, reason why they are still not so common. Promoting NBS in rural areas requires broad application of agro-ecological agronomic practices, the promotion of agroforestry, woody landscape features or food forests and agrobiodiversity.
- **The ecosystem approach:** Ecosystems are very complex systems, where even the tiniest action taken in one location may have unforeseen consequences elsewhere, often far away and many years later. In this context, an approach is needed, able to offer a powerful strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The ecosystem framework approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It also recognizes that humans, with their cultural diversity, are an integral component of many ecosystems. The ecosystem approach is essential in guiding action under the various programmes of work and it requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete understanding of their functioning and contains elements of "learning-by-doing" or research feedback. The ecosystem approach will ensure that management decisions are based on the best available science in the context of the precautionary approach. ("The Ecosystem Approach (CBD Guidelines)" 2004)

NBS for market challenges

NBS adoption would create new economic opportunities and jobs in the green sector. Additionally, NBS in urban and rural environments could generate economic benefits, like the increased value of natural capital, an increase in average land productivity and profitability, increased land or property

13 Rif. (European Commission. Directorate-General for Research and Innovation., n.d., chaps. 2–3) (Wild et al. 2020, chap. 4)

value in proximity to the project sites and increased retail and commercial activity in proximity to NBS.

> "Nature-Based Solutions also play a critical role in promoting 'transitions' from a resource-intensive growth model towards a more resource-efficient, inclusive and sustainable growth model. Transitions are radical innovations in structures, mind-sets and practices that involve actors from different sectors, domains and scale levels in the co-design and co-implementation of solutions." (Faivre et al. 2017b)

NBS has raised interest from communities and governments for many reasons and especially regarding the risks to societies and businesses from climate change and biodiversity loss mount. Interest is also growing from various potential investors, including impact and institutional investors, private companies, the insurance sector, banks and philanthropists. However, right now the NBS market is still developing and struggles to become self-sustaining for multiple reasons. One is that easily monetised benefits of individual NBS investments do not exceed costs in many individual cases, so that is difficult to see and calculate the return of investment. NBS often tend to produce multiple benefits, some of that are difficult to quantify in monetary terms and many others are public benefits that do not produce direct financial revenue streams. As a result, the funding of NBS has typically focused on a narrow range of public sources or public-private partnerships. (Wild et al. 2020)

2.1.3 Nature Based Solutions and Sustainable Development Goals

The *2030 Agenda for sustainable development and Sustainable Development Goals* is "a plan of action for people, planet and prosperity" (United Nations 2015). It was promulgated and adopted by all United Nations Member States in 2015, during the *UN Sustainable Development Summit*, after years of conferences and mediation starting from 1992 and culminating in 2015, the same year of the *Sendai Framework for Disaster Risk Reduction* (March 2015), the *Addis Ababa Action Agenda on Financing for Development* (July 2015) and the *Paris Agreement on Climate Change* (December 2015), all important international commitments on fighting Climate Change.

It represents a global call for actions to achieve sustainably in different sectors, including water, energy, climate, oceans, urbanization, transport, science and technology, by 2030. The agenda addresses the negative global trends affecting society, the economy and the environment in order to activate a plan of solutions to address those problems. The *Nature-Based Solutions R & I* agenda has shown to be a useful contribution to a wide number of Sustainable Development Goals (SDGs) considering the ones more directly enhancing nature and natural processes (i.e. SDGs 14 and 15), but also the ones more sideways related. (See Figure 2.3) After 2015, another key event was the 2019 *UN Climate Action Summit*, which brought political attention to the power of NBS for climate and sustainable development, with the *NBS for Climate Manifesto*, proposed by a coalition co-led by China and New Zealand. The manifesto clearly recognises the importance of NBS to meet the Paris Agreement standards and exhorts investments for action to fulfil their full potential:

> *"A plan to unlock the full potential of nature for climate action, with the support of more than 70 governments, private sector, civil society and international organizations, accompanied by nearly 200 initiatives and best practices from around the world" (UN environment program 2022).*
>
> *"There is a need to recognize that NBS have an enormous potential which can be effectively realized through international and regional cooperation among States and with the participation and inclusion of all stakeholders, including youth, women, indigenous peoples and local communities."(United Nations 2019)*

The more directly SDGs sustained by NBS improvements and policies are the ones more connected to the sustainable management of the ecosystems, CCA and DRR, but there are also other side SDGs where NBS cand provide indirect multiple benefits, as reported in the following:

- **SDG 6 Ensure availability and sustainable management of water sanitation:** different NBS aim to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. They also help with water management in urban and rural environment, with natural draining, storage an releasing systems.
- **SDG 12 Responsible consumption and production**: aims to achieve the sustainable management and efficient use of natural resources, regulate chemicals and micro-pollutants in water bodies, address air pollution in urban areas and restore polluted soils.
- **SDG 13 Climate action:** NBS can explicitly addresses the challenge of combatting climate change by also increasing the resilience to abrupt natural hazards and slow onset events, such as heavy precipitations, droughts, floodings, sea level rise, landslides etc. Also they can increase the adaptive capacity of society and ecosystems.
- **SDG 14 Life below water** and **SDG 15 Life on land:** address the need to protect and restore marine and terrestrial ecosystems, to combat desertification and to halt land degradation and biodiversity loss.
- **SDG 2 End hunger, food security and sustainable agriculture** and **SDG 15 Sustainable use of terrestrial ecosystems**: NBS like agro-ecological agronomic practices and agroforestry can help protect and promote sustainable use of terrestrial ecosystems, including forest management, fighting desertification, land degradation and the loss of biodiversity capital.
- **SDG 3 Ensure healthy lives and well-being at all ages:** many chronic medical conditions disproportionately affect those living in deprived communities, where green areas are absent.

Other studies demonstrated a direct correlation between the existence of green space in urban settings and decreased morbidity and mortality (Hartig et al., 2014; Mitchell et al., 2015). Hence, access to healthy natural environments is especially important for vulnerable populations. NBS could improve mental well-being, attentiveness, concentration, sociability, stress, depression et., but also mantein immune defences and enhance physical health.

- **SDG 10 reduce inequalities within and between societies: "**Research has shown that access to recreational/green areas may help prevent socioeconomic inequality from leading to health inequality" (Faivre et al. 2017a) Also, in aged societies such are the European ones, green spaces could actually help liveability for the older and more fragile generations in urban contests, providing social cohesion.
- **SDG 11 on Making Cities Inclusive, Safe, Resilient and Sustainable:** urban areas have a large share of the overall population and still destined to grow in the next years, and they are recognized as drivers of economic growth. These factors, combined with the often-limited access to natural environments in urban areas, suggest that introducing Nature-Based Solutions to urban areas, like GBI, will be especially beneficial.
- **SDG 8 sustainable economic development:** NBS could create green jobs and new green economic opportunities.[14]

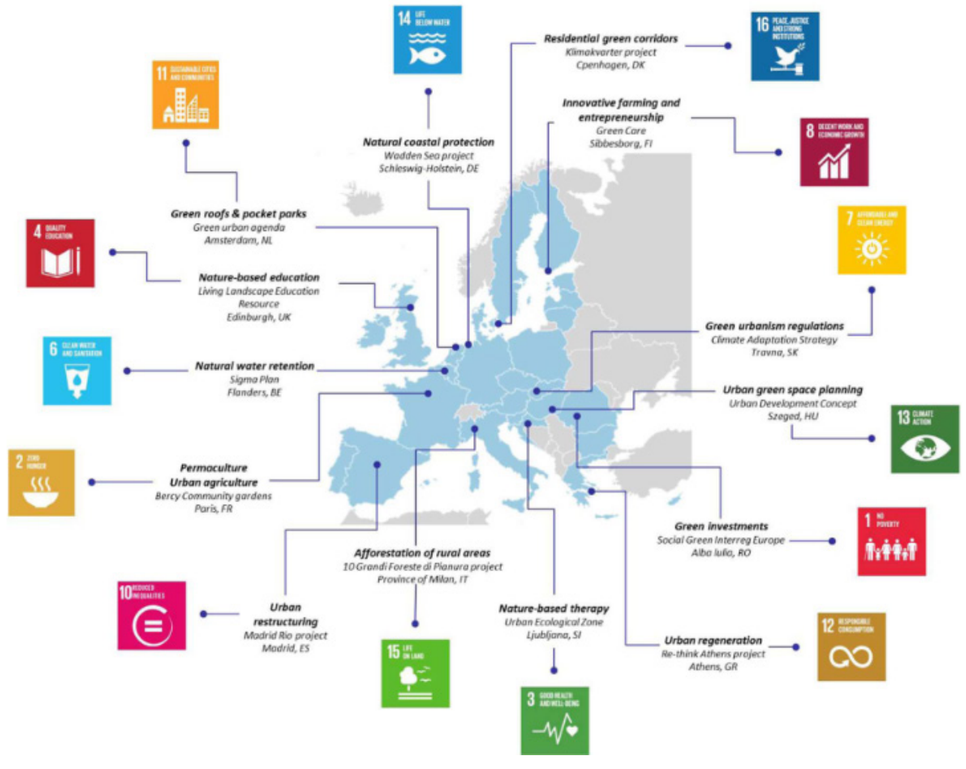


Figure 2.3 How Nature-Based Solutions address sustainable development goals: examples of approaches that use Nature-Based Solutions and measures linked to SDGs across Europe. (Faivre et al. 2017)

14 Rif. (Faivre et al. 2017a) (European Environment Agency 2021, chap. 1)

2.1.4 Nature Based Solutions, why now?

As reported by the European Commission[15] there are several reasons why in this particular moment there's growing interest and effort in research and projects about NBS:

1. Historical moment:

A momentum is growing for NBS investments as a vehicle for delivering green resilient and inclusive development;

> *"[...] since 2012, the World Bank's portfolio of NBS investment projects contributing to climate resilience is worth nearly 5 billion USD. NBS investments have increased especially sharply in the last three years, 2018–2020, when the total number of NBS-lending projects rose by 35 percent." (World Bank 2021)*

The economic situation has reached one of its lowest peaks recently with the COVID-19 pandemic, which affected all nations worldwide. Such situation requires special recovery plans such is the *Next Generation* for the EU. Financially, for the first time in EU, the debt is going to be shared amongst all European countries with high favourable conditions. The plan for recovery has on the other hand strict conditions for the approval and all investments are going to be pointed towards the green transition, including NBS in the sum. NBS involve innovative governance, institutional, business, and finance models and frameworks, leveraging both public and private funding. They tend also to involve engagement with others across disciplines and sectors and different stakeholders, including citizens. After years of research and collaboration within international and European projects, their knowledge is well founded, established and the policies and governance have had the time and funds to adjust to the practice.

2. Growing business interest in the value of nature:

There is a growing interest and awareness within the business community[16] of the value of managing and maintaining biodiversity and ecosystem services as a business opportunity and as an essential means to reduce economic risks by ensuring the continued supply of vital resources. The primary materials scarcity and other critical factors are shifting the economy towards a greener and circular economy making it convenient to invest in. The importance of nature to society is recognized by the growing number of policy initiatives for the conservation and sustainable use of the natural, as from the number of bottom-up initiatives, particularly in community efforts to bring nature back into urban areas.

3. Cost-effective opportunity:

> *"Infrastructure spending amounts to about 3.8% of global GDP, equivalent to US$2.6 trillion in 2013, and could grow to US$3.4 trillion per year through 2030. In a time of fiscal austerity, cost-effectiveness has become critical." (Directorate-General for Research and Innovation Climate Action 2015)*

Governments have every interest in evaluating alternatives to grey or technology-based infrastructure to address challenges rapidly arising from climate change, urbanization and biodiversity loss; NBS could be an actually interesting solution, having demonstrated financial competitiveness and advantages, being able to tackle different factors simultaneously.

4. Europe as an inspiration and world leader in markets:

Europe R&I policy, scientific expertise and technological capability relevant to nature-based solutions are placing it in a position of word leadership, both in research and in the global market for NBS. All that is needed is to enhance the evidence base and to implement NBS at a greater speed and a

15 Rif. (Directorate-General for Research and Innovation Climate Action 2015)

16 E.g. World Business Council for Sustainable Development, The Natural Capital Coalition

wider scale.

5. If not now, when?

We have less than seven years more to address climate change before it's too late. A famous project that tries to shake the public opinion on climate change has elaborated a clock timing the critical time window to reach zero emissions before it's to late.

> *"The next 7 years is humanity's best window to enact bold, transformational changes in our global economy to avoid raising global temperature above 1.5ºC, a point of no return that science tells us is likely to make the worst climate impacts inevitable." (The climate clock[17])*

2.1.5 Nature Based Solutions' effectiveness

The economic advantage of NBS is one of the key questions slowing their use and implementation. For this reason, it is very important to determine the economic assessment of NBS, to realize a proper evaluation of NBS.

> *"Indeed, assessing the value of costs and benefits of NBS and being able to compare them to alternative strategies such as business as usual grey solutions is fundamental for decision makers to develop these solutions and eventually turn them into implementable projects."* (le Coent et al. 2021)

Are NBS a proper alternative to grey solutions? Different papers and research have tried to settle the question, but the matter is still distant from being closed; Existing knowledge gaps and *"a lack of comprehensive evidence on the reversibility, flexibility, cost-effectiveness and feasibility or long-term sustainability of NBS as compared with grey approaches are barriers to mainstreaming of NBS, suggesting still other studies and experimentations have to be carried on, but the premises are overall promising."*(le Coent et al. 2021) At EU level a great number of field studies have been exploited at rapid pace and soon will provide all the specifical evidence and impact data required for accelerating the integration of these emerging concepts in urban and regional planning and design. This spreading of experimentation and pilot projects, promoted with the Horizon programs, is already calling for further actions, creating a positive cycle for the creation of a furthermore detailed knowledge base on NBS efficiency and cost-effectiveness. The European Union has invested in a sectorial Nature based solution Research & Innovation program[18] that is giving its results in both scientific, economic, social and practical knowledge.

At this regard, the EU Commission has determined a reference text for NBS *Evaluating the impact of nature-based solutions* (European Commission. et al. 2021) based on 12 societal challenges[19],often simultaneously addressed. The evaluation is related to the interpretation of a series of selected indicators to assess NBS performance. In the text the concept of effectiveness for NBS projects is defined as:

> *"the degree to which objectives are achieved and the extent to which targeted problems are solved. In contrast to efficiency, effectiveness is determined without reference to costs."*(Raymond et al. 2017)

To better understand the concept of effectiveness applied to NBS project the text asks the following questions as examples:

- *"Does the NBS lead to enhanced climate resilience in the urban area?*
- *Does the NBS lead to environmental benefits?*
- *Does the NBS lead to social benefits?*
- *Does the NBS lead to economic benefits?*
- *Does the NBS lead to biodiversity benefits?"* (European Commission. et al. 2021; Raymond et al. 2017)

To take into account the multiple benefits of NBS, it is important to sum throughout the process eighter the different solutions used in the project and the different impacts that are its outcome. This marks the need to crack each step in the process with a functional analysis and consider them as a hole, making the process complex. A correct process' analysis is the key to choosing the best suitable indicators for each application.

> *"Clustering of indicators can be handy for NBS effectiveness comparisons across cities or regions and help decision-makers to move towards better solutions."*(European Commission. et al. 2021, chap. 2)

The comparison of different projects comes very handy for public and private investors that have to decide between different solutions; this is why another important part of an impact evaluations is the assessment of cost-benefit and cost-effectiveness of the solution, to make the best-informed decision. (European Commission. et al. 2021, chap. 2; Raymond et al. 2017)

17 For the *Climate Clock* initiative website: https://climateclock.world/

18 See 2.2.3 Nature Based Solution Research & Innovation program

19 Climate resilience, water management, natural and climate hazards, green space management, biodiversity, enhancement, air quality, place regeneration, knowledge and social capacity building for sustainable, urban transformation, participatory planning and governance, social justice and social cohesion, health and wellbeing, new economic opportunities and green jobs. See 2.1.2 Nature Based Solutions challenges

2.2 Nature Based Solutions in the EU contest

2.2.1 International policy framework

To contextualize the international policy framework NBS research and policies were developed at a Eu level, in this paragraph it is shown a brief focus on the most significant international agreements. The role of the European Union in this convention has always tried to be as a leading part, trying to influence with direct and indirect methods to implement the worldwide discussion on Climate Change.

Going back on time, 2015-2016 were an important period for Climate discussion, signing the moment for a wider worldwide involvement; four global policies were adopted recognising at different level the role of the ecosystems in the promotion a sustainable development in CCA and DRR:

- The Paris Agreement (2015)
- the 2030 Agenda for sustainable development, Sustainable Development Goals (2015)
- the Sendai Framework for Disaster Risk Reduction 2015-2030 (2015)
- the New urban agenda – Habitat III (2016).

All these major policies have their EU ratification form concerning biodiversity, climate, agriculture, water and land management and the urban areas.

For the UN Sustainable Development Goals, the author remands to the 2.1.3 NBS and Sustainable Development Goals chapter, the other policies are better explained in the following paragraphs.

COP21 the Paris Agreement

The COP21 Conference of the Parties was held in Paris from the 30 November to the 11 December 2015 and concluded with the Paris Agreement. The COP meetings started in 1992 with the Rio conference, 154 Parties involved, two years after the first IPCC 1990 report showing the clearest evidence of human impact on Climate Change. The first COP obtained only the objective of non-binding agreements on the emission cuts and the promise of yearly monitoring encounters, but the first restrictions were decided only with the Kyoto protocol at the COP3, with great difficulties and a small number of participants. The non-binding agreement was also a weak point of the agreement because the parties did not reach the agreed standards. Only in 2015 with the COP21 there was the first-ever universal, legally binding global climate change agreement ratified by 196 Parties.[20]

With The Paris Agreement, the national governments agreed on the mitigation strategy:

- to keep the increase in global average temperature to well below 2°C above pre-industrial levels, with the aim to limit to 1.5°C for 2100.
- on the need for global emissions to stop the peak and start the reduction, with the recognition that this will take longer for developing countries.
- to undertake rapid reductions for the 2050 and zero emissions for the 2100.
- The submission of comprehensive national climate action plans, that were not yet enough to reach the agreed temperature objectives but represented a way to call for further action.
- For meetings every 5 years to assess the collective progress and inform the other Parties on their nationally determined contributions.

20 https://oggiscienza.it/2015/11/30/cop21-clima-parigi-cambiamento-climatico/

And on the adaptation strategy:

- To improve societies' ability to deal with the impacts of climate change with CCA and DRR implementations.
- To provide support for adaptation to developing countries.

The Paris Agreement was followed *by The Katowice package* in the COP24 in 2018, containing common and detailed rules, procedures and guidelines to operationalise it. The EU formally ratified the agreement on 2016 and later uploaded it in 2020 providing enhanced nationally determined contribution (NDC) with the target of a net reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990.[21] The NBS are a recognized tool the EU considers towards the reaching of the Paris agreement's goals both for the mitigation and the adaptation strategy.

The Sendai Framework for Disaster Risk Reduction 2015-2030 (2015)

The Sendai Framework for Disaster Risk Reduction for 2015-2030 was adopted during the Third UN World Conference in Sendai, Japan, on 2015. It is the outcome of a stakeholder consultation between inter-governmental parties, supported by the United Nations and poses a strong emphasis on preventing new risk, reducing existing risk and strengthening resilience opposed to disaster management, underlining the necessity for global prevention measurements instead of the consequences. It reached the definition of seven global targets:

1. the need for better understanding and research on disaster risk, vulnerability and hazards
2. the strengthening of disaster risk governance in each governance
3. the strengthening of international cooperation and global partnership with a Global Platform for Disaster Risk Reduction
4. the accountability for disaster risk management
5. the preparedness to "Build Back Better" after a disaster quickly and effectively
6. the recognition of stakeholders and their roles
7. the mobilization of risk-sensitive investment to avoid the creation of new risk, NBS are cited as preventive measures for their action on DRR. (Wild et al. 2020; United Nations Office for Disaster Risk Reduction 2015)

The New urban agenda (2016).

New Urban Agenda was agreed in 2016 to develop a "multi-level working method promoting cooperation between Member States, cities, the EC and other stakeholders in order to stimulate growth, liveability and innovation in the cities of Europe and to identify and successfully tackle social challenges" (Wild et al. 2020). The Urban Agenda refers to different topics that are going to be directed in the next years to enhance urban livability from housing and the inclusion of migrants and refugees in local communities, through to issues related to local economic development, poverty and the digital transition. One of the interested measures is the conversion towards the challenge of sustainable communities and the introduction of NBS in urban contests. (Wild et al. 2020)

21 https://ec.europa.eu/clima/eu-action/international-action-climate-change/climate-negotiations/paris-agreement_it

2.2.2 European Union Policy framework

While different science-based organizations have been active integrating NBS in their strategies and policy debates (*The Nature Conservancy and the International Union for Conservation of Nature*, for example) and the World Bank has helped with substantial investments over the years, the EU has certainly played a leading role in the spreading of the NBS approach in the international policy arena for issues such as climate, biodiversity, environment and disaster risk. (Faivre et al. 2017a) The EU has both directly and indirectly implemented the use and research on NBS throw either internal policies and influencing the worldwide discussion on Climate Change in the negotiation of the *Paris Agreement* (2015), the *New Urban Agenda* (2020), the *Paris COP24* and the *UN 2030 Agenda for Sustainable Development Goals* (See 2.1.3). The EU's policy is trying to encourage the research and use of NBS at the EU and global level as a way to foster biodiversity and make Europe more climate resilient. The commission supports NBS throw Research and innovation programs and projects fundings as a key part of different EU policies such are the *European Green Deal, the Biodiversity strategy and Climate adaptation strategy*. As from the European Commission website the current policy goals are to:

> *"provide the evidence for nature-based solutions, improve framework conditions for nature-based solutions at EU policy level, develop a European research and innovation community, advance the development, uptake and upscale of innovative nature-based solutions, mainstream nature-based solutions in international research and innovation".* (Directorate-General for Research and Innovation 2022)

The European commission has integrated in its policies the ecosystem approach, which NBS are closely supporters, since the early 2000s. It involves an integrated management of all the natural elements and organisms to promote their conservation and sustainable use. With this approach in mind the Commission has over the years created different policies and strategies such as the *Ecosystem-based Adaptation EbA, Green Infrastructure or green and blue infrastructure GI/GBI, Ecosystem-based Disaster-Risk Reduction Eco-DRR and Natural Water Retention Measures*. EU policies support to varying degrees the uptake and implementation of NbS for CCA and DRR. The use and implementation of NBS for CCA and DRR has been strongly supported by different policies, here intended as a set of ideas or plans used as a basis for decision making in politics, such as regulations, strategies, action plans, agendas, or global agreements.

A recent analysis from the *European Environmental Analysis EEA* tried to assess 16 EU policies considered the most relevant for NBS implementation. They were reviewed based on the extent to which a policy supported the deployment of NNS for CCA and DRR, identifying four levels of support, from the strong explicit support to the low support and underlining the most frequently used terms across the seven policies. This terms, which are all under the NBS umbrella concept, are: EbA, nominated in all seven policies and SM/EbM/SFM (six), followed by Eco-DRR (five) and NbS and EbAp (four). GI/BGI appear in three policies, while NWRM appear in two. In the following pages it is reported a selection of European strategies that are important for NBS research and implementation.

European Environmental Analysis policies comparison table

Table 2.1 Levels of support of nature-based solutions for climate change adaptation and disaster risk reduction in policies (European Environment Agency 2021)

Level of support	Description
Strong explicit support	Explicit mention of NbS in connection with CCA and/or DRR; strong embedding throughout the policy, including in objectives, actions and instruments
Strong implicit support	Strong framing of nature, biodiversity and ecosystems as a means to address CCA and/or DRR challenges but no explicit mention of NbS; strong embedding throughout the policy, including in objectives, actions and instruments
Medium support	NbS are mentioned explicitly or implicitly, but they are not a prominent feature in the policy and/or linkages to CCA and DRR are weak or missing
Low support	NbS are neither a prominent feature of nor relevant for or mirrored in policy measure design and supported actions, particularly with regard to CCA and DRR

Source: Adapted from Davis et al. (2018).

Table 2.2 Explicit use of nature-based solutions terms, references to climate change adaptation and disaster risk reduction and level of support (European Environment Agency 2021)

EU policy	NbS-related terms							Reference to DRR	Reference to CCA	Level of support
	NbS	EA/EbAp	GI/BGI	EbA	SM/EbM/SFM	NWRM	Eco-DRR			
European Green Deal	✓							✓	✓	Strong explicit
Bioeconomy strategy (update)	✓	✓	✓		✓				✓	Medium
Biodiversity strategy for 2030	✓		✓		✓			✓	✓	Strong explicit
Green infrastructure strategy	✓	✓	✓	✓			✓	✓	✓	Strong explicit
Forest Strategy			✓		✓				✓	Medium
LULUCF Regulation					✓			✓	✓	Medium
Action plan on the Sendai Framework	✓	✓	✓	✓	✓	✓	✓	✓	✓	Strong explicit
Adaptation strategy	✓		✓		✓			✓	✓	Strong explicit
Floods Directive					✓	✓		✓	✓	Strong implicit
Water Framework Directive					✓				✓	Medium
Urban agenda	✓		✓					✓	✓	Medium
Farm-to-fork strategy	✓				✓				✓	Medium
Common agricultural policy					✓			✓	✓	Medium

Note: LULUCF, Land use, land use change and forestry.

Source: EEA.

European Green Deal

The European Green Deal was announced in 2019 by the EU Commission as a commitment towards tackling Climate Change and environmental-related challenges, referred as "*this generation's defining task*" (European Commission and Secretariat-General 2019) It is meant as a new growth strategy to radically transform the EU society and economy with the ambition to get no net emissions of greenhouse gases by 2050 and an economic growth decoupled from resource use. It also aims to protect and enhance the EU's natural capital, the health of citizens from environment-related risks and promote social justice and inclusion. It is intended as a deeply transformative plan, that focuses on regions, industries and workers to face this renovation challenges and it needs the collective efforts of all the European citizens.

> *"This upfront investment is also an opportunity to put Europe firmly on a new path of sustainable and inclusive growth. The European Green Deal will accelerate and underpin the transition needed in all sectors."* (European Commission and Secretariat-General 2019)

To reach the goal of the climate neutrality for the 2050, major actions are required in four strategical sectors, that are the most effected by the renovation plan:

1. Energy: to decarbonize energy production
2. Buildings: to renovate them and cut energy use
3. Industry: to support to circular economy and the use of recycled materials
4. Mobility: that represent 25% of the total emissions.

But on the other side of this structural economic measures, the Deal also exhibits the aim *"to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts"* (European Commission and Secretariat-General 2019)

And in this field, it shows clear support for research and innovation in NBS for both CCA and DRR. Biodiversity is recognised as an important area to contribute to climate neutrality, the value of ecosystems and their ability to provide essential services, including mitigating natural disasters and regulating the climate, are outlined. Public and private investments are recognized and encouraged as a key component of the transformational change needed to adapt to climate change and help ongoing efforts to limit it. On the Green Deal roadmap it was clearly intended a series of actions to focus on specific NBS related sectors, such as the 2020 *European climate law* to ensure a climate neutral European Union by 2050, 2020 *EU biodiversity strategy for 2030*, the 2020 *farm-to-fork strategy* for a fair, healthy and environmentally friendly food system and the 2021 new *EU strategy on adaptation to climate change* that will be central in this regard. These and many other promising initiatives as part of the Green Deal have the potential to turn the biodiversity and climate-related crisis around in Europe and encourage the use of NBS. A step in this direction is the Horizon 2020 call in support of the European Green Deal, which will mobilise EUR 1 billion funding for research and innovation activities. (European Environment Agency 2021)

Bioeconomy strategy

The Bioeconomy strategy was originally stated in 2012 and updated in 2018, it covers *"all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles."* (Bioeconomy team 2022)

The strategy reports five objectives and one of them is mitigating and adapting to climate change. In its 2018 update it is increased the consideration of NBS and they are explicitly outlined as *"a tool to rehabilitate urban brownfield sites, apply nature-based remediation solutions, and stimulate GI to reduce*

the urban pressure on agricultural and forest land as well as to solve complex soil pollution." (European Environment Agency 2021) It also calls for active strategies against ecosystems degradation. NBS are although not reported for DRR and CCA, indicating a medium level of support for NbS.

2020 EU biodiversity strategy for 2030

The strategy aims to ensure that ecosystems are healthy, resilient to climate change and rich in biodiversity and NBS are suggested for this particular aim. A specific focus is direct to ecosystem restoration, that will be subject to legally binding nature restoration targets. Sustainable management also plays a big part, highlighting the importance of sustainable forest, nutrient, water resource and soil management. Different NBS solutions are suggested, such as applying EbM approaches for the conservation of marine resources and GI in the urban context.

The strategy also sets up biodiversity goals for urban environments, encouraging all the mayors of European cities with more than 20 000 inhabitants to establish urban greening plans under a new *Green City Accord.* NBS are highlighted as a key instrument for climate adaptation and mitigation and for greening cities. Another important point of the strategy is that it recognises the value of investing in natural capital to achieve these ambitions and to recover from the COVID-19 crisis. One goal is to unlock at least EUR 20 billion a year for spending on nature, coming from, for example, Invest EU (NbS for a green recovery), 25% of the EU budget dedicated to climate action and public authorities. Given these considerations, the EU biodiversity strategy for 2030 is assessed as showing strong explicit support for NbS for CCA and DRR. (European Environment Agency 2021; Wild et al. 2020)

Strategy on green infrastructure

Green Infrastructures GI and Green and Blue Infrastructures GBI are a core part of Europe environmental strategies. They are reported as ways to create and restore degraded ecosystems both at landscape level, and urban and rural areas, providing healthy habitats for species and improving the connectivity between different areas throughout Europe. The EU strategy on green infrastructure explicitly refers to GI and GBI and NBS as well as to Ecosystem-based Approaches EbA for CCA and DRR. The strategy also highlights their critical role in implementing prevention measures, citing examples such as functional floodplains, riparian woodland, protecting forests in mountainous areas, barrier beaches and coastal wetlands. (European Environment Agency 2021)

2020 farm-to-fork strategy

Structured as a component of the European Green Deal, it aims to address the food system inequalities, the food healthiness and its environmental impact. NBS are explicitly recognised as a tool to address these challenges, especially towards climate resilience and water management. The funding proposed for the action is up to 10 billion for research and innovation. The topics are food, the bioeconomy, natural resources, agriculture, fisheries, aquaculture and the environment, as well as the use of digital technologies and NBS for agri-food systems. (European Environment Agency 2021)

2021 new EU strategy on adaptation to climate change

The first EU strategy on adaptation to climate change was launched in 2013 and then was implemented in 2021 as a key priority in the European Green Deal. The strategy *"recognises CCA as a crucial component to achieving the Paris Agreement's global adaptation goal and aims to make 'adaptation action smarter, more systemic, and faster'."* (European Environment Agency 2021) It explicitly recognises the role GBI, SM/EbM and NBS for CCA and DRR, due to their cost-efficiency and ability to provide multiple benefits. Relevant EU funding and investment programmes are called on. In particular, 'biodiversity-friendly afforestation, reforestation and closer-to-nature-forestry

practices' are needed for the agriculture and forestry sectors. (European Environment Agency 2021)

Horizon 2020/ Horizon Europe

Horizon 2020 and *Horizon Europe* are two framework programs of the European Union built to foster sustainable growth, demonstrating the commitment to supporting the UN's Sustainable Development Goals (SDGs) and the targets of the COP21 Paris Agreement. The *Horizon Europe 2021-2027 Framework Program* is succeeding as an evolution of the *Horizon 2020* (active between 2014-2020) and keeps testing and promoting NBS and their benefits. The *Horizon 2020* research programme has already provided knowledge on appropriate designs, implementation techniques and cost-benefit analyses for Nature-Based Solutions. The program wants now on to strengthen the impact of research and innovation (R&I program) in developing, supporting and implementing Union policies, like are NBS, supporting in the use of innovative solutions in industry and society. It supports training and mobility for scientists, creates transnational, cross-sectoral and multidisciplinary collaborations, leverages additional public and private investment, builds the scientific evidence necessary for EU policies, and has structuring effects on national research and innovation systems as well as fostering competition. (Faivre et al. 2017a; European Commission et al. 2018) The key features of Horizon 2020, that are expected to continue on the Horizon Europe program are reported in the following:

- *"significant budget (close to EUR 77 billion) for 7 years (2014-2020), with a target of 35% related to climate action and 60% related to Sustainable Development;*
- *seamless integration of R&I into a single framework,*
- *direct R&I investments through an EU-wide competition based on excellence as guiding principle*
- *central management by the European Commission,*
- *a three-pillar structure focusing on excellent science, industrial leadership and societal challenges.*
- *major simplification measures implemented through the Common Support Centre, such as a single set of rules, an easy to use cost reimbursement model, a single point of access for participants, fewer audits."* (European Commission et al. 2018)

The Horizon 2020 has already founded projects such as CONNECTING, GROW GREEN, UNALAB and URBAN Green UP that have demonstrated the benefits of renaturing cities and provided evidence on the efficacy, efficiency and scalability of Nature-Based Solutions.

Next generation EU

The Next Generation EU is a recovery plan launched to confront with the COVID 2019 crisis that involved all European and global economies worldwide. It is considered more than just a recovery plan, but an incredible chance to transform European economies and societies. It was agreed by the European Council on July 2020 and adopted in December, with the intent to operate from 2021 to 2026. It is a break from the austerity policy adopted after the financial crisis of 2007–2008, demonstrating for the first time that the EU member states can collectively agree on policy, along with funding, to tackle large-scale crises. This recovery fund package is ging to be established by the European Commission, which will borrow the money on financial markets for the EU budget and distribute it to the member states. The plan is going to invest €806.9 billion divided throw the UE members. The money has to be spent with the goal of making Europe the first climate-neutral continent by 2050, realizing and implementing the Green Deal strategies. The challenges to tackle are the green and Digital transformation, throw investments in environmentally friendly technologies, greener vehicles and public transport, adaptation of the current buildings and public spaces to be more energy efficient. But also to protect the natural environment, improving water quality, reducing waste and adopt Nature based solutions to make cities greener and to restore and protect the natural biodiversity. The project funding is also going to encourage Research and innovations, encouraging to study science and technology, supporting further education and apprenticeships and supporting the development of new green and digital jobs. . (European Commission and Directorate-General for Communication 2022)

2.2.3 Nature Based Solution Research & Innovation program

The Horizon 2020 Expert Group report on *Nature-Based Solutions and Re-Naturing Cities* (European Commission et al. 2015) was one of the first steps for the development of the R&I agenda on Nature-Based Solutions. The Horizon program had the objective of providing evidence for the cost-effectiveness of NBS with the demonstration phase, where all the projects were organized on front runner cities and replicated in the following cities. The group described several research and innovation actions on NBS, stressing the need to develop a scientifically sound R&I programme, articulated around multi-stakeholder engagement across different disciplines and sectors, to be implicated in the design, implementation, financing and decision-making processes. The R&I agenda focuses also on the development of innovative business and investment models, as well as legal and institutional frameworks to ensure the long term financing of Nature-Based Solutions. The report stresses the necessity to pay attention to empowering and involving citizens and re-connect them with nature. This is going to be particularly addressed with participatory approaches towards NBS projects (see also 3.1.2 Participatory approach for NBS design). (Faivre et al. 2017a)

The research on NBS is continuing and will continue furthermore in the coming years, starting from the gaps and priorities highlighted from existing NBS projects. It will continue the research with the input from the stakeholders on the development of future programmes*. "Knowledge gaps and priorities identified by stakeholders can be classified as follows:*

1. *general calls for investment in R&I into NBS and underpinning research;*
2. *policy- and governance- research involving social sciences and humanities;*
3. *technically oriented scientific research, e.g. involving quantitative data;*
4. *policy development and associated advocacy promoting NBS implementation;*
5. *co-production and trialling of educational programmes and initiatives;*
6. *application of economic and financial instruments (loans, investments); and*
7. *development and testing of decision support systems, tools and models."*(Wild et al. 2020)

The Research and Innovation program develops thanks to the exchange of knowledge from all over Europe and through the experimentation carried on with the various programs promoted under the Horizon program. To enhance this sharing process various mobility programs are promoted between different countries and there were created different online sharing platforms. In the following it is reported a selection of European sharing platforms on NBS and different European Programs.

Creating a Nature-Based Solutions community

The EKLIPSE[22]*mechanism Knowledge & Learning Mechanism on Biodiversity and Ecosystem Services* was commissioned by the European Commission in 2016 to help governments, institutions, businesses and NGOs make better-informed decisions when it comes to biodiversity in Europe. The assessment framework is also used by demonstration projects in the design, development, implementation, and assessment of Nature-Based Solutions in urban areas, as happened in most Horizon 2020 projects. The platform is designed to "*enable policymakers and other societal actors to make use of existing studies by synthesising available knowledge. This process is particularly helpful for requests which require an in-depth collection, analysis and synthesis of existing knowledge from the scientific literature and other sources."* (Eklipse 2022) It can also help decision-makers identify knowledge gaps that involve a call for experts and the creation of an Expert Working Group (EWG). It was from one of this requests that was created the first impact-evaluation framework with a list of criteria for assessing NBS performance, *Evaluating the impact of nature-based solutions: A handbook for practitioners* (European Commission. et al. 2021)

22 For more on *EKLIPSE* look at www.eklipse-mechanism.eu/

The creation of the platform *OPPLA*[23] is a complement to the EKLIPSE service, making it easier to confront and communicate through different NBS projects and different type of users. It provides a knowledge marketplace, where the latest thinking on natural capital, ecosystem services and nature-based solutions is brought together. It is an open platform for collaboration between NBS communities, but also a knowledge forum where the outputs of research are made accessible to end-users. It offers a range of products, including a case-study finder, an ecosystem-service assessment support tool, as well as a 'Question & Answer 'helpdesk.

THINKNATURE[24] platform is a multi-stakeholder dialogue platform and think-tank for promoting innovation with Nature-Based Solutions. It aims at bringing together multi-disciplinary scientific expertise, policy, business and society together to further increase knowledge exchange and capacity building. The project is executed by a consortium of 17 partners originating from 8 countries across Europe. The project is led by the Technical University of Crete.

BIODIVERSA+[25] is the new European Biodiversity Partnership supporting excellent research on biodiversity with an impact for society and policy. It was jointly developed by *BiodivERsA* and the European Commission as part of the *EU Biodiversity Strategy 2030* and will contribute to the ambition that "by 2030, nature in Europe is back on a path of recovery, and that by 2050 people are living in harmony with Nature". The BiodivERsA ERA-Net collected in 2008-2021 a broad network of national research programmes on biodiversity across Europe.

NETWORKNATURE[26] was funded by the European Commission under the Horizon 2020 programme as a network for the nature-based solutions community, with the joined forces of the other NBS networks *ICLEI Europe, IUCN, BiodivERsA, Oppla and Steinbeis 2i,* that provided their expertise in research, implementation, business strategy, policy and communication and with the close collaboration of the *European Commission Directorate-General for Research and Innovation* and *Executive Agency for SMEs*. The project wants to create a community that contributes and guides NBS's work, through participation in Task Forces and a NBS Project Board, that consists of the coordinators of H2020-funded nature-based solutions projects. The principal *NetworkNature*'s activities are :

- To consolidate and strengthen the NBS evidence gathering experiences, knowledge, tools and services from over 30 Horizon 2020 projects,
- To engage existing stakeholders and expand and support a community of practice for NBS, upscaling the use of NBS across science, business, policy and practice, providing guidance and capacity building for new European NBS regional hubs,
- To ensure NBS science informs the policy agenda and vice versa, functioning as an interface between NBS innovators and knowledge generators and business and policy makers. (NetworkNature 2022; European Commission et al. 2015)

Building the evidence base with a repository of best-practice examples

The *Horizon 2020* and *Horizon Europe* framework programs are going to keep testing and gaining knowledge around NBS efficacy, providing funding opportunities for building the evidence base and further developing the concepts. *"Several successful FP7 (2007–2013) projects have already demonstrated how approaches that use Nature-Based Solutions work in practice, and the positive outcomes they can generate"* (Faivre et al. 2017a) such as the ones described in the following.

23 For the *OPPLA* website, http://oppla.eu/

24 *THINKNATURE* website https://www.think-nature.eu/

25 *BIODIVERSA+* webpage https://www.biodiversa.org/

26 *NETWORKNATURE* webpage https://networknature.eu/more-about-project

One example is the *GREEN SURGE*[27] *Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy* project, that was set out from 2013 to 2017 to identify, develop and test ways of linking green spaces, biodiversity, people and the green economy to develop the planning principles for urban green infrastructure, such as the integration of green and grey infrastructures, the connectivity of green spaces, the multifunctional nature of green infrastructure, and social inclusion in urban planning. It embraced a comparative approach throw 20 European cases, synthesis of good practices, and establishment of five Urban Learning Labs in the cities of Bari (Italy), Berlin (Germany), Edinburgh (UK), Ljubljana (Slovenia), and Malmö (Sweden).

Another case is the *OpenNESS*[28] *Operationalisation of Natural Capital and Ecosystem Services* project, that applied the concept of ecosystem services in 27 real-life case studies covering different social-ecological systems in 23 European and 4 non-European countries from 2012 to 2017. One of its case studies showed how a green infrastructure strategy could be integrated into the urban planning of the city of Vitoria-Gasteiz (Spain) and its peripheral areas. The project was developed with a systemic approach, with the scope of putting NBS research in practice and the results were reported and analysed as improved water-flow regulation and energy efficiency, an increase in biodiversity, enhanced health and better liveability in the city, that had better air quality, reduced noise and a reduction in the heat-island effect. From the experience of testing 43 methods in the *OpenNESS* case studies resulted an integrative ecosystem service assessment framework, with a set of decision trees to help structure and guide the process of selecting individual methods.

the *OPERAs*[29]*Operational Potential of Ecosystem Research Applications* project was yet another case-study program, running from 2012-2017, that had its focus on the combination of NBS with traditional solutions. The project involved the construction and maintenance of 15 km of semi-fixed dunes on Barcelona's urban coastline to optimise the flows of ecosystem services and enhance coastal defence against sea-level rise. A systematic analysis of the beach management system led to a simpler and more cost-effective strategy, which integrated the building of natural capital and adaptation to climate change. (Faivre et al. 2017a)

Other projects such as *CONNECTING NATURE, GROW GREEN*[30]*, UNALAB*[31]*, PROGIREG*[32] *and URBAN GreenUP*[33] and many others are organized as five years programs, being experimented under the *Horizon 2020* from 2017 to 2022*,* for the use of NBS for climate and water resilience in cities. The projects under this growing portfolio of Horizon 2020 are 'clustered' around key topic areas to bring opportunities such as learning from each other, enabling synergies, communicating and disseminating results with broader impact and saving resources around common areas of work. Clustering means agreeing on some common core parameters and producing common outputs, while keeping its project's specific diversities, which are this five Taskforces:

- Data Management and EU NBS Knowledge Repository;
- NBS Impact Evaluation Framework;
- Governance, Business Models and Financial Mechanisms;
- NBS Communication;

27 GREEN SURGE (Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy; http://greensurge.eu/)

28 *theOpenNESS Operationalisation of Natural Capital and Ecosystem Services* website www.openness-project.eu/

29 *OPERAs Operational Potential of Ecosystem Research Applications* http://operas-project.eu/

30 *GROW GREEN* website https://growgreenproject.eu/

31 *UNALAB* website www.unalab.eu

32 PROGIREG website https://progireg.eu/. For more information on the project see also 2.2.4 Focus on the ProGIreg (rileggere)

33 *URBAN GreenUP* website www.urbangreenup.eu

- Co-creation for NBS. (Wild et al. 2020)

The CONNECTING NATURE COproductioN with NaturE for City Transitioning, INnovation and Governance[34] project is coordinated by Trinity College Dublin, with a consortium of 30 partners within 16 European countries and hubs in Brazil, China, Korea & The Caucasus (Georgia and Armenia). The project aims to co-develop the policy and practices necessary to scale up urban NBS resilience, innovation and governance, and is currently co-working with local authorities, communities, industry partners, NGOs and academics in urban settings. While measuring the impact of these initiatives, the project is developing financing and business models and a diversity of innovative actions to nurture the start-up and growth of commercial and social enterprises active in producing nature-based solutions and products. (Connecting Nature 2020; Wild et al. 2020)

The *UNaLab*[35] project's objective is to develop, via co-creation with stakeholders and implementation of 'living lab' demonstration areas, a robust evidence base and European framework of innovative, replicable, and locally attuned nature-based solutions to enhance the climate and water resilience of cities. The project has three front running cities Eindhoven (NL), Genova[36] (IT) and Tampere (FI), where green façades and roofs, water stockage areas (retention ponds, detention basins), streambank restoration, green corridors and urban trees were experimented. The follower cities are going to keep implementing these practices in four European cities, but also in Turkey, Argentina and China.

The *URBAN GreenUP* aims at developing, applying and validating a methodology for Renaturing Urban Plans to mitigate the effects of climate change with NBS. Its main objectives are: the *demonstration of an innovative methodology to re-naturing cities, through the concept of Re-naturing Urban Planning (RUP) which incorporates NBS like SUDs, Urban carbon sink, Urban Catchment forestry, planting trees, pollinator verges, pollinator roof, floating gardens, mobile gardens, green façade, and new green cycle routes in the city planning. It has different demonstration sites, such as Liverpool (UK), Valladolid (Spain) and Izmir (Turkey).*

Nature4Cities and NATURVATION are also EU-funded Research & Innovation projects, but are, on the other side, investigating new governance, business and financing models and economic-impact assessment tools.

Nature4Cities[37] is a Nature Based Solutions knowledge diffusion and assessment platform to help process of benefits, cobenefits and costs of NBS projects: NBS project creation, urban, socio-economic and environmental impact evaluation and final NBS project implementation, including tools to manage stakeholder's participation. It offers technical solutions, methods and tools to empower urban planning decision making, with the goal of helping European cities to address the contemporary environmental, social and economic challenges. This new technical and governance approach implies new collaborative models driven by groups of citizens, researchers, policy makers, and industry leaders, relying on participative processes and sharing of best practice. The platform offers an integration framework of interconnected tools to provide access to NBS knowledge, and to complete the NBS assessment. (Wild et al. 2020; Nature4Cities 2017)

The *NATURVATION*[38]project also aims to advance assessment, enable innovation and build momentum for the uptake of NBS in cities across Europe. The project brings together 14 partners across six EU countries and a wide variety of stakeholders in six urban-regional innovation partnerships supported by a high-level taskforce.(Wild et al. 2020)

34 *CONNECTING NATURE COproductioN with NaturE for City Transitioning, INnovation and Governance* website https://connectingnature.eu/

35 Seea also U*nalab* page 95

36 For more on the Genova *UNaLab* project see the *2.3 Analysis of case studies* chapter.

37 *Nature4Cities* website https://www.nature4cities.eu/

38 *NATURVATION* website www.naturvation.eu

2.3 Case studies

2.3.1 Focus on the ProGIreg

About the Project

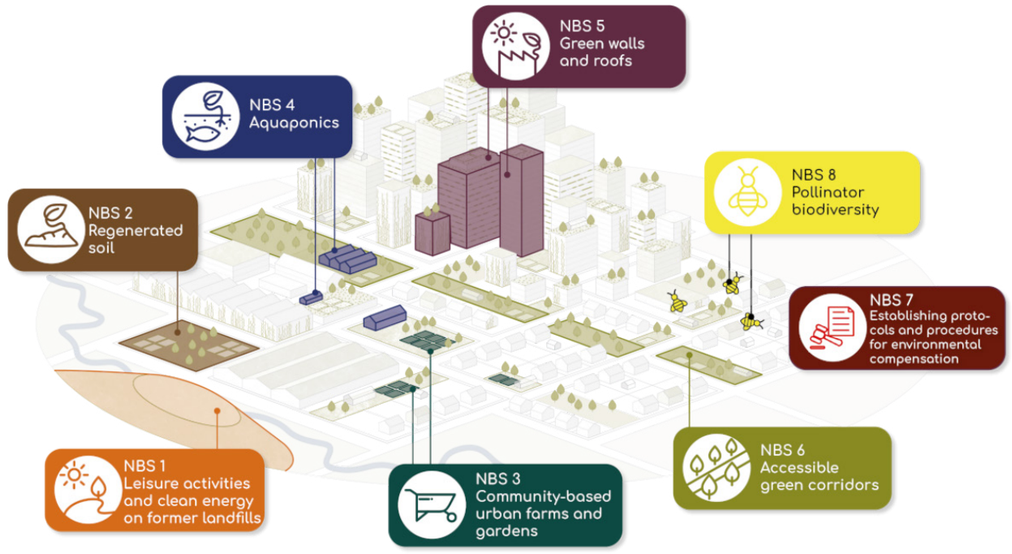
ProGIreg stands for '*productive Green Infrastructure for post-industrial urban regeneration: nature for renewal*'. It uses nature based solutions for urban regeneration with and for citizens. The social impact of the project is extremely important and constantly monitored. The project is funded by the European Commission under the *Horizon 2020* programme and will run from June 2018 until 2023. It involves four front-runner cities**:** Dortmund (Germany), Turin (Italy), Zagreb (Croatia) and Ningbo (China), that host *Living Labs*[39] in post-industrial districts where nature-based solutions are developed, tested, and implemented. After those four, other cities follow the process in the *Living Labs* and are going to engage in city-to-city exchange to replicate the nature-based solutions: Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece) and Zenica (Bosnia and Herzegovina). Eight different nature-based solutions are experimented all around the world to create a productive green infrastructures that help improving living conditions, reducing vulnerability to climate change but also provide measurable economic benefits to citizens and entrepreneurs in post-industrial urban districts.

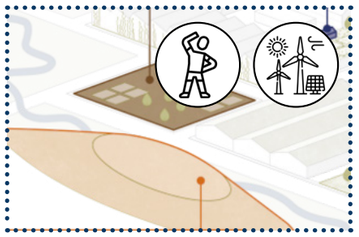
ProGIreg in Turin

In Turin, the ProGIreg project is set mainly in a historic residential district, Mirafiori, with seven out of eight NBS solutions activated. The district of Mirafiori is envisioned as a "*young and green engine"* for the city of Turin, referring to its industrial past and the FIAT production plant. The neighbourhood is historically bounded to the FIAT factory that was in the district, that as rapidly grown to face its necessities. In just twenty years from 1951 to 1971 the neighbourhood increased its population from 18,700 to 141,000 inhabitants. In 1956-1957 Fiat doubled the industrial plant, participating in the *INA-Casa plan*, a residential housing program, and adding other accommodations to be assigned to the employees. Throughout the neighbourhood, the first seven to ten-story condominiums were built with subsidies from the company, followed later by some popular condominiums from private and public contractors. The neighbourhood is now formed by several housing condos and has a post industrial view.

39 *Living Labs* are participatory networks promoted by the UE, they mentioned more extensively in *3.2.1European Initiatives*

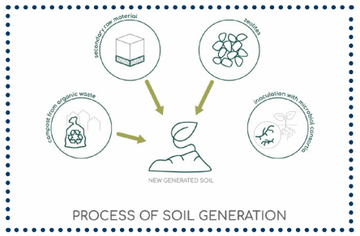
ProGIreg Nature based solutions





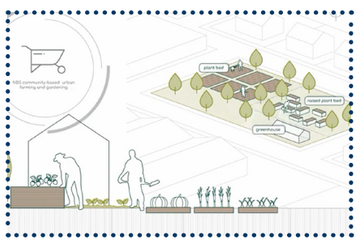
1. Leisure activities and clean energy on former landfills:

Landfill sites are common in post-industrial areas, as are the challenges of securing them and making use of the space when no longer in use. Their well-exposed high shapes can however be an advantage; they are ideal for producing solar or wind energy, their slopes can be used for different sports, and they provide scenic views when converted into public parks.



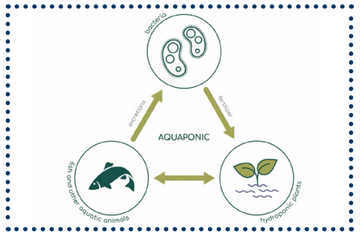
2. Regenerated soil:

After decades of neglect, the soil in post-industrial areas is often of poor quality, unfit for any use. Importing fertile soil from elsewhere is costly, both environmentally and economically. Carbon-neutral methods to restore soil fertility involve combining the poor quality soil with compost from organic waste, secondary raw material, zeolites and biotic compounds (microbiol consortia), to regenerate it.



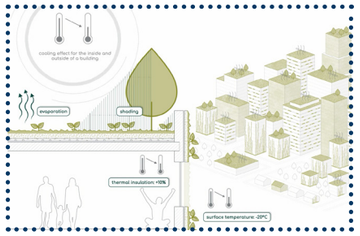
3. Community-based urban farms and gardens:

Post-industrial areas often lack green spaces for public use, so turning unused land into community gardens can have a positive impact on locals, contributing to improved mental and physical health and healthy sources of food and a community feeling. The intent of Urban agriculture (both Urban farming and urban gardening methods) is to fill the distance between food production and consumption, with bioagricultural methodos in urban and pery-urban areas.



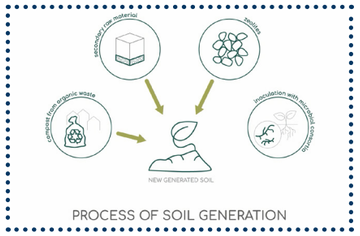
4. Aquaponics:

It is the combination of raising fish (aquaculture) in tanks together with soil less cultivation of plants (hydroponics) in a symbiotic environment, whereby the fish wastewater provides the nutrients needed to feed the plants with the nutrification process.



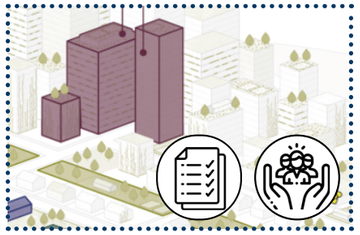
5. Green walls and roofs:

Green walls, green roofs and vertical gardens can contribute to improve building's insulation, to reduce stormwater run-off, capture CO2, filter pollutants, and increase biodiversity. This all leads to reduced energy consumption and increased urban resilience. The available technology is advanced but the challenge is to increase uptake by integrating it into local urban policies.



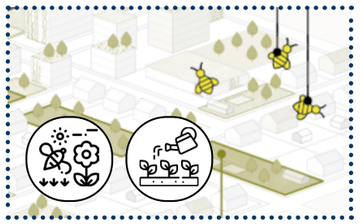
6. Accessible green corridors:

Needed for transporting goods, rivers were a common feature of early industrialization. Nowadays, post-industrial cities are often left derelict and inaccessible for locals. While other existing projects are involved in renaturing the rivers and green corridors of the *Living Labs*, the focus of proGIreg is to improve the accessibility to these green corridors so that the cities become more livable and locals can connect more to nature.



7. Local environmental compensation processes:

As shown within these nature-based solutions, measures to compensate the environment are available. However, embedding them into mainstream policies and urban planning procedures requires more effort, in the shape of establishing the evidence-base for NBS and unlocking funds for example via adaptation funds, taxes or public-private partnerships.



8. Pollinator biodiversity:

This nature-based solution complements all other greening actions of proGIreg, since pollinators are essential to a healthy and functioning ecosystem. To make urban areas more pollinator-friendly, cities can reduce pesticide use and increase the size of green spaces and plant species diversity. Green networks and corridors help prevent in-breeding of isolated populations, which can lead to species extinction. Monitoring the variety and amounts of pollinators is a good way of assessing the pollinator-friendliness of a city. ProGIreg's citizen science approach involves local citizens creating, monitoring, and promoting awareness of pollinator-friendly spaces.

ProGIreg eight nature based solutions. All the pictures of the following pages are from the ProGIreg website (proGIreg project 2022)

ProGIreg in Turin

European Union's Horizon 2020 project

Torino, IT

2017-2019

In Turin, the ProGIreg project is set mainly in a historic residential district, Mirafiori, with seven out of eight NBS solutions activated.

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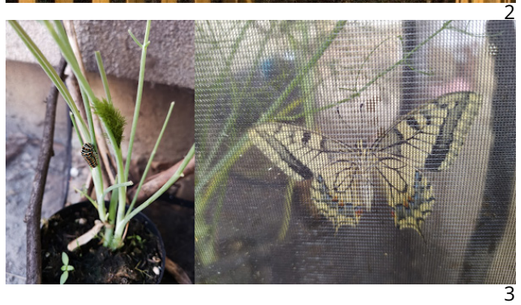


3

New regenerated soil: Local authorities in Turin have identified the need for additional arable soil for new green spaces and have decided to use the Sangone Park for producing and testing regenerated soil. This soil is ideal for urban forestry and the aim is to make the regenerated soil available for use in public green spaces throughout the city. The aim is to create an area of *"urban forest"* along the banks of the Sangone through the use of regenerated soil, based on aggregates and compost from *FORSU* and innovative biostimulants. The Partners of the partner are *Dual, Envipark* (Acea e ccs as third parts), *Unito* with its research department (DISAFA and Dip. Chimica) and the City of Turin.

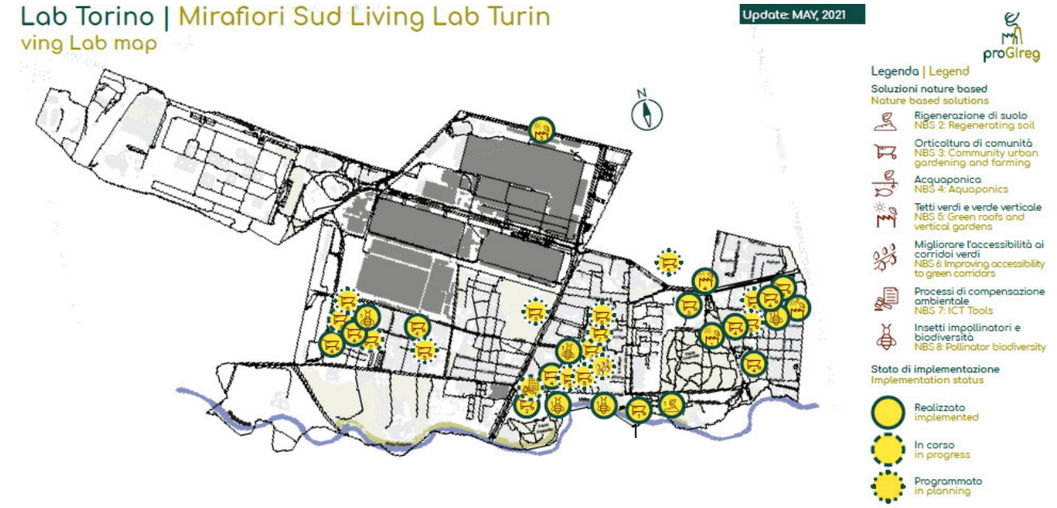
Community-based urban farms and gardens: Abandoned parts of the Sangone Park will be redesigned and used for community urban gardens. The aim is to improve the safety of the area and encourage community activities and productivity. In the Piemonte Park, 2.5 hectares of land will be used for social farming activities including teaching, training and for job placements. The urban farms are a big part of the proGIreg project in Mirafiori with several initiatives aimed to create a sense of community and encourage school activities with 2.5 hectares devoted to the project.

Castello di Mirafiori ruins recovery. The intent is to promote a Landscape transformation for the enhancement of an area of historical and environmental interest with the partnership of Orti Generali and Comitato Borgata Mirafiori.

Gardens in Cascina Piemonte (Orti Generali). This is a project that took a start from a master thesis project of the landscape architect Stefano Olivari to revaluate the unused land near the Sangone river who was spontaneously planted for years by the inhabitants of the district. The aim is to create collective gardens and facilities rented to individual citizens, common educational area for training and community activities.

Pollinator friendly gardens at WOW: The project uses Box gardens and beehives for urban regeneration.Partners are Orti Alti, Fondazione Mirafiori, Miravolante and Città di Torino.

School garden in box: It has proved to be very important for educational purposes the realization and integration of educational gardens and scientific laboratories aimed at primary and high schools, with advantages



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1
Green wall on a charity shelter, Credit: City of Turin

2
Orti Generali social urban garden – Credit: City of Turin

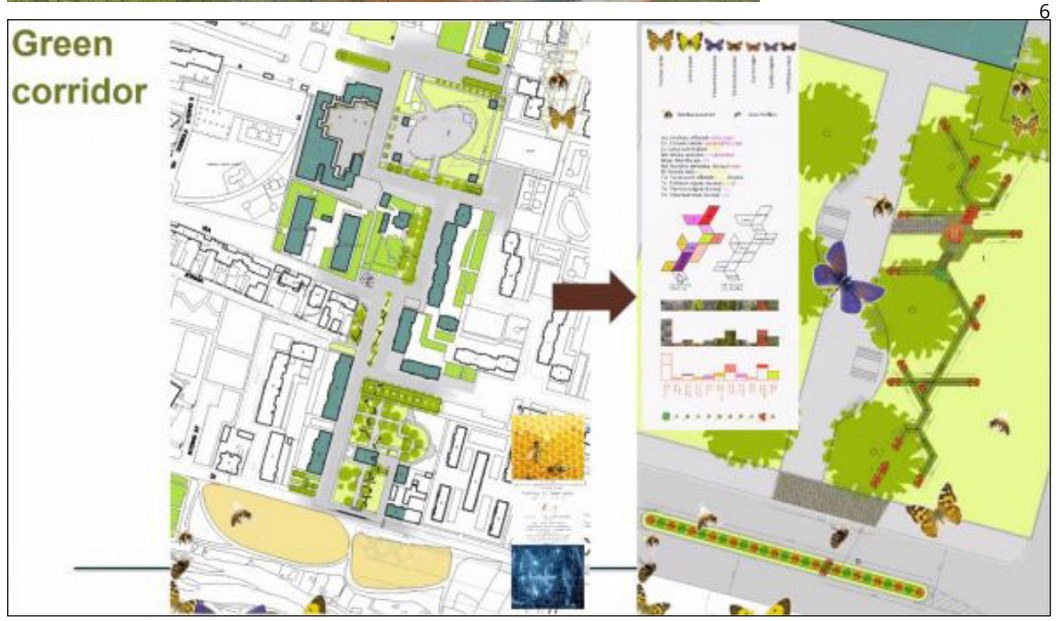
3
School project for butterfly monitoring – Credit: City of Turin

4
Mirafiori Living Lab plan https://progireg.eu/

5
New regenerated soil in Turin, at the Sangone Park, https://progireg.eu/

6
Green corridor Project for the Mirafiorii neighbourhood, *Farfalle in ToUr* project for a pollinator garden. https://progireg.

6



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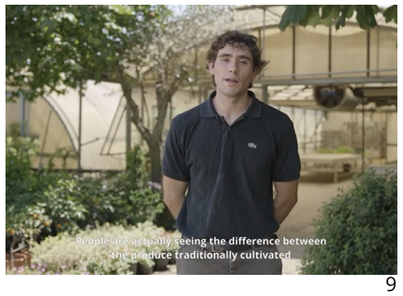

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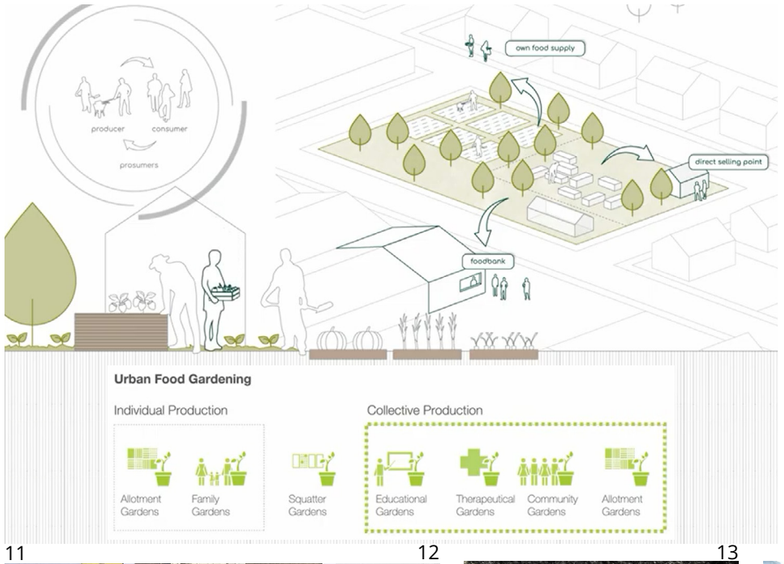

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7-8-9
Acquaponic system in Turin, pictures from the dissemination video, https://progireg.eu/

10
Educational urban gardening with raised plant bed in a school in Mirafiori, photo by the thesi's author

11
Urban gardening explanation illustration from the dissemination video, https://progireg.eu/

12
Bag of semen for the a pollinator garden (fig.6), planted by the locals in a ProGIreg workshop event in March 2022, photo by the thesi's author

13-14
Pollinator green corridor (fig.6) plantation event with the locals in March 2022, photo by the thesi's author

15
green wall in a school of Turin, Credit: City of Turin

in promoting healthy diets and relationships with nature. Partners: Fondazione Mirafiori, Miravolante, Unito (DBios e DISAFA).

Portable school gardens: Supply of a stock of wood cassettes for the realization of "micro-garden" and composters for schools and practical courses for teachers. Partners: Iter, Unito (DBios e DISAFA).
Community school gardens: Vegetable garden in wood boxes (raised bed). Partners: Iter, Liceo Scientifico Primo Levi, Unito (DBios DISAFA)

Gardens between houses: Placing of fixed containers for urban horticulture.
Partners: Fond. Mirafiori, Miravolante.

Aquaponicsics: Supported by the Dortmund Living Lab, Turin is testing its first-ever aquaponics system, with the potential for future replication, if successful. The small-scale community-designed system will be set up on an abandoned public site.

Green roofs and walls: Green roofs and walls are fitted to public buildings, including the Casa nel Parco community centre, social housing, schools and other buildings - chosen with the help of citizens within the Turin Living Lab. New green roofs have been designed at the Casa nel Parco and at the WOW building. Partners: City of Turin, Fondazione Mirafiori, OrtiAlti. A green indoor wall with a removable tray system has also been experimented in a school and designed with a participatory process and co-management for the mantainence of the students and the school staff. A second green wall was experimented at a homeless shelter, giving it a more appealing frame. It was designed as an outdoor self-supporting green wall, with removable trays and felt pockets. Also in this case was experimented the participatory design process/co-management for the mantainence together with the users.

Green corridor: Turin has also experimented with the creation of a green and pollinator-friendly corridor. Enhancement of the naturalistic area and promotion of the cycling path through the creation of vertical signage and street furniture.

Strategic public-private partnership for greening the City. Identify, collect and display tools and concrete opportunities to allow the Administration to improve the green assets of the City through public-private collaboration.

Pollination strategies: Butterfly gardens in schools and for disadvantaged people. Description: Realization of training activities on the life of butterflies. Supporting the creation of the butterfly garden. Biomonitoring with the transect method. Partners: Unito (DBios) e Unito (DISAFA). (Hanania et al. 2019; Torino city lab and Città di Torino 2022; proGIreg project 2022)

15

Bibliography

ProGIreg project. 2022. "ProGIreg Webpage." 2022. https://progireg.eu/.

Torino city lab webpage: https://www.torinocitylab.it/it/progireg

Hanania, Serene, Barbara Anton, Deliverable No, Author Serene Hanania, Co-Author Vasileios Latinos, Bettina Wilk, Rieke Hansen, Axel Timpe, and Riccardo Saraco. 2019. *"Co-Designing Nature-Based Solutions in Living Labs, Deliverable 2.4 on Workshop Round 2 in Frontrunner Cities (Dortmund, Turin, Zagreb)."* www.proGIreg.eu.

2.3.2 Nature Based Solution urban case study projects

LAND Italia
Gavoglio Park

UNaLab Project

Genova, IT

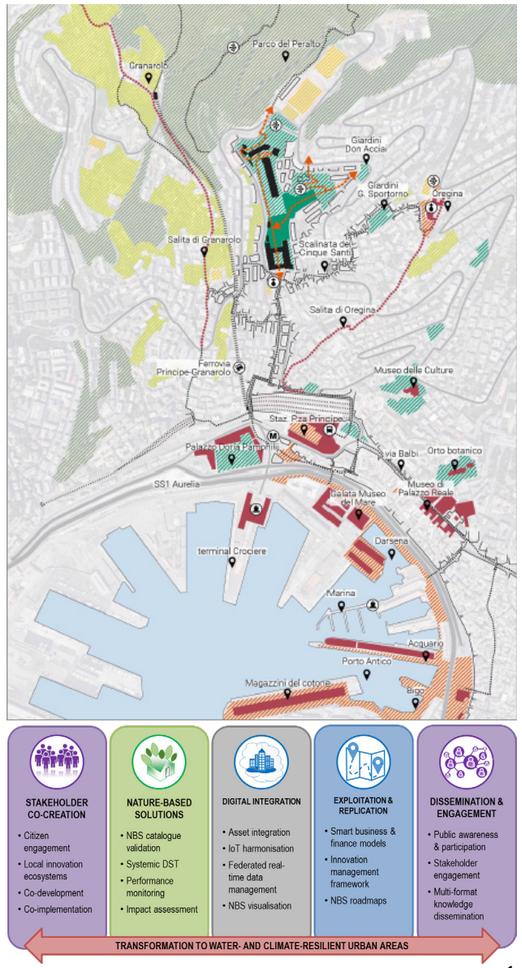
2017-2019

Key project data

The Gavoglio military barrack is located in the Rione Lagaccio, one of the most densely built up and socially vulnerable neighborhoods in Genoa. The project envisages a new park for the community that will open the impervious industrial complexes and strengthen the connection with the upper part of the area, up to the protected natural hill area of the Parco dei Forti. New green areas, playgrounds, sports facilities and meeting spaces will be created. UNaLab (Urban Nature Labs) is a Horizon 2020 funded project that unites 29 public and private partners from across Europe to develop smarter, more inclusive, more resilient and more sustainable local societies through innovative NBS developed through a co-design process.

The project involves 12 different NBS solutions and intends to demolish 5 buildings in the barracks area to free up soil. The main features of the projects are:

- Water infiltration systems: 5,000 m² of drainage flooring, 1 rain garden (400 m²), 1 infiltration pond (100 m²), 1 underground rainwater tank (30 m³)
- Increased biodiversity: 125 new trees, 7,000 new native bushes and grasses, 1,600 m² of low-maintenance lawns, 150 m² of green walls,
- Public and meeting spaces: 2,000 m² of playgrounds, 2 new public squares, 1300 m³ of concrete from demolished buildings reused to create gabions on site.



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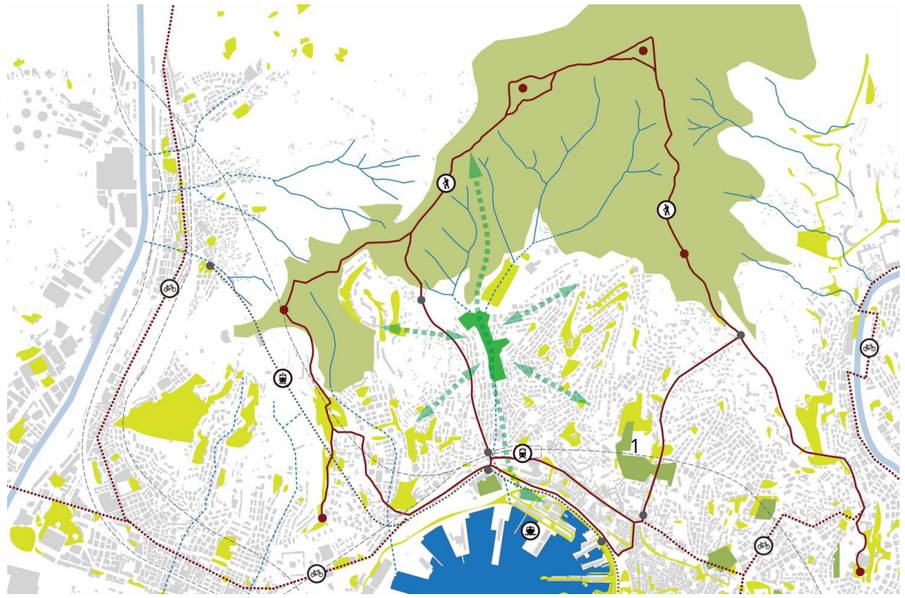
children. Everything has been designed with a view to inclusion and every part of this area, including the games, that are accessible to those with motor disabilities, following the guidelines of the Municipality of Jesolo “Same games, same smiles”. The sports park has two playgrounds with steps, a rain garden, an orchard with picnic area and, a little further north, an area dedicated to the free play of dogs. The rain garden consists of a green area, populated by vegetation that

The public square covers the area immediately north of the quadrilateral of the former barracks, it is designed as structure with steps and ramps, covering 5 meters of difference in height, which can be used as a rest area or as a stalls for square shows. Here the original historic stone flooring will be restored, while the rest of the flooring is in draining and ecological materials. The play garden extends on the east side and includes a Skate Park, a recreational area and games for



2

1
Urban plan for Genova, http://puc.comune.genova.it

2
Urban landscape plan, http://puc.comune.genova.it

3
Project render of the Legaccio park, www.landsrl.com

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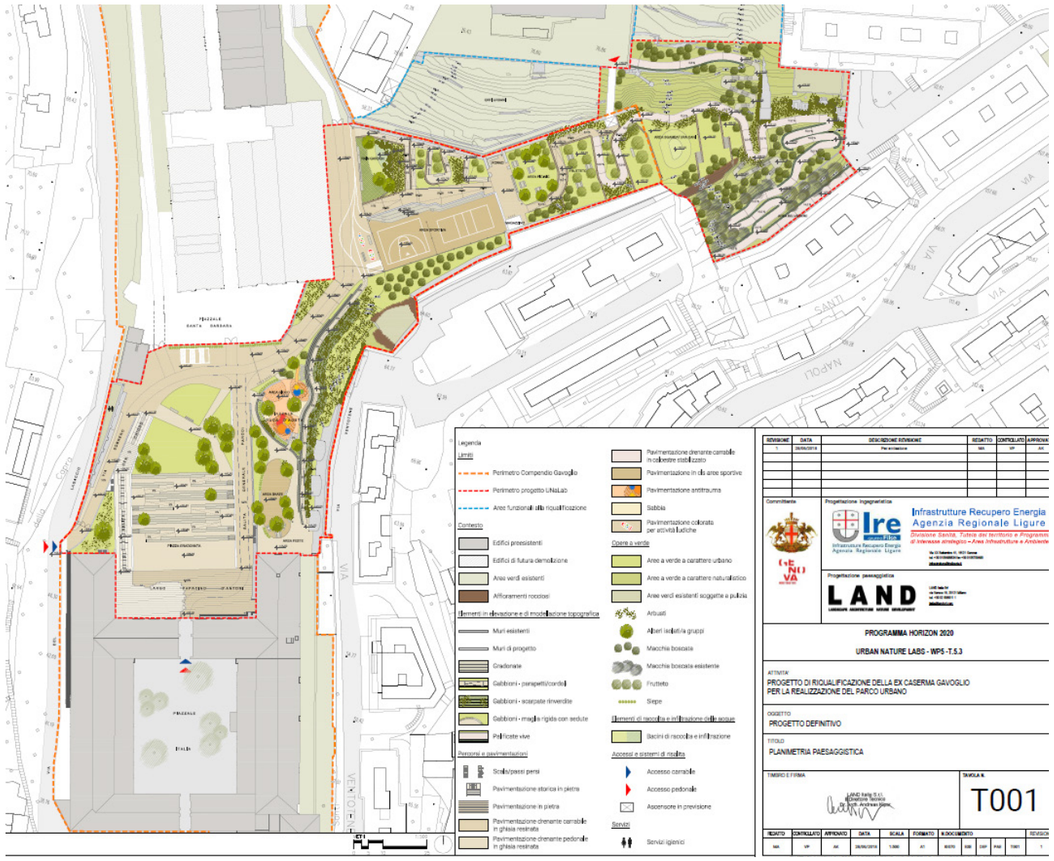

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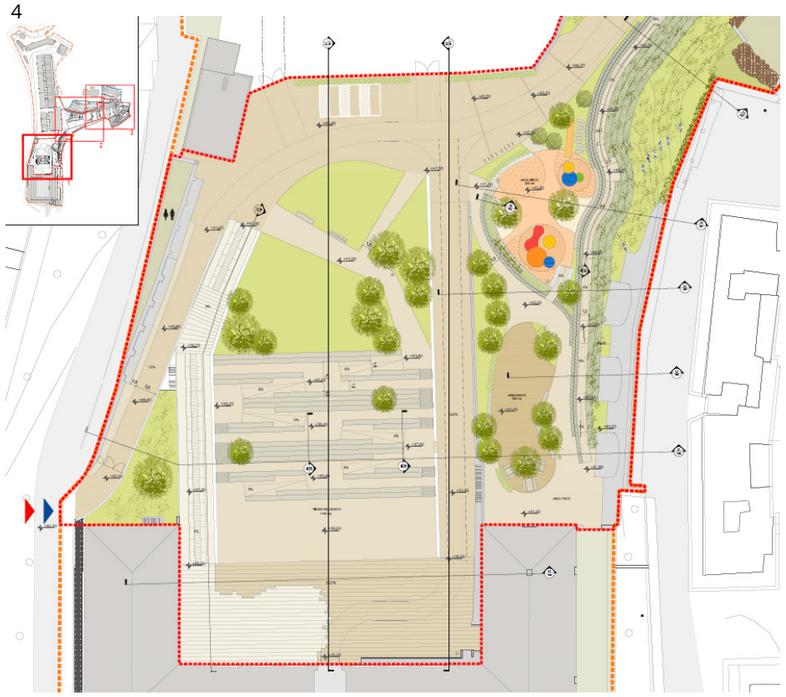

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4
Masterplan for the Legaccio Park, http://puc.comune.genova.it

5
Zoom of the plan fro the public square with steps and ramps, http://puc.comune.genova.it

6
Photo from the construction, https://www.landsrl.com/portfolio-land/gavoglio-park

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Photo from the construction, http://puc.comune.genova.it

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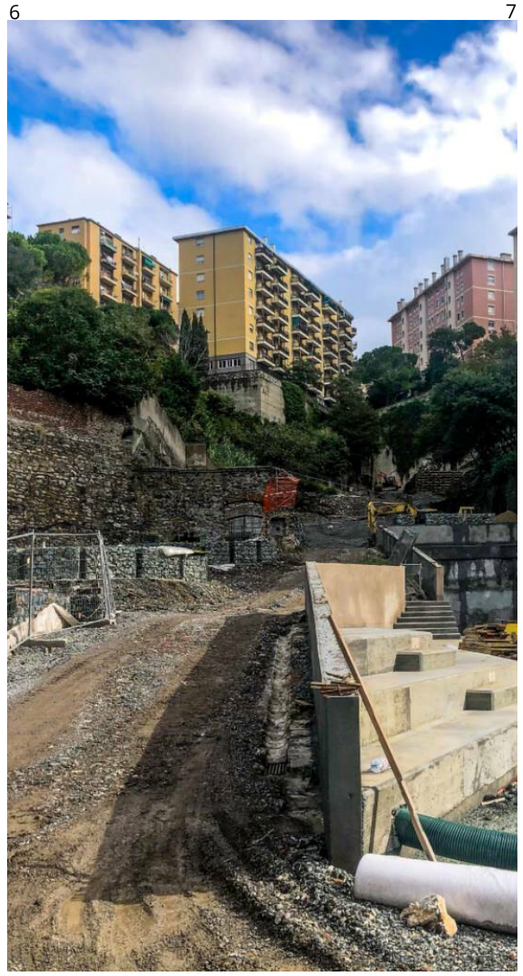

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loves humid, which serves to retain and filter rainwater. In case of heavy rain, the rain garden floods and slowly drains the water over a period of between 12 and 24 hours, ensuring constant and unpolluted absorption in the ground and underground banks. This aspect is essential to prevent floods due to possible flooding of rivers that flow underground. At the same time, the absorption time is fast enough to prevent the spread of insects. Behind this area, there is the urban forest, which is a real wooded area characterized by spontaneous vegetation that does not need irrigation, with forest species typical of the area. Inside the forest there is a naturalistic path that brings to a panoramic area. This part of the park, with a difference in height of about 30 meters for a development of just 150 meters, will have such a slope that it cannot guarantee access for people with motor disabilities for which is imagined the installation of elevators.

Bibliography

https://www.librotondo.it/il-parco-che-verra

http://puc.comune.genova.it

https://www.landsrl.com/portfolio-land/gavoglio-park

http://genova.erasuperba.it/caserma-gavoglio-casa-di-quartiere-progettazione-partecipata

https://www.youtube.com/watch?v=IEG2CFos4Lo

IRIDRA srl
Proposal for San Lazzaretto

BLUE AP project
Bologna, IT
2019

Key project data

The project was developed within the *Climate Change Adaptation and Resilient Cities* project promoted by the *European Investment Bank* and Bologna's municipality, in the *Life BlueAp project*, that was carried out by *Atkins* and *IRIDRA Srl* on two pilot cities, Bologna and Newcastle.

The proposals for the new Lazzaretto were made to adapt the district to climate change for the new urbanization project, that is planned for a total of 73 hectares and various uses: residential, public, educational.

A series of actions have been identified in detail, in terms of permeable pavements, drainage systems and expected retention capacities, from the irrigation of green areas to thermoregulation and water saving solutions, like rain collection, separation treatment and gray water recovery with natural solutions, sustainable urban drainage and green infrastructures.

Three major risks were identified for the urban environment: Drought , Heat islands and Heavy rain.

The types of solutions proposed are an Eco-Boulevard and a Water Arena, conceived along the central ridge of the new district and include Sustainable Drainage Systems (SuDS) designed along a 200 m of a pedestrian road and a public square of 2500 sqm. The Eco-Boulevard and the water arena have been pre-dimensioned, proposing a functional scheme, estimating the construction and management costs and the expected benefits (a retention volume of 200 m^3, generated by 4600 m^2 of draining surface).

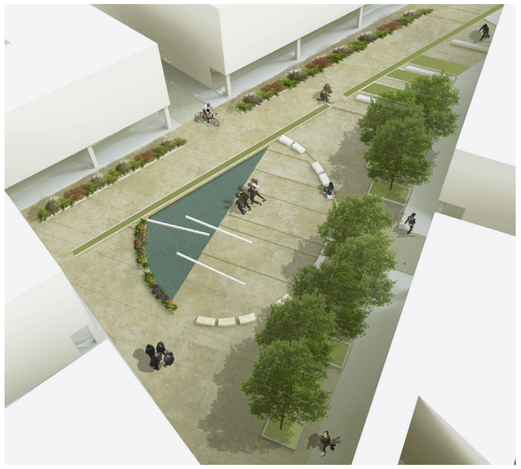
The bio-retention areas have the purpose of lamination and treatment of run-off water.

The hydraulic operation system of urban drainage is shown in the figure 4. The run-off waters of the Eco-Boulevard are managed differently between the right and left side:

The rainwater falling on the right side is sent to the bio-retention areas, while those falling on the left are conveyed by the vegetated canals to the detention basin in the square. 14 Bioretention areas have been planned to collect the water flow coming from the right of the area, each of approximately 15 m^2 and Dry vegetated canals with drainage Swales and a Dry Detention basin in urban environment of 1400 m^2, which receives the waters of the left side.

The SuDs were designed along with the urban furniture and functions of the public area, to fit completely. The SuDs are therefore waterproofed and connected to each other with drains, in order to have a more resilient response in the event of one of them malfunctioning. These drains convey the waters infiltrated in the bio-retention areas in wells external to them and equipped with calibrated mouth that discharges into the project sewer, in such a way as to limit the flow rates of infiltration, and then laminate the waters while ensuring an adequate infiltration time necessary for effective water treatment (mainly solids removal). Furthermore, each bio-retention area is equipped with an overflow that drains into the sewer existing.

The detention basin, inserted in the urban context of the Water Arena, receives the waters



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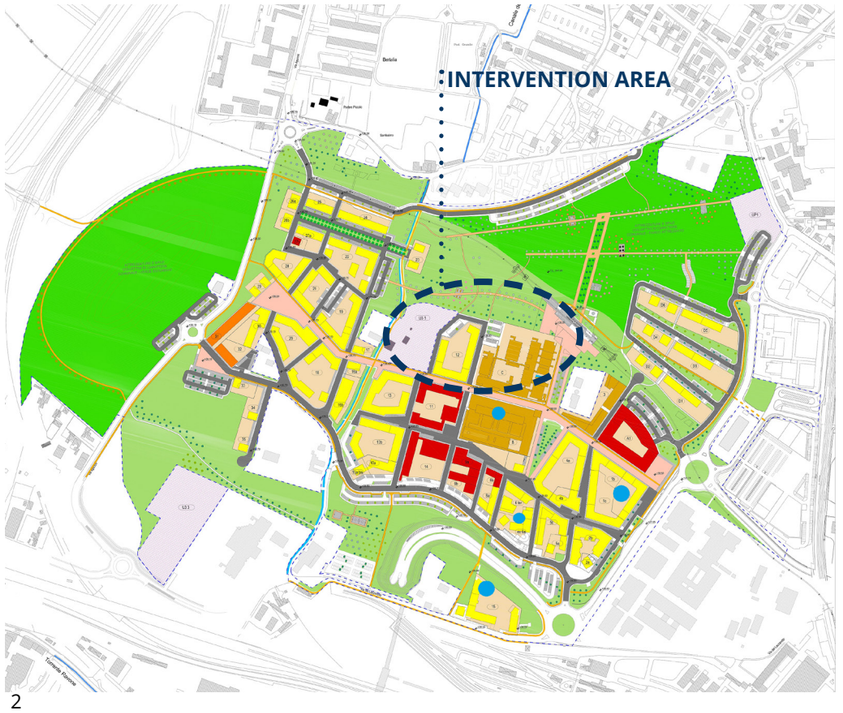

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1
Water Arena during a low intensity rain event +10 cm, https://www.facebook.com/iridra

2
Masterplan of the new urbanization area in Lazzaretto, http://fondazione innovazioneurbana.it

3
Project render for the water areana in the new urbanization area in Lazzaretto, http://fondazione innovazioneurbana.it

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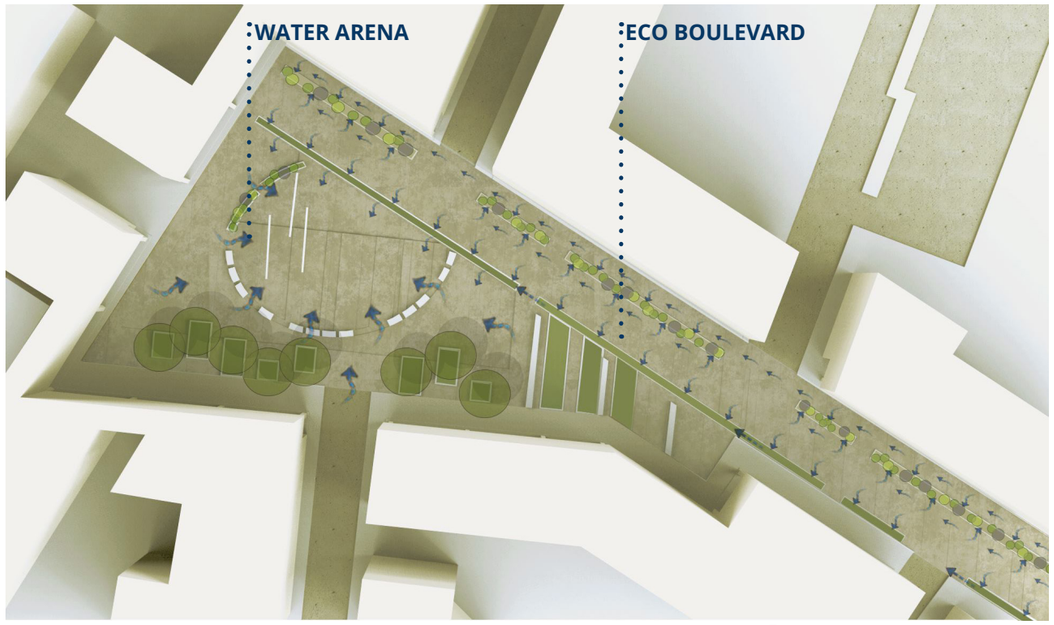

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4
Masterplan hidraulic functioning for the SuDs water arena and eco boulevard

5
Water Arena during a medium intensity rain event +30 cm, https://www.facebook.com/iridra

6
Water Arena render during a medium intensity rain event +50 cm, https://www.facebook.com/iridra

7
Water Arena during a high intensity rain event +50 cm, https://www.facebook.com/iridra

8
Eco Boulevard with swales, https://www.facebook.com/iridra

9
Rain gardens in the bouevard, https://www.facebook.com/iridra

8

of rain falling on the left side of Eco Boulevard, conveyed by vegetated canals, and those falling on the square itself.

The square is inspired by the Rotterdam's Water Plaza. In fact, the rainwater is discharged into a well with a calibrated mouth, while a second well is equipped with an overflow. Thereby rainwater is laminated, reducing the peak flow discharged into the sewer e allowing a controlled flooding that affects different portions of the square in function of different intensity of rain, always maintaining a safe water level (maximum 50 cm).

The Water Arena was designed for water management function, as well as aesthetics. Wanting to also add the treatment objective, provided for the run-off water on the right side of the Eco-Boulevard from the bio-retention areas, the square could be easily equipped to drain the waters with areas of bio-retention themselves inserted in such a way consistent in the urban environment.

Bibliography

Iridra Spa, Comune di Bologna, *Linee guida sull'adozione di tecniche di drenaggio urbano sostenibile per una città più resiliente ai cambiamenti climatici*, 2018, Bologna

https://www.facebook.com/iridra

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DE URBANISTEN
Water Square Benthemplein

Rotterdam Climate Initiative
Rotterdam, NL
2011-13

Key project datas

To cope with climate change adaptation, the De Urbanisten has designed a Water Square, a public space obtained with a system of basins and canals that collect rainwater, mitigating runoff phenomena and reusing it for the irrigation of the surrounding greenery. The square combines water storage with the improvement of the quality of the urban public space. It makes investments for the adaptation of water management systems visible.

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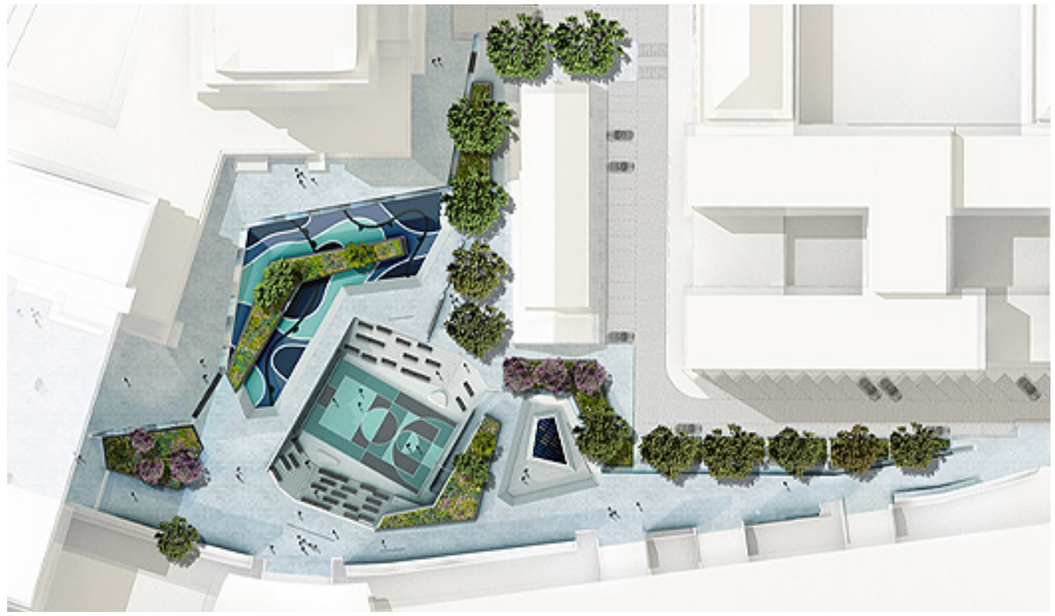
An intense participatory path with the local community led to the idea of the square: students and teachers and inhabitants of the Agniese district all participated. The request was for a dynamic place for young people, lots of space for play, but also pleasant, green and intimate places. Three basins at different altitudes collect rainwater from the ground and also from the drainage channels of the surrounding buildings: two shallow basins nearby receive water whenever it rains,the deepest functioning as a repository in cases of heavier rainfall. Rainwater is channeled into the basins through large stainless steel gutters, which are oversized steel elements also suitable for skaters in their performances. Two other devices make rainwater gush out onto the square: a water wall and a rain well. The wall transports the water to the deep basin with a rhythm of the falls directly proportional to the amount of water coming down from the sky. After the rain, the water of the two basins shallower flows into a device of underground accumulation and from here it penetrates slowly into the ground.

An open-air baptistery is placed next to the church, from which starts a fountain that winds across the square in one of the shallow pools. After the rain, the water from the two shallow basins flows into an underground infiltration system and from there it gradually flows back into the aquifers within 36 hours, not into the mixed sewer system. The system allows to avoid an overload of rainwater towards the sewerage and purification systems, limiting the amount of gray and dirty water that reach the sea. This helps to avoid drought periods, to keep the city's trees and plants in good condition, to reduce the urban heat island effect. For the most part of the time, however, the square is dry and offers space for dancing, skating and cycling and playing sports, football, basketball and volleyball. There is also a flight of steps which functions as a recreational arena, where young people can meet and carry out sports activities.

Everything that can flood is painted in shades of blue, and everything that carries water is polished stainless steel.



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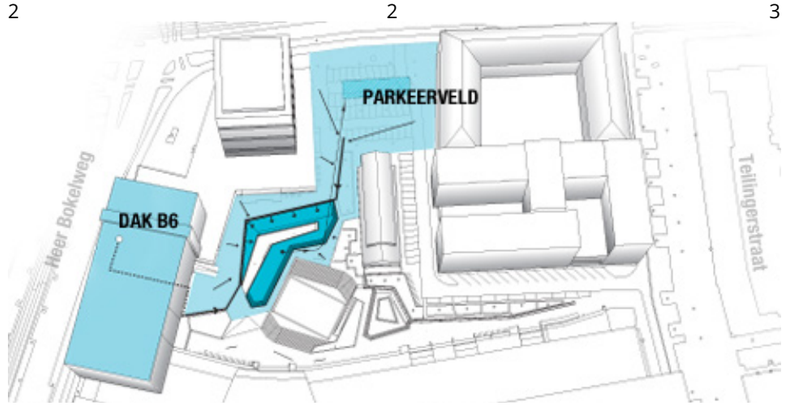

1
Water Arena dry, http://www.urbanisten.nl

2
Masterplan of the project for the water plaza, http://www.urbanisten.nl

3
Water usage map per the plaza, http://www.urbanisten.n

4
Picture of the plaza from the top, http://www.urbanisten.n

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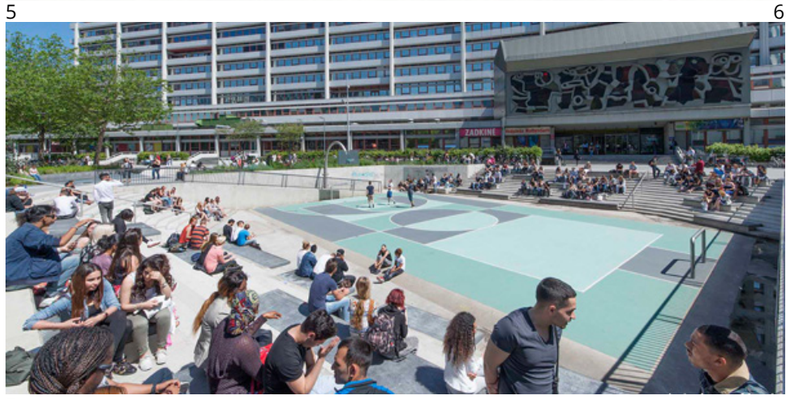

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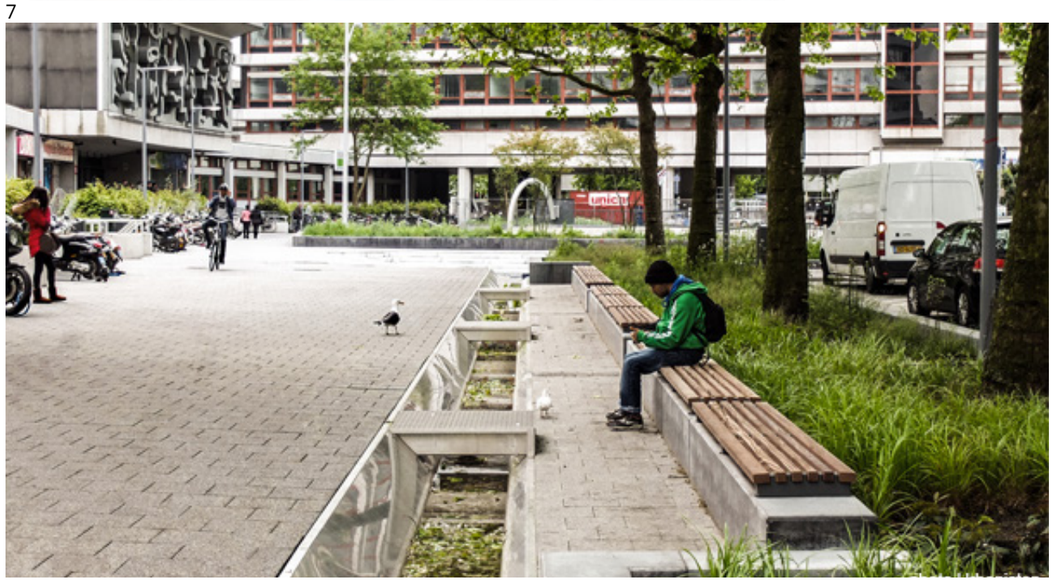

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5
Water Arena dry, http://www.urbanisten.nl

6
The water arena as a basketball court (ibid)

7
Metallic rain gutters and public furniture(ibid)

8
Basin for water collection (ibid)

9
Details of the stairs and water flowing (ibid)

10
Water flowing in gutters (ibid)

11
Basin for water collection (ibid)

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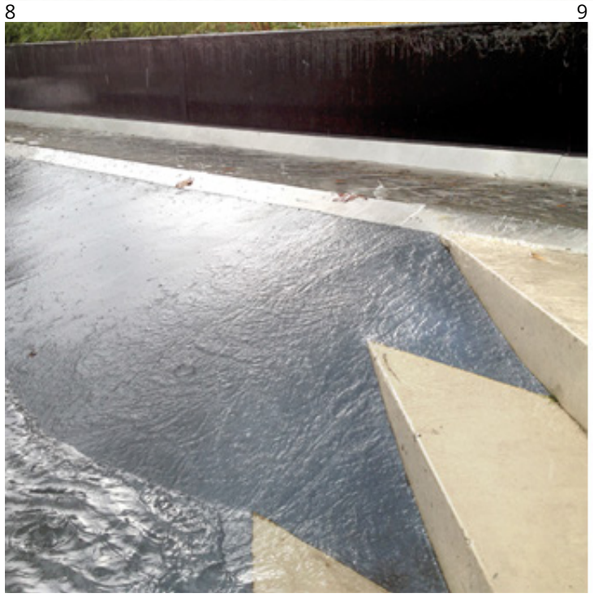

9

10

11

Bibliography

IoArch, *La piazza dell'acqua*, 2018, Bologna

Rotterdam Climate Initiative RCI, *Water plaza Benthemplein Rotterdam*, https://www.youtube.com, 2013

http://www.urbanisten.nl

SLA
Sankt Kjeld's Square and Bryggervangen

Climate district initiative

Copenhagen, DK

2015-2019

Key project data

Sankt Kjeld's Square and Bryggervangen form a cornerstone in the Copenhagen Climate District and the project is one of the city's largest and greenest mitigations area.

The competition-winning project "*Use Nature in the City*" aims to improve the social and ecological functioning of the neighborhood by making the area more beautiful and useful, integrating trees, plants, walking paths and green space into this streetscape, previously dominated by hard, non-porous surfaces and a very wide circular roundabout.

The project shows how making a neighborhoods resilient to climate risks can also enhance green and give a new life to recreational urban spaces that enhance biodiversity and reduce traffic, air pollution, and the urban heat island effect. The project is now a Copenhagen landmark for nature-based storm protection combined with recreational spaces, biodiversity and new infrastructure. The design is aimed towards flooding protection and biodiversity enhancement.

In heavy rain periods, the rainwater is contained and delayed in several specially designed urban green spaces. With the use of SUDs, instead of channeling rainwater into overflowing sewers, it is managed locally. Thus, the water gives life to plants and trees as well as creating new experiences of blue-green nature, right in the middle of the city. The square is designed to bring biodiversity in the city. It functions as a dispersion corridor and "green infrastructure" connecting the neighboring parks, Fælledparken and Kildevældsparken, and is designed to house local flora and fauna.

For the intervent 25000 m^2 of existing asphalt were removed and transformed. The project brings 586 new trees and plants from 48 local species to the neighborhood. Together, the trees, plants and rain beds cover 2/3 of the area's original asphalt, which gives a strong nature injection to the neighborhoodIt also brings a

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whole new kind of nature to the city, that is both aesthetic, functional, biodiverse and sustainable.

The project encourages residents to spend more time outside and to engage with nature by having areas for outdoor dining, benches between the trees, and large tree trunks that children can play and climb on.

By reducing once-busy streets, optimizing parking spaces and adding new cycle paths through nature-rich spaces, safe and stimulating mobility is now a accessible and secure for everyone. A network of paths has been traced between the newly planted trees, inviting everyone to explore the spaces, benches for a quiet break among the trees and large dead trees for children to climb on and insects to inhabit.

The project uses the latest strategies within climate adaptation in the city's space. 30% of the rainwater is handled on the surface in green areas, and in case of cloudbursts, the excess water is led via cloudburst roads and pipes to the port. Rather than using salt in the winter months, the intention is to use potassium formate in the area as an anti-slip treatment, which enables seepage into green areas to a much greater extent. The project works with the

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1
Sankt Kjeld's Square and Bryggervangen, https://landezine-award.com/sankt-kjelds-square-and-bryggervangen/

2
Square top view, https://landezine-award.com/sankt-kjelds-square-and-bryggervangen/

3
Green corridor project urbanistic and landscape plan, Sankt Kjeld's Square and Bryggervangen, https://landezine-award.com/sankt-kjelds-square-and-bryggervangen/

4
Site photo, https://landezine-award.com/sankt-kjelds-square-and-bryggervangen/

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5
Photo of the project, https://www.sla.dk/

6
Photo of the area from above, https://www.sla.dk/

7
Detail of the water collection system, https://www.sla.dk/

8
Detail of the water collection system and raingarden, https://www.sla.dk/

9
Sections of the street site https://www.sla.dk/

10
Water SUDs, https://www.sla.dk/

11
Site plan comparison between the existing roundabout and the actual solution (Peters, 2021)

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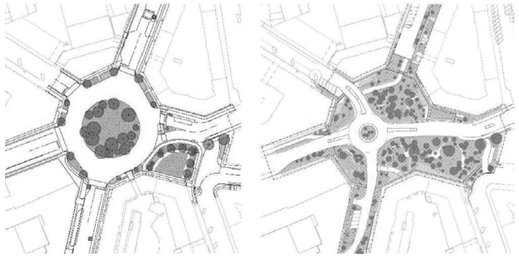
First Flush method, where you direct the first dirty rainwater on the roadway into the sewer, but then direct the subsequent clean water, Second Flush, to seep into green areas.

The residents and businesses in the area have been involved in the development of the project right from the start in 2012, through a series of citizen meetings, workshops and project groups. Based on this preliminary work, the program for the project has been developed.

*"It is important that the residents are involved in the process of developing the urban space. In this way, we create a more site-specific urban space that is adapted to the specific conditions and the life in the area. The process is also important in order to give the residents knowledge and ownership of the project, so that they feel secure in relation to the upcoming construction inconveniences, and so that they occupy the new green areas as their own when the project is finished." (*Project manager Louise Molin Jørgensen, 2015



11

Bibliography

SLA, 2021. Bryggervangen and Sankt Kjeld's Square. [Online] Available at: https://www.sla.dk/en/projects/bryggervangen-sankt-kjelds-plads [Accessed 31 March 2021]. https://www.sla.dk/cases/sankt-kjelds-square-and-bryggervangen/

https://landezine-award.com/sankt-kjelds-square-and-bryggervangen/

https://worldlandscapearchitect.com/sankt-kjelds-square-and-bryggervangen-wins-arne-of-the-year-award/

SLA, *Skt. Kjelds Square and Bryggervangen - A Climate Adapted Neighborhood*, 24/11/2020, https://www.youtube.com/watch?v=7dpRwoxkFfg

Terri Peters, *Resiliency in Performativity, A Shared Vision with Sustainability, 2021*

COMPARISON TABLE
of the Nature based urban case studies

LAND Italia, *Gavoglio Park*

PROJECT'S LOCATION

Genova Rione Lagaccio, IT, 2017-2019

PROJECT PARTNERS

Genova municipality, UNaLab Project (Horizon 2020), LAND etc.

FUNCTIONS

- Hydro geological disaster risk reduction
- New community space: square, park, playground, sports

TYPE OF NBS USED

- Water management: SuDs, permeable pavements, a raingarden, infiltration pond, underground rainwater tank
- Urban forestation: tree plantation, new native bushes and grasses, low-maintenance lawns
- Green walls
- Reuse of concrete from demolished buildings to create gabions on site.

PARTICIPATORY APPROACH USED

- Citizen consultation, participatory urban planning

IRIDRA srl, *Proposal for San Lazzaretto square*

PROJECT'S LOCATION

Bologna San Lazzaretto, IT, 2019 (proposal)

PROJECT PARTNERS

Bologna municipality, *Climate Change Adaptation and Resilient Cities* project (European Investment Bank), Atkins, IRIDRA

FUNCTIONS

- Drought , Heat islands and Heavy rain disaster risk reduction.
- New neighbourhood's square and boulevard, public space

TYPE OF NBS USED

- Water management: Water arena, SuDs, permeable pavements, water saving solutions, rain collection, bioretention and reuse for irrigation of green areas, separation treatment and gray water recovery with natural solutions, swales, detention basin
- Thermoregulation: climate mitigation with cool materials, trees and water games.

PARTICIPATORY APPROACH USED

- Not used

DE URBANISTEN, *Water Square Benthemplein*

PROJECT'S LOCATION

Rotterdam, NL, 2011-2013

PROJECT PARTNERS

Rotterdam Municipality, DE URBANISTEN, Waterboard Schieland & Krimpenerwaard

FUNCTIONS

- Water management and Heavy rain disaster risk reduction, avoids sewer system overloading and spillage of dirty water into the sea
- Urban heat island effect reduction
- Improvement of urban public space

TYPE OF NBS USED

- Water management: Water arena, SuDs, 3 water basins for water collection, rainwater channeled with steel gutters, water well and rain well, shallow pools, water reuse.
- Climate mitigation with cool materials, trees and water games.

PARTICIPATORY APPROACH USED

- Participatory path of consultation with the local inhabitants of the district.

SLA, *Sankt Kjeld's Square and Bryggervangen*

PROJECT'S LOCATION

Copenhagen, DK, 2015-2019

PROJECT PARTNERS

Copenhagen Climate District, Copenhagen Municipality, SLA

FUNCTIONS

- Water management and Heavy rain and flooding disaster risk reduction, avoids sewer system overloading, water reuse for gardening
- Biodiversity enhancement
- Improvement and safety of urban public space, relationship with nature

TYPE OF NBS USED

- Water local management: Water arena, SuDs, GBIs, urban green spaces for water collection with pipes, raingarden, rainwater infiltration and reuse.
- Urban forestry, tree plantation,local species asphalt removed

PARTICIPATORY APPROACH USED

- Citizen consultation citizen meetings, workshops and project groups

Case study projects comparison

The projects reported are all set in very different locations, having to face environmental problems very different one from the other, from the heatwaves of Bologna to the flooding rains of Copenhagen. Any way they all use Nature based solutions towards the same goal: Climate change adaptation in urban areas.

A common goal Nature based solutions are used in all the projects is to help improve water management. Almost all the cities have a huge problem in governing the urban drainage system in cases of extreme rainstorm events, since all our European cities have a very complex historic background and the urban drains and pipes are in most cases very old and underestimated for today's conditions. Having this common goal it can be really clear that all the project selected confronted it in very different ways and even in the project for a similar solution, like is the Water plaza for the Bologna and Rotterdam projects, The outputs were very different and mediated in the second case by a strong participatory process, that really shaped the project to the citizen's needs. In the Rotterdam square it was places a baptistery for the church as well as rain gutters to use as a skate park for the younger ones. This gives the feeling of how much can be learned from a participatory process that really confronts with the people's opinion and needs.

Three projects out of four have had a participatory process before or during the design, the fourth one didn't get the chance since it was not realized yet. There is a strong link between NBS and PA and it is of course also because of strong administrations at EU and local level that believe in both things and in the importance of informing and sharing with and from the citizens the (only) future we have upfront, the adaptation and mitigation strategies for climate change.

03

PARTICIPATORY APPROACHES

3 PARTICIPATORY APPROACHES

3.1 The participatory approach literature review

3.2.1 What is participatory approach and why using it

Why using participatory approaches

> *"Più che mai oggi le cittadine e i cittadini si mobilitano per incidere sulla progettazione del loro ambiente di vita, si tratti dei quartieri o del comune o della regione, e pretendono di avere voce in capitolo nella progettazione e nello sviluppo dello spazio pubblico, senza delegare in toto le decisioni ai politici eletti. Cittadine e cittadini fanno cancellare vecchie leggi e ne fanno approvare di nuove, chiedono asili e scuole migliori, pongono il veto sulla privatizzazione delle aziende municipalizzate o decidono in prima persona sullo sviluppo futuro di aree non ancora urbanizzate. Da molto tempo non rappresentano più una minoranza sociale. E sono alla ricerca di nuove vie per prendere parte attivamente alla vita politica: o attraverso i canali della democrazia diretta (tramite petizioni e referendum) da un lato, o, dall'altro, attraverso processi deliberativi basati sul dialogo in cui si elabora un punto di vista e si cerca di approdare ad una decisione."*[40] *(Nanz and Fritsche 2014)*

In these last years we have been assisting to an increasing number of participatory events where people were called to express their opinion on public laws or plans, demanding to have more decisional power. Most famous cases are those of the islandic constitution that was rewritten after 2009 and 2010 National Assemblies, organized by private individuals to discuss its the core new values; but this is also true at local and municipality levels, where the number of petitions and referendums called were increasingly higher worldwide from the '90 on (APuZ 2006). Other participative processes are the *Citizens' Assembly* in Canada, which proposed a rewriting of the election system for the Britannic Columbia, the *Consensus Conferences* in Denmark, to evaluate the consequences of the use of new technologies, from the participation at the base of the profound public administration reforms in Christchurch (New Zealand) and Kerala (India), to the birth of the first participatory budget in Porto Alegre (Brazil), up to local initiatives to promote social commitment in the disadvantaged neighbourhoods of many European and North American metropolises. As for the Italian case we can cite the examples of the most recent *Eutanasia legale* referendum that, with many others reached the quorum and overcame it in a very rapid time, demonstrating the attachment to the issue and also a clear desire to make the public voice heard with direct democracy methods.

This prone to active democracy and participation is mostly considered an upfront of the discontent for the traditional democratic methods, such are the elections, the representative methodology and the parties. People often feel they cannot influence anything just by voting in the elections and are growing a general discontent and disaffection towards these methods, but this doesn't necessary mean they have lost the interest towards active citizenship and social commitment. A clear data is

40 Translation: *"Today more than ever, citizens are mobilizing to influence the design of their living environment, may it be its neighbourhoods, the municipality or the region, and claim to have a saying in the design and development of public space, without delegating in full decisions to elected politicians. Citizens have old laws cancelled and new ones approved, ask for better kindergartens and schools, veto the privatization of municipal companies or decide themselves on the future development of areas not yet urbanized. They have long ceased to represent a social minority. And they are looking for new ways to take an active part in political life: either through the channels of direct democracy (through petitions and referendums) on the one hand, or, on the other, through deliberative processes based on dialogue in which a point is elaborated of sight and trying to arrive at a decision."*

that in most developed democratic countries the number of voters is increasingly diminishing[41], but on the other side participatory events are blooming. Social commitment is increasingly focused on specific issues, is limited in time, is less linked to political parties and is more tailored to personal interests[42]. Politics are understanding that is not only necessary but advantageous to take part in this kind of processes, to restore the trust from the voters and the public administrations, and maybe even wake up a new interest in politics itself. (Nanz and Fritsche 2014)

> *"Così si rafforza il rapporto di fiducia con la politica e l'amministrazione pubblica e in definitiva si può anche risvegliare interesse per la politica, non solo da parte delle cittadine e dei cittadini scettici verso i partiti, ma anche da parte dei giovani che non possono (ancora) votare o anche di persone con un background da migranti che li rende spesso difficili da coinvolgere. La partecipazione aiuta a comprendere i processi politici e aumenta la coscienza democratica di tutte le/tutti i partecipanti. Oltre a modernizzare le strutture dell'amministrazione e a migliorare i servizi pubblici, la partecipazione dei cittadini punta a rivitalizzare le comunità locali o regionali e a rafforzare i principi della democrazia."*[43] (Nanz and Fritsche 2014)

These forms of social involvement, if well experimented, can be very effective in modernizing public administrations, provide better and more suited services to the citizens, that can understand the mechanisms beyond the decisions and get involved, especially for the less represented, like are younger ones under 18 years old and people who do not have the citizenship yet or that come from a migrant background and are less prone to participate or feel integrated. But there are also other reasons to engage in participatory design approaches, like the improvement of knowledge upon the social system and municipality problems, to give the citizen a true viewpoint and realistic expectation. Also, to reduce its resistance to change, like often happens towards environmental limitations or the closure to traffic for the city centres. It is a matter of "*Increasing democracy by giving the people the right to participate in decisions that are likely to affect their environment.*" (Mahabadi, Zabihi, and Majedi 2014)

Democratization

> *"Democratic design is an approach that strives to establish the theoretical grounding for a new ethical discourse informing decision-making in the built environment and develop a new form of practice. It raises important questions about how environment should be produced and how this might become a reality."* (Mahabadi, Zabihi, and Majedi 2014)

The public space is a matter that involves all the community, it is shared, used and maintained by the citizens, so it is the perfect battleground for experimenting active democracy. The reappropriation of public space is a crucial theme that expanded its importance after the covid pandemic, revealing how much we needed to live better in our cities. Different municipalities in Italy responded to the need of social distancing offering public space for free to bar and restaurants, enlarging pedestrian

41 Italy, as well as other high voting European countries, like Belgium, Luxembourg, Denmark, Austria and Germany, have reported a significant voting drop since 1946 to these days. We report as an example the Italian case, where the participation to the national election dropped from the over 93% level of the post war to the nearly 80% of 2008 elections and is considered even lower nowadays. For more information see: Maurizio Cerruto, «*La partecipazione elettorale in Italia*», Quaderni di Sociologia, 60 | 2012, 17-39.

42 The text (Nanz and Fritsche 2014) here refers to the Enquete-Kommission 2002, Neblo 2007 for more information.

43 Translation: "*In this way, the relationship of trust with politics and public administration is strengthened and ultimately it is also possible to awaken interest in politics, not only on the part of citizens and citizens sceptical of parties, but also on the part of young people who (still) cannot vote or even of people with a migrant background, which often makes them difficult to involve. Participation helps to understand political processes and increases the democratic consciousness of all participants. In addition to modernizing administrative structures and improving public services, citizen participation aims to revitalize local or regional communities and strengthen the principles of democracy".*

spaces and drawing new bike lanes to avoid the crowding of public transports. In this process that involves at different level almost all Italian cities, some responded also calling for participatory design, taking a step forward to the democratization of public spaces. This is the example of the city of Bologna with *Fondazione Innovazione Urbana*[44], where the city, jointed with the University of Bologna and other partners founded this foundation to promote cooperation towards urban change, with research, urban regeneration opportunities, codesign and other projects.

Definition

It is difficult to give a unique and exhaustive definition of participatory approach since it was developed and applied in the most different contexts, so that different approaches and conceptualizations exist in this field today. In the following it will be given a general overview of what is participative approach and why using it.

> *"Participatory design deals with the problem of enabling users to participate in the design process and with the task of generating ideas by means of generative toolkits and workshops."* (Mahabadi, Zabihi, and Majedi 2014)

Clay Spinuzzi in 2004 defines participatory design as a methodology and argues it is important to define it so in order to build on a solid body of knowledge on the subject.

> *"Participatory design draws on various research methods (such as ethnographic observations, interviews, analysis of artifacts, and sometimes protocol analysis), these methods are always used to iteratively construct the emerging design, which itself simultaneously constitutes and elicits the research results as co-interpreted by the designer-researchers and the participants who will use the design."*(Spinuzzi 2005)

In the same article he describes its use in in Scandinavia in the 1970s and 1980s. This early challenge was driven by a commitment to democratically empower the workers in the workplace and aimed to form partnerships with different stakeholders, such as the labour unions that would allow workers to determine the shape and scope of new technologies introduced into the workplace. To achieve the goal participatory design emphasizes co-research and co-design, so that researcher-designers come to a conclusion in conjunction with users through an iterative process that allows to examine the problems and fix them.(Spinuzzi 2005) From the Scandinavian workers example cited before, participatory design has developed different methods and applications, from user centred design, to technologies applications, to urban regeneration because it gives the citizen power to affect their everyday life.

> "*The Collective Resource approach* [for the Scandinavian workers] *is based on the assumption that there is a connection between a democratic process and a democratic result. The democratic result should be a workplace—and a working life— in which everybody has a voice and in which all voices are heard and have an impact. A democratic process is a process in which everybody has a voice and in which all voices are heard and have an impact*" (Bjerknes and Bratteteig 1995)

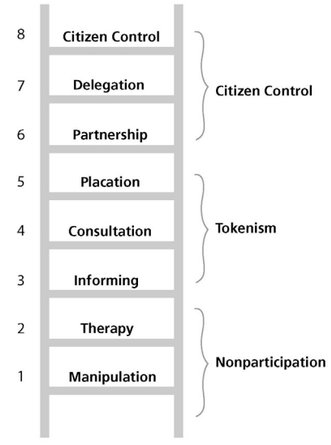
44 *The Fondazione Innovazione Urbana (FIU),* founded in 2018 in Bologna, is a multidisciplinary centre for research, development, co-production and communication of urban transformations at the service of the construction of the future imaginary of the city. The FIU plays a driving role in relations between public administration, universities, companies (Acer Bologna, BolognaFiere, Centro Agroalimentare Bologna, TPER and the Association of the Engineers), the third sector and citizenship. (https://www.fondazioneinnovazioneurbana.it) See also the paragraph *Advantages and disadvantages of PA in public administrations, the case of the city of Bologna*

Arnstein's Ladder of Citizen Participation

In 1969 Sherry Arnstein in the United States develops the famous Ladder of citizen Participation based on the different types of citizen's engagements. He defines citizen participation as a *"categorical term for citizen power",* categorizing the levels of engagement by looking at who has power when important decisions are being made. In the USA of the sixties the discussion about the empowerment was of course seen as a racial and classist fact stating its importance as "*the means by which they* [the have-not citizens[45]] *can induce significant social reform which enables them to share in the benefits of the affluent society."*(Arnstein 1969) Even if obsolete, the ladder is cited because it describes most problems still present in today's participations efforts, exceeding the naïve narration for public participation. It clearly represents the differences in terms of quantity and quality of the forms of participation.

Not all types of participation are equally valid by the ladder's criterion: the bottom two, 1) Manipulation and 2) Therapy, are considered as non-participative since they don't involve any redistribution of power. The aim is mainly to achieve public support through public relations and in the article is made as an example the one of the Citizen Advisory Committees (CACs) in city housing where in the name of urban renewal was created this system of bottom-up confrontation that had no true power of changing the issues reported, so that it resulted in a distortion of participation and a disillusion for the citizens. This first two types of participation are mostly listed to note what should not be done in participation.

The third and fourth steps, enable citizens to hear and be heard. 3) Informing is the first step to open a confrontation and legitimate participation, but too frequently the emphasis is on a one way flow of information blocking any feedback or negotiation from the audience. 4) Consultation can be a first step to a full participation of the citizens, carried on mostly throw attitude surveys, neighbourhood meetings and public enquiries. The risk here, as Arnstein feels, is these methods are still just a window dressing ritual if used without considering the inputs from the citizens. 5) Placation, that allows citizens to advise or plan, sometimes ad infinitum, but retains the right to judge the legitimacy or feasibility of the advice. Examples of this method are the co-option of hand-picked 'worthies' onto committees, so that have-nots can be easily outvoted, as Arnstein affirms.



Arnstein's Ladder (1969)
Degrees of Citizen Participation

Figure 3.1 Arnstein's ladder, the degrees of citizen participation, https://www.citizenshandbook.org/arnsteinsladder.html

45 Referred as *"blacks, Mexican-Americans, Puerto Ricans, Indians, Eskimos, and whites"*. (Arnstein 1969)

The last steps of the ladder are the ones that allow the most power to the citizens, but are still open to errors that can induce to an incorrect participation. 6) Partnership, where the negotiation between citizens and power holders allow a redistribution of power through sharing of planning and decision-making responsibilities for examples with joint committees. Than there's 7) Delegation. Citizens can hold a clear majority of seats on committees with delegated powers to make decisions. Public now has the power to assure accountability of the programme to them. And in the end 8) Citizen Control. Have-nots handle the entire job of planning, policy making and managing a programme e.g. neighbourhood corporation with no intermediaries between it and the source of funds. (Arnstein 1969)

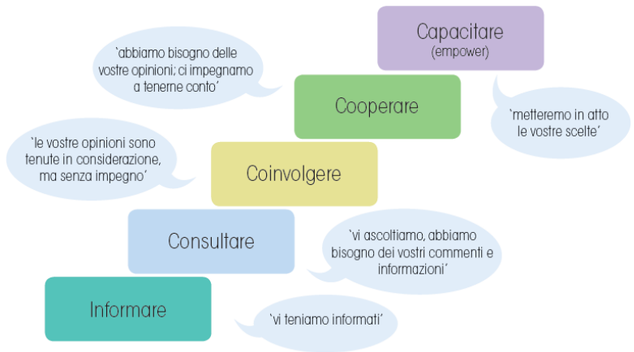


Figure 3.2 Ladder of participation in simplified version from the Association for Public Participation (Nanz and Fritsche 2014)

Different types of participative design

As we have seen there are different forms of participation and it's very important to define them along with three dimensions, that form the so-called *democracy cube* of institutional design choices. (Fung 2006).

The first dimension is the scope of the participation, who participates and how long is the process going to be: some participatory processes are open to any kind of stakeholder, others differ and only involve a part of an interested group as representatives. The first reason to open a participatory process is to gather more knowledge, competence, cooperation and resources and its obtainment is highly influenced by appropriate representation. It is important to define the methods of participants' selection because they highly influence the output. For example, a good participatory process for an urban regeneration project is the one that is able to involve the majority of the people living in the area, taking into account everyone's necessities and opinion. The selection can be influenced for example by publicizing urban planning initiatives in low-income and minority communities, other times the initiative itself can be self-selecting, stimulating the engagement of the interested people.

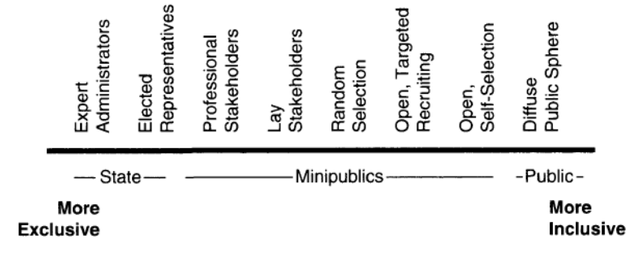


Figure 3.3 Participants selection methods (Fung 2006)

Randomly selection of participants from the general population is nevertheless considerate the most descriptive form of representativeness.

The second dimension is the mode of communication, "*how participants exchange information and make decisions.*"(Fung 2006) Here the attention must be focused on choosing the better methos to involve the participants and have their feedback: in many public meeting, there is a unilateral exchange of information, that doesn't take into account citizens' opinion. There are usually three methods of communication: public meetings where everyone is a spectator (not much space for participation), other meetings where the audience can express their thoughts directly and discussions where there is a first part of learning and a second for the discussion in small groups. This kind of approaches favour exchange of opinion, rather than a pure translation of views into a collective decision. Then there are three ways of decision making: the most common is aggregation and bargaining, where the participants know what they want and are mediated towards a social choice; then there's deliberation and negotiation in which participants figure out what they want individually and as a group with a knowledge background provided from the organizers. the last is the technical expertise, than does not involve participation and is the domain of officials and specialized experts.

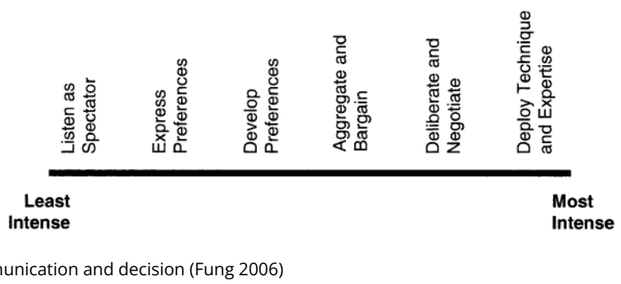


Figure 3.4 Modes of Communication and decision (Fung 2006)

The third dimension *"describes the link between discussions and policy or public action",* or the extent of the authority, what is the connection between the debates and the public action. There are five levels of influence the participatory process can have on the output: the first is none or very little, they are mostly informative events and the participants fulfil mostly a sense of personal benefit or civic obligation. The second level of influence can be the expression of a preference between given options; then there's the development of preferences with advice and consultation methods. Less commonly we have also direct power mechanisms with aggregation and bargain, deliberation and negotiation and a deeply expertise, as described before.

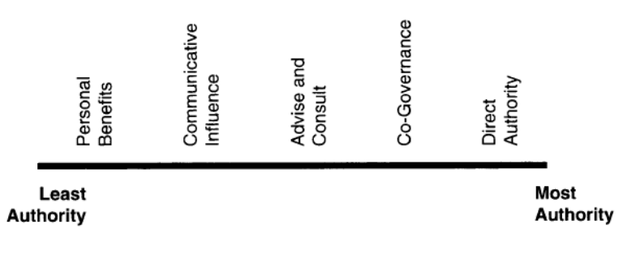


Figure 3.5 Extent of authority and power (Fung 2006)

3.2.2 Participatory approaches in practice

How to organize a participatory process

When organizing a participatory process there are a few things that are extremely important to define in order for it to be efficient and truly representative.

Firstly, it is important to define the timings of the event and the number of people it is going to involve. These decisions are in fact linked with the costs of the process, so an accurate planning is very important. The modality of selection and quantity of people, as we have seen before, plays a determinant role on the efficacy of the consultation, that's why it is important to determine the criterion of selection it is most suitable to the specific situation. (Nanz and Fritsche 2014):

- Auto selection: in auto selection the communication of the process must be the wider possible, so to open the participation to anyone interested. Who wants to participate is there for his or her own will, so even if the number is elevated there is a risk to have an over representation of some categories, that are already more represented; most of the time they tend to have a higher instruction or a better comprehension of the event, or simply more time to dedicate, like can be elderly or students, instead of more fragile categories that have no time or will to participate. Examples of auto selection processes are the *Planning for real* and *Participative Budgeting*. The *Planning for real*[46] usually has a small and local participation, mostly residents, highly motivated and committed to concretely shaping a specific site of a neighbourhood.
- Random sampling: the random sampling avoids the problems described before. It is considered, in theory, particularly democratic, reducing the prevalence of special interests. On the other side there is no certainty that the selected ones are actually interested in participation. The *Citizens' forum* and *Deliberative Poll* are a good example of the category. The *Deliberative Poll* is a research method that aims at the collection of the participants' opinions through a questionnaire that is administered in two distinct moments. To have the most representative sampling, the participants are randomly selected and receive a retribution for the days invested in the poll.
- Targeted sampling: this form is open to any interested person but also directly invites specific groups of people, associations and less represented ones. This kind of selection can be also achieved with the introduction of incentives such as an allowance for participation designed for those subjects otherwise not inclined to participate. A targeted sampling for example is used for the *Scenario Workshop* and the *Zukunftskonferenz (Conferences on the future).*

The second issue that must be addressed when thinking about a PA is to choose the better way for the citizens to communicate and to different forms of communication there are different forms of participation, as we have seen before (Different types of participative design, page 74). The PA are seen as sharing arenas to exchange ideas and grow more knowledge and *democratic skills*, but also to take decisions. They can be distinguished in the following forms:

- Articulation of interests with conferences and debates in plenary assembly or in small subgroups: where the participants are offered the opportunity to exhibit their own desires, interests and ideas to compare their views with those of others and possibly even change them. They are mostly confrontational events, where learning and sharing are the priorities.
- Negotiation: where representatives of different interests negotiate with each other to arrive, in the end, at a solution of compromise.
- Exchange of arguments and deliberations: where the dialog between the participants becomes the central element for the negotiation, so that they are encouraged to learn about the other point of views and to discuss them to develop an opinion shared by all.

46 For more information on *Planning for real* and the other cited examples see 3.1.3 Participatory approach examples chapter

The third and decisive point is to determine the capacity of a participatory event to connect and integrate into the political-administrative system. It is important for the participatory process to be incorporated in the subsequent planning and decision-making processes. For the success of the operation the promoters of the process should reach before the beginning the consensus of the decision makers on the output of the PA. Most of the times a PA has more than one of these objectives:

- Personal skills and knowledge: the PA has a small of none influence on the decision making but it's about sharing ideas and making new connections.

- Influence on public opinion and society: PA can influence the public discussion and create a sense of community building around a subject even with small decision-making power. Examples are the *Citizens' forum*, the *Deliberative Poll* or the *Open Space Technology.* The *BürgerForum or Citizens' forum* are a process in which discussion meetings alternate face-to-face and online phases, with the participation of experts on the subject and informative moments. In has been used for example in 2008 from the European Union, to talk about the expectations on the EU's future an at the end a *Citizen's Program (BürgerProgramm)* was redacted, with all the suggestions.

- Consultation by the citizens: in this area the central element is the advisory function of participatory processes, whose scope is to formulate some recommendations, of which the political decision makers and the public administration declare themselves ready to consider in the decision-making process. Full acceptance is not guaranteed. An example of this kind is the *Town Meetings of 21st century*. In *Town Meetings* can participate even 5000 people divided in smaller groups where they can discuss with each other in various rounds, guided by the process' facilitators.

- Co-decision and co-governance: In these cases, there is the warranty that the recommendations expressed by participants will be incorporated in the decision-making process. Co-governance means that it directly affects political decisions. Co-governance can come to be configured as decision-making responsibility placed directly in the hands of the citizens. Examples are the *Town Meetings of the 21st century* and the *Participatory Budgeting* that present the potential conditions for achieving co-decision and co-governance.

Advantages and disadvantages of PA in public administrations, the case of the city of Bologna

The participatory processes have a cost and are not always suited to every kind of situation, especially if public administrations are the ones promoting it, but they can have a positive impact if used correctly. The Emilia-Romagna region in Italy has redacted a guide for technicians and public administrators[47] to promote the use of participatory methods in city and local management. The region is in fact one of the first in Italy for number of participatory approaches promoted and has a high rate of success on the field, involving local communities, neighbourhoods and cities in the most different projects. The advantages that have been found when participatory processes are carried on are multiple. Here is a summary of its positive aspects:

- It is positive for the public local administrations, because it opens a direct democratic process that helps a better communication with the citizens, creating more understanding and approval for the government and a more careful decision making. The citizens have a clearer vision of the problems and possibilities of a local government.

47 *Partecipare e decidere. Insieme è meglio Una guida per amministratori e tecnici* (Emilia-Romagna and Tamburini 2009)

- It contributes to the diffusion of the "think global, act local" expanding the themes of discussion and promoting more knowledge and education and sustainable behaviour. It invests in the human and social local capital.
- it creates a sense of identity, responsibility and belonging towards a community, enabling better dialog and it can contribute to the beginning of new partnerships between different stakeholders.
- It can enact the building of new capacities between involved persons to promote and empower involved people
- It can help the speeding of the process, preventing conflicts and highlighting the possible problems.
- It can create new competences and new working opportunities.

On the other side, public administrations list a series of disadvantages they have found out during this first years of participative events:

- It usually has a long or medium-long timing for the start and the management of the approach, considering technical and institutional timings.
- It can have communication issues between the administration and the citizens involved, also if there is low trust in the administration or if the people on both sides, from the citizen but also the public administrators, are not used to work group it can be very difficult to reach the objective if not managed properly. (Emilia-Romagna and Tamburini 2009)

The city of Bologna, capital of the Emilia-Romagna region, is one of the biggest cities in Italy and a crowded centre with a metropolitan area with more than one million people. It is famous for its university, that is the oldest in Europe. The city can cite different participatory projects carried on by the *Fondazione Innovazione Urbana* in collaboration with the city's municipality. FIU operates with the collaboration of the public administration, the *Alma Mater Studiorum* university, private companies and the third sector as a multidisciplinary centre for research, development, co-design of urban transformations. The foundation itself report around 15.000 people involved in those first four years, 500 meetings organized in the city and 53.000 votes on the *Participatory Budgeting*[48], allowing the citizens to signal, purpose, vote and co-design projects and ideas for their neighbourhoods. The city adopted the participatory budgeting as a form of participatory process to allow a democratization of the administration's choices, where the citizen can express their preferences with an online platform and decide how to allocate part of a municipal or public budget. This way citizens and residents can discuss and prioritize public spending projects, with a more understanding point of view, and at the same time they have the power to make real decisions about how money is spent. The foundation contributes organizing several participatory events to discuss public space regeneration in each neighbourhood, doing quantitative and qualitative research with surveys, focus groups, interviews, data analysis and participatory research tools. They also promote urban space regeneration in the city with tactical urbanism solution[49], pedestrian and bike lanes creation and other solutions.

48 The *Participatory Budgeting* is a process that aims to build of the municipal budget through the participation of citizens and citizens. See 3.2 Participatory approaches

49 *Tactical urbanism*: also known as DIY Urbanism, Planning-by-Doing, Urban Acupuncture, or Urban Prototyping, is a citizen-led approach to neighbourhood building using short-term, low-cost and scalable interventions to catalyse long-term change. Tactical Urbanism projects can be led by governments, non-profits, grassroots groups, or frustrated residents. Though the degree of formality may vary, Tactical Urbanism projects share common goal of using low-cost materials to experiment with and gather input on potential street design changes. (http://tacticalurbanismguide.com)

It also promotes collaboration pacts[50] between private citizens and the municipal administration to manage, reuse and maintain public spaces and buildings. Collaboration pacts have been used to create a kit for kids' birthdays celebration in public parks, where the administration covers the gazebo, benches and chairs expenses and the parents for the park's maintenance after the party; but also, to create a 3D map and tour of the city's undergrounds and to regenerate a parkour area and association, to learn and practice the sport in safety. (Centro Ricerca per l'interazione con le industrie culturali e creative (CRICC) and Fondazione Innovazione Urbana (FIU) 2021)

Instruments for public participation

The FIU over his years of practice in citizen's participatory processes has redacted an inventary of tools that were used during the various phases of the events. They are reported as example of the because they are considered particularly useful for the facilitation and organization of a process for any kind of public administration. The reference publication is the *Fondazione Innovazione Urbana, Visioni e azioni dell'istituzione dedicata alle trasformazioni di Bologna 18-21 (*Fondazione Innovazione Urbana (FIU) 2021)

The first part of a participatory process in focused at understanding the situation, the collectivity or the area and can be carried out with: Benckmark processes, Desk reseaches, Interviews, questionnairs , walks in the neighbourhood, an area reportage, an actor's map or a thematic map.

Then in the second part, where the administration tried to co-design or collaborate with the citizens are usually adopted the following strategies: district plenary assemblies, Open Space Technology methodologies, focus groups, co-design tables, Workshops, digital platforms, actor's books, digital workshops, gamification processes or guarantor's committees.

For the deliberative part, when there is the necessity to take collective decisions the instruments used are Citizen's deliberative's polls, Online voting calls. Some of this instruments are explained better in the next pages.

Figure 3.6 *Parco della Resilienza project and photo* in Bologna, co-designed in 2019-21 with consultation methodologies , walks in the neighbourhood, co-design tables (FIU 2021)

50 *Collaboration Pacts (or patti di collaborazione):* are regimented solution that allows the collaboration between private or associated citizens and the public administration to take care of a common good or a public space, that can become the object of regeneration, reuse or management. This proposal comes "from above" or "from below" but always results as an action, material and / or immaterial, which cannot ignore the responsibility of the various contracting parties, who undertake to respect the agreed commitments.(https://www.fondazioneinnovazioneurbana.it/68-urbancenter/collaborare-bologna/1560-patti-di-collaborazione-il-punto-della-situazione)

3.2.3 Participatory approach examples

In the following are reported as examples different types of participatory approaches, that were used over time and indifferent situations.

The Planning for real

The Planning for real[51] is a participatory planning process that aims at improving life quality of life in concrete places, like squares, neighbourhoods, districts, urban parks, etc. This method was devised in the seventies at the University of Nottingham (UK) by a research team headed by Tony Gibson; it was firstly adopted in 1988 in Glasgow and it has been further developed under the *Neighborhood Initiatives Foundation*. It has been used mainly in UK but also in Germany by the exponents of the *New Urbanism*[52]. In the UK it was used for the cities of Sheffield for the High Hazels Park, for Queensborough and Rushenden. A similar process is the *Charrette*, developed in the '90 in the USA. The *Planning for real* usually has a small and local participation based on the active commitment for community. It aims at activating a concrete urban planning process on a specific area of a neighbourhood involving residents, administrations and businesses. It is composed of a first encounter of all the interested citizens to set a goal, then there is the collective construction of a 3D model so that everyone can visualize the areas and what they want to change. The model is then exposed and events are organized to draw attention on the theme, also with the help of technical figures and experts. On the base of the project's priorities and of the different tasks it is created an action plan and the project is realized (Nanz and Fritsche 2014).

The Participatory Budgeting

The *Participatory Budgeting* is a process that aims to build of the municipal budget through the participation of citizens and citizens. In principle, all interested persons can submit proposals for the use of the resources available. The first participatory budgets were born in the late eighties in the city in Porto Alegre in Brazil and in Christchurch in New Zealand. While the model developed in Porto Alegre is presented in the literature sector specialist as an exemplary experience of *"democratization of democracy"* through the adoption of principles of social justice, that of Christchurch is considered a successful case of the modernization process of the public administration. (Nanz and Fritsche 2014) For the reported case of the city of Bologna the participatory budgeting was experimented also with *Collaboration Pacts* to offer the possibility of a wider action from the citizens.

The Citizens' forum

Citizens' forum (or BürgerForum) [53] was developed by Bertelsmann Stiftung (*Bertelsmann Foundation)* in collaboration with the Ludwig-Erhard-Stiftung and the Heinz-Nixdorf-Stiftung (*Heinz-Nixdorf Foundation),* and was only adopted in Germany, where *Citizens' forum* was held in 2008 on the *Soziale Marktwirtschaft* (Social market economy), in 2009 on the European Union and in 2011on the *Zukunft braucht Zusammenhalt– Vielfalt schafft* theme (The future needs cohesion- a chance from the differences).

The *Citizens' forum* are a process in which meetings alternate face-to-face and online phases: two meetings of two days each open and close the process. In the middle, the participants discuss online on the subject. On the first phase the participants are invited to inform themselves on the subject through the initiative website, then they can confront and share ideas at the face-to-face event. There is another online phase where the website become a discussion network with experts 'opinion and live-chat and at the end there is the final face-to-face meeting where the best solutions are voted and redacted. The participant's selection is based on the principle of randomness, paying particular attention to socio-demographic criteria such as age, sex, educational level and domicile.

The Town Meetings of 21st century

Town Meetings of 21st century and the *Century Summit* are a modern version of the traditional Town Meetings born in New England (USA), in which all the inhabitants of a city or region get together in assembly to settle questions that involve everyone. They differ on the methods and number of selection. The participatory technique of the 21st century Town Meeting was developed by *AmericaSpeaks*, an organization that mainly applies it in American, but also Australian and British, cities and communities. It is usually conducted on behalf of public institutions, for example municipalities (Nanz and Fritsche 2014). Town Meetings on the subject of living wills were held in April 2009 in Turin and Florence as part of the *Biennale della democrazia*[54] festivals.

An example of this kind is the *Town Meetings of 21st century*[55]. In *Town Meetings* can participate even 5000 people divided in smaller groups where they can discuss with each other in various rounds, guided by the process' facilitators. At the end the facilitators *super partes* collect the more important ideas that are later voted by the participants through an online button system for rapid feedback and then used for decision making.

The Deliberative Poll

This method was invented and used by the American political scientist James S. Fishkin and by its *Center for Deliberative Democracy* at Stanford University. In the US it has been used since the beginning of the nineties and it was recently used also in Europe. *Deliberative Polling* experiments have been conducted over 100 times in 29 countries, including Canada, the United States, Greece, Italy, Bulgaria, Hungary, the United Kingdom, Brazil and China.

The method is inspired by two distinct features of the ancient Athenian democracy model: first the random selection of citizens, that was anciently carried with a lottery, and secondly the remuneration for the participation to the assembly, which is a principle that *Deliberative Polls* also utilize in order to ensure that a more representative public is constructed by encouraging participant heterogeneity. The *Deliberative Poll*[56] is a research method that aims at the collection of the participants' opinions through a questionnaire that is administered in two distinct moments. The method is used to analyse how information and discussions can influence the opinion on a specific matter. During the interval the people can inform themselves on the subjects and it is asked to express their opinion at the end and repeat the survey. The event lasts 2-3 days and there is plenty of time for discussion and experts' interviews. On the the deliberative event, participants are randomly assigned to small groups with trained moderators and encouraged to develop questions to pose a panel of experts and policymakers at a plenary session. The results of the first and the last poll are compared and any changes in opinion are analysed and disseminated to the public. (Participedia 2022; Nanz and Fritsche 2014)

51 *Planning for real* official website *https://www.planningforreal.org.uk/*

52 The *New Urbanism*: is an urban design movement which promotes environmentally friendly habits by creating walkable neighbourhoods containing a wide range of housing and job types. It arose in the United States in the early 1980s and its organizing body is the *Congress for the New Urbanism*, founded in 1993. (https://en.wikipedia.org/wiki/New_Urbanism)

53 For the *BürgerForum* on the *Bertelsmann-Stiftung* foundation website, see https://www.bertelsmann-stiftung.de/de/unsere-projekte/abgeschlossene-projekte/kommunale-buergerbeteiligung/projektthemen/buergerforum

54 For more on the *Biennale della democrazia*, look at the website: http://www.comune.torino.it/biennaledemocrazia/testamentobiologico

55 For more on the *Town Meetings of 21st century* on the *AmericaSpeaks* website: http://www.americaspeaks.org/democracy-lab/innovation/21st-century-town-meeting/index.html

56 *Deliberative Polling* method website https://cdd.stanford.edu/what-is-deliberative-polling/

The scenario Workshop

Scenario Workshop (or *Scenario building* process) tries to examine problems that could arise in the future within schemes of solutions. It can be used for a wide range of issues: from assignments related to the local area up to international missions, from strategic planning of a company, for example, to military strategies, to long-term political programs, up to the development prospects of a municipality. This method is mainly adopted in Europe. Similar techniques are the *Bürgergutachten/ Planungszelle* or *Conferences on the future* or the *Real Time Strategic Change*, adopted in Germany, UK and USA.

The *Scenario Workshop i*s a method ideated to illustrate possible future trends and the future consequences for a group, a community, a region or a company. The purpose of the process is to provide for direct participation of different social groups from civil society. The selection of the participants is usually carried on by the organizations that conduct the process. Usually the group of participants (from 25 to 250) includes political decision-makers, experts but also ordinary citizens. The process goes on three phases:

1. the critical phase, where it is carried an analysis of the problem and solutions over a specific subject and then the analysis of the decisive and influential factors for the subject,

2. the visionary phase, where future scenarios are discussed and interpretated by the participants in small groups,

3. the implementation phase, where the participants is asked to develop some strategies and measures for the scenarios' management.

During the Scenario Workshop, time is allotted for brainstorming, discussion, presentations and voting. This method was also utilized by large organizations, such as the United Nations and the European Union to address social and environmental concerns.

Dialog café

The D*ialog café*[57] participatory approach has the purpose of creating a shared dialog, exchanging experiences and knowledge. It is usually carried out in small conversation groups gathering to explore a question or a specific theme. After a certain amount of time discussing with the same group, the participants have to change.

> *"This method is suitable when sharing experiences or discussing a question with the aim to increase the individual knowledge sought. In addition, it is suitable when similarities and differences in opinion needs to be highlighted or when different perspectives on an issue are desired"* (van Dinter and Habibipour 2019)

57 The *Dialog café* website www.theworldcafe.com

3.1 Participatory approach for NBS design

The effectiveness of nature-based solutions is highly dependent on the local context since it involves synergies with local urban actors, urban planners, administrations and policy makers. In this kind of processes involving local stakeholders from the first phases of the planning and design is crucial for ensuring social acceptance and ultimately for the full delivery of multiple benefits. This is where the participatory processes can really make the difference for the success of the operation. The social acceptability of such solutions is one of the key objectives of NBS, since they aim also at the spreading of sustainable good practices, this can also be improved by making nature-based solutions aesthetically appealing to citizens.

> *"Stakeholder involvement, dialogue and co-design of tools and measures are key to increase awareness, to tackle potential stakeholders' conflicts more effectively and to create social acceptance and demand for nature-based solutions. About half of the European cases analysed strongly emphasise stakeholder involvement."* (European Environment Agency 2021)

In the European Commission communication from the European Green Deal it is clearly reported the necessity to *"protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts"*, but at the same time, the EC stresses on the transition to be *"just and inclusive*" to be fully accepted and supported.

> *"It must put people first, and pay attention to the regions, industries and workers who will face the greatest challenges. Since it will bring substantial change, active public participation and confidence in the transition is paramount if policies are to work and be accepted. A new pact is needed to bring together citizens in all their diversity, with national, regional, local authorities, civil society and industry working closely with the EU's institutions and consultative bodies."*(European Commission and Secretariat-General 2019)

Also at the core of other important policies, like the *New Urban Agenda*[58], the SDGs with the goal for *Sustainable Cities and Communities*[59] *(SDG11)* and the European *Sustainable Communities*, it can find this same boost towards the cooperation between States, cities, and other stakeholders, towards inclusive design and that such strategies are "are transformative not only in environmental terms but also account for issues of social justice." (Wild et al. 2020)

Evidence suggests that Nature based solutions can advance the principles of these preceding concepts by explicitly engaging all stakeholders within collaborative design, implementation and management processes and by simultaneously considering the multiple benefits, but at the same time they could exacerbate inequalities if not designed with sufficient caution. (Wild et al. 2020)

Creating awareness: Eurobarometer surveys

In early 2015, the European Commission launched two Eurobarometer studies to assess public awareness, public opinion and the public's potential willingness to engage in Nature-Based Solutions, involving surveys and focus groups across the 28 Member States. A qualitative study entitled *'Innovating Cities with Nature: Citizen Engagement in Nature-Based Solutions'* was carried out with nearly 28,000 citizens in 28 cities to investigate citizens' concerns, ideas, preferences and willingness to pay for greener and healthier cities. The results showed that six out of ten Europeans favour Nature-Based Solutions over other technological solutions to these problems. The second Eurobarometer survey was focusing on citizen views on NBS for renaturing cities. The citizens were interviewed face-

58 See2.2.1International policy framework

59 See 2.1.3NBS and Sustainable Development Goals

to-face on their views of the benefits of NBS in response to the problems they faced in their local areas, their main concerns, and their own willingness to participate in an eventual implementation of NBS, resulting that many would like to participate in some way, mostly by volunteering with their time. A quarter of the participants feared that natural features may not be properly maintained, but a wide majority (83%) were in favour of the EU NBS promotion. The citizens were able to easily recognize the primary benefits of NBS on their lives and on the environment, a fewer part though to the economic and business opportunities as well. The mainly perceived barriers to the applications were indicated in the lack of financial resources (for 50% of respondents) followed by the lack of political will, as NBS are not seen as a priority in urban planning. The biggest variations revealed by the two surveys could be related to socio-demographic differences between and within countries. (Faivre et al. 2017a)

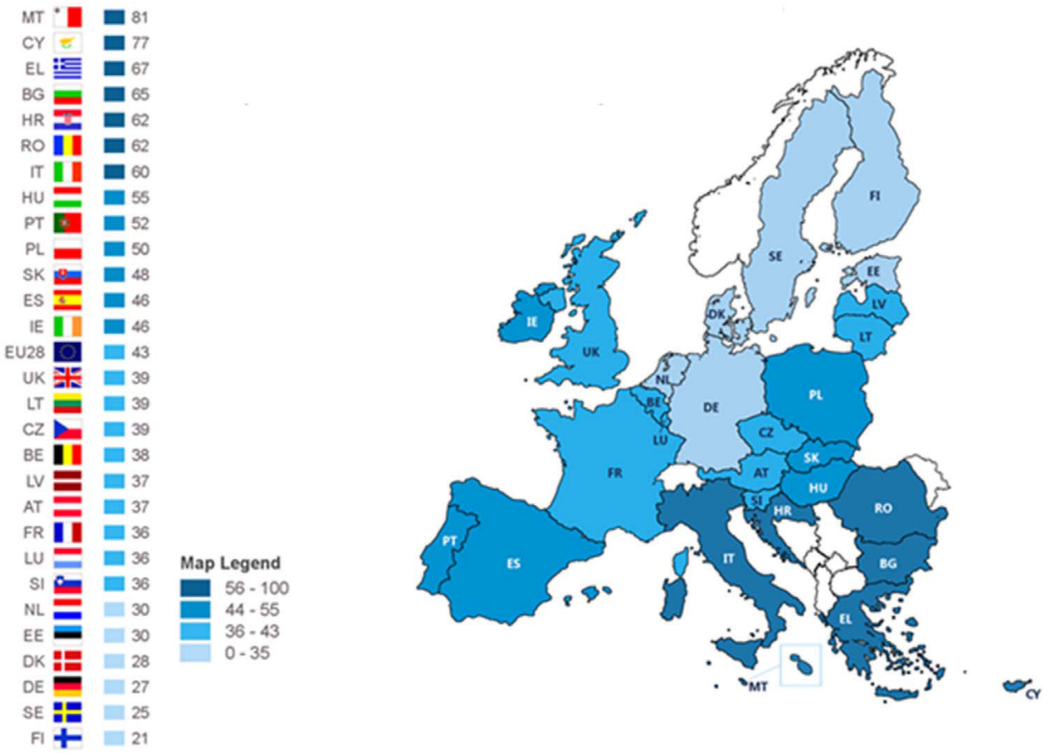


Figure 3.7 The map shows differences in the percentage of EU citizens across the 28 Member States who say they would like more natural features in the urban area in which they live. (Faivre et a. 2017a)

From the survey's results in 2015, more and different NBS projects have developed and in almost every every European country we can see one or more European founded projects, a signal that the lack of founding opportunities has been filled up. Now the challenge is how to engage citizen and private stakeholders in keeping the projects going and implementing their opportunities.

Participatory Planning and Governance

Nature-based solutions require planning approaches and governance architectures that support accessibility to green spaces, but also maintain and restore their environmental quality for the ecosystem services. Especially in urban planning, attention must be paid to bridge different types of knowledge and integrated plans for designing and implementing NBS. The *Eklipse Impact evaluation framework to support planning and evaluation of nature-based solutions projects* report a series of potential actions towards a good planning:

- Co-design and participatory planning processes could bring transparency in the governance processes, empowering citizens and civil society, practitioners and policy stakeholder involvement in NBS projects, *"enabling NBS to be designed in line with community aspirations and expectations."* (Raymond et al. 2017)
- Create different institutional spaces for cross-sectoral interactions and partnerships of different stakeholders for NBS design, implementation and maintenance could foster co-management and knowledge sharing leading to more efficient design, delivery, and monitoring of NBS.
- Support processes that enrich or regenerate ecological memory for restoring urban ecosystems with NBS to promote a better understanding of urban nature by local communities and a sense of belonging.
- Promote and work towards creative designs of NBS like the codesign and stakeholders that are adaptive overtime, so that the collaboration in NBS designs provides multi-functionality of the project, thus becoming also better resilient to climate and social change.
- Support community-based projects on greening and restoring urban green spaces that also ensure accessibility to these spaces and stewardship to promote equal access to green space and social justice outcomes. (Raymond et al. 2017)

As another research, from the OPENNESS project, points out, *"participatory local planning and approaches that seek to co-design interventions with communities can strength joint decision-making and generate "co-ownership, higher public support, a higher likelihood of implementation" and are "likely to save time in the long run"."* (Wild et al. 2020) The case study project further suggests, over data evaluation, that with the implementation of codesigned plans, could higher the chances for a more sustainable outcomes and enhance societal well-being.

As PROGIREG reports there are different levels of involvement taking place in NBS, from one-way informational processes for the stakeholders and members of the public, to "*consult, involve, partner and empower*" modes, which shift control away from municipal authorities, who are most often the initiators of such projects, towards stakeholders and community groups (Hanania et al. 2019). Throw the different gradations, three main approaches to participation can be identified:

1. the research emphasised the value of involving stakeholders and communities in NBS *"as a means of increasing their knowledge about and action towards urban sustainability."* (Wild et al. 2020) These kinds of approaches point out the importance of open and transparent planning processes and institutionalised forms of participation.
2. It is recognized the importance of various kinds of co-production processes in NBS design as a mean through which different actors can share knowledge and experience. Here the focus tends to be on the need to design novel settings and processes within which actors can be engaged to generate new outcomes for specific places, such as urban living labs.
3. The attention is pointed on how NBS may serve to sustain or challenge issues of inequity in urban planning and development processes, and whether alternative means of participation can overcome long-standing issues of exclusion. *"Research suggests that this is unlikely to be possible within the frameworks of existing institutions or through the careful design of new processes but must necessarily also allow for forms of contestation and conflict."* (Wild et al. 2020; Hanania et al. 2019)

As we have seen, one of the main goals of participatory approaches has always been placed on the ways in which *"well-designed processes of stakeholder and public engagement can be used to inform or educate, with the intention of fostering acceptance of public policies or active engagement in their implementation."*, meaning that the most important barriers to participation and action lie in relation to information and knowledge. This point of view seems to be confirmed by the *RESIN* project, who's

objective was to Foster sustainable communities by building stakeholder knowledge and trust between municipal authorities and stakeholders.

The research carried from yet another Horizon 2020 project, UNALAB, has found that the development of 'citizen platforms' for data collection and analysis that actively engage citizens, can can also prove to be a valuable resource for increasing citizen awareness of the value of urban nature.

Furthermore, as GREEN SURGE found, this kind of engagement techniques are not only useful for informing citizens but can also lead to improvements in urban planning outcomes. The project found that *"Public Participation GIS tools provide a suite of options that can be used at different stages of the planning process to support planners in "making better decisions about land-use, management and resource allocation" and supporting greater citizen "involvement in assessing and planning urban green spaces*"(Wild et al. 2020). In the project they have been used for example for mapping the uses of green spaces, their perceived environmental quality and ecosystem services. (Wild et al. 2020)

3.1.1 European Initiatives

Urban living lab

Living labs are organized in different European cities under the *European Network of Living Labs*[60], as a strong instruments to support cities and regions in their ecological transition based on open and inclusive innovation.

> *"They represent a key element in empowering citizens to co-create their cities & regions while enhancing their ecosystems through emerging technologies. "*

They are both practice-driven organisations that facilitate and foster open, collaborative innovation, creating stakeholders' involvement, as well as real-life environments or arenas, where new solutions are developed fostering co-creation and open innovation. The involved actors, following the *Quadruple Helix Model*, are: Citizens, Government, Industry and Academia. Despite the differences, all the Living Labs share the following central elements: Multi-method approaches, user engagement, multi-stakeholder participation, real-life setting an co-creation methodologies. It is reported a summary of two case studies representing different approaches towards *Living Lab* methodologies, all following the exploration, experimentation and evaluation phases.

The first is the *FRACTALS* project, to support start-ups and SMEs with agrifood solutions in market penetration across Europe. They experimented end-user engagement with the objective to gather farmers, agronomists and other to interact with ICT companies (solution developers) and provide feedback on their applications to bring the applications closer to the market's needs. In this the stakeholder's involvement of both public and private sectors was crucial and realized throe different methodologies:

- Brainstorming was encouraged between farmers and ICT geeks on topics related to needs of agriculture
- Service design workshop together, after the identification of the challenges, they worked together to develop the solution that would bring benefit to both sides.

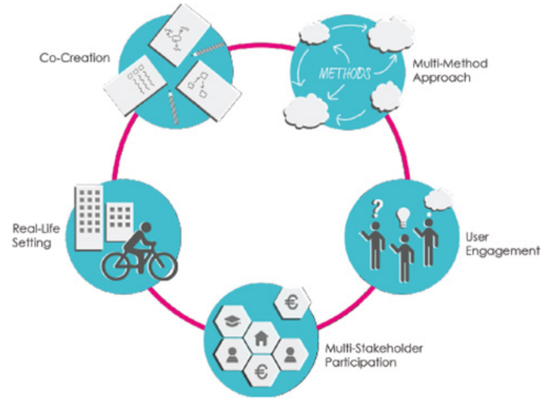


Figure 3.8 Common Elements of Living Labs,

The *SMARTLAB* case, tried to bridge the *Smart Gap* between high tech and economic development among Smart Cities, and the complete absence of knowledge and information in rural areas. the

60 The *European Network of Living Labs (ENoLL)* is the international, non-profit, independent association of benchmarked Living Labs, website: https://enoll.org/
For more on the ENoLL history https://issuu.com/enoll/docs/enoll-print

living labs, and *Guadalinfo Living Lab network*[61] in the specific, tried to bring all the smart cities possibilities also to rural areas, where they are even more relevant to overcome depopulation. End-user engagement for this platform was determinant and also stakeholders' involvement that was developed by the lab throw the Academia, public and private sectors. The following methodologies were used during the course of the project:

- Design Thinking
- Observation
- How might workshop to create first ideas or understand the problem
- Service design workshop to develop the solution together
- Community Building
- Social media

Unalab

Under the *European Network of Living Labs* we can also find a specific Living Lab that follows the implementation of Nature based solutions projects, the *UNaLab*, always using participative approaches and co-creation methodologies. The UNaLab focuses on *"urban ecological water management, accompanied with greening measures and innovative and inclusive urban design."* The project's front runner cities: Tampere, Eindhoven and Genova, have a track record in smart and citizen driven solutions for sustainable development and will impact on different urban socio-economic realities, with diversity in size, challenges and climate conditions. UNaLab uses the ENoLL Urban Living Lab model and the European Awareness Scenario Workshop method for the co-creation of solutions. To gain insight into the needs that different stakeholders have was important to start by determining the target user group for the 'discover needs' phase, where different methods were used, like:

- Contextual Inquiry or Contextual Design
- Why-Why-Why
- Cultural probe
- Dialog café
- Future Workshops
- Brainstorming
- Brain-writing
- Experience Prototyping
- Innovation by Boundary Shifting
- Rapid prototyping

For interaction design there are several techniques that can be used to illustrate and transfer users' needs in a co-creation activity, like the ones in the following:

61 For the project's video presentation: https://www.youtube.com/watch?v=vHT29gV9_cE and the *Guadalinfo* website http://www.guadalinfo.es/

- Scenarios workshops
- Mock-Ups
- Storyboards
- Personas
- Design games
- Field tests.

For the Eindhoven case[62] for example, were organized different co-creation workshops with a core of 14 participants. For the first Workshop the group was created and it was given a NBS definition, a project timeline and a stakeholder map. From the second workshops the participants started to tackle the challenges together by sharing ideas for NBS implementation, raising awareness, linking NBS with ordinary world with the support of experts, designers and planners. In the third and final workshop, ideas to tackle the challenge were defined and ideas tested.

New European Bauhaus

The *New European Bauhaus NEB*[63] is a EU initiative that connects the *European Green Deal* to the citizen's daily lives and living spaces for a more sustainable and build a more inclusive future. It leverages green and digital challenges and tries to address societal problems through co-creation and participation strategies. The New European Bauhaus is inspired to the *Bauhaus movement* that more than 100 years ago radically changed European art, architecture and design starting from Weimar (DE). Key points of the project are accessibility, inclusion and sustainability in any form. The NEB aims to promote the exchange of knowledge between people across Europe through an interdisciplinary project, which seeks visionary solutions that incorporate sustainability and circularity, quality of experience and aesthetics, inclusion and affordability. It is a transformative project that aims to inspire new behaviours, change thoughts, attract markets and influence the public society to make new and sustainable ways of living possible. Although it was born by looking at buildings innovation, the ultimate goal is to involve all sectors, for a future that will be co-created and realized in an innovative and inclusive way. The New European Bauhaus process follows three phases: Design, Delivery e Dissemination.

After the first collective planning phase (October 2020 to June 2021), people and institutions are going to present their ideas and concrete contemporary contributions and examples and the European Commission will summarize the fundamental principles that emerged from the listening and it will translate them into action proposals with a policy document. At the same time, the partners are working to broaden the reach of the new European Bauhaus and build an open community that combines international cooperation with local action. In September, the implementation phase began, setting up and implementing new pilot projects. The projects will be closely followed and monitored with the aim of sharing the lessons learned from the first experiments. The dissemination phase will therefore focus on presenting good ideas and practices across Europe and the rest of the world. The objective is to create networks and share knowledge in order to identify open and replicable methods, solutions and prototypes, making them available to cities, localities, architects and designers. To open a dialogue with citizens, businesses and the academic world and the strengthening of urban institutional capacities will also be fundamental. From January 2023, the third and final phase of dissemination is expected. (European Commission 2022)

62 https://unalab.eu/en/blog/game-nature-based-solutions-eindhoven

63 For more on the *New European Bauhaus NEB* https://new-european-bauhaus.europa.eu/index_en

Grow green

The *GrowGreen Horizon 2020* project has used two participatory approaches for citizen engagement, developed by *Paisaje Transversal*[64]for the cities of Valencia, Manchester and Wroclaw.

The first is the *Listen and Transform* method, which is focused on a collaborative process that pursues several objectives:

- Listening to citizens through information collection and analysis tools. This allows for recognition of their needs to optimise the potential of each site and neighbourhood.

- Transforming the environment in a collaborative manner involves defining strategies, actions, and projects that improve the quality of life of people living in the area and encourages cooperation and co-responsibility as well as promoting commitment to the development of the area.

For the Valencia case, aimed at tackling heat stress, innovative citizen engagement actions were organized in public spaces to communicate the intentions of the pilot projects to the local residents. For example, in *Benicalap*'s public spaces were used visual messages and painted floor signs to explain the location of the projects and its environmental improvements. Another measure was the development of a mobile app to engage local people and make them aware of local plants and wildlife. The app allows people to identify the flora and birds that are part of the neighbourhood's local biodiversity. Listening to the concerns of the community regarding the public space helped to highlight the problems and rectify them with the use of NBS. For example, it was suggested that the neighbourhood secondary school, gets really hot due to a lack of shade. To resolve the problem a shaded structure was built alongside the implementation of the vertical wall.

The second methodology is the *Dissemination, Citizenry, and Participation* method for the development and implementation of NBS projects. There *Dissemination* refers to the project's transparency and visibility, both of locally and globally; The *Citizenry* component refers to the construction and strengthening of the community identity, with opportunities for citizen participation, education and information sharing. The *Participation* refers to the engagement of stakeholders in the planning, design and management phases of the proposed NBS projects.

For the *Manchester West Gorton Community Park*[65] for example, the Citizen engagement was organised by the Groundworks charity that was already active in the community. The park was implemented with Nature Based solutions for flooding and water run-off prevention, like sensory planting, a permeable and filtering paving plaza, a rain garden and bio-swales, but also biodiversity measures, like a pollinator garden. The local community was involved in planting and a number of activities such as *seeing is believing,* an online tour of the site. Also young people were involved throw school projects. This helped build trust and reduce scepticism around the project and ensuring their inputs and ideas into the process helped reducing anti-social behaviour in the park in the long term.

In the Polish case other citizen engagement techniques were used in the workshops, the most successful technique highlighted was the use of photo maps and posters. The photo maps were helpful to give the citizens an overview of the entire area and the identification of what they preferred in each location. Secondly, the photos wee used by the designers to incorporate NBS and citizen's suggestions into their designs. The team received over 130 proposals from residents from the workshops. The final designs were publicly exhibited in the local library. (Grow Green 2020a; 2020b)

64 *Paisaje Transversal* studio website: https://paisajetransversal.com/

65 For the *Manchester West Gorton Community Park* website http://growgreenproject.eu/key-features-manchesters-west-gorton-community-park/

3.1.2 Why Start Park

For the case study if was selected one particular participatory tool, the *Start Park* gamification tool, that was ideated to facilitate the co-design of a park with Green and Blue infrastructures GBI.

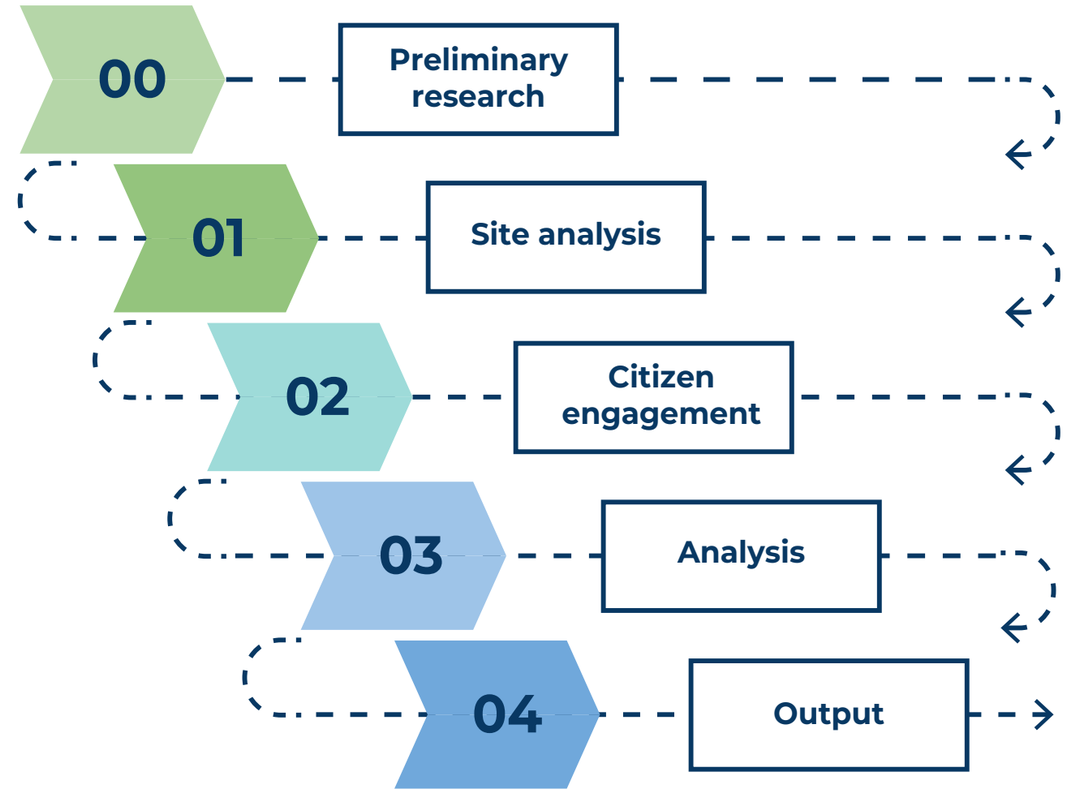
The choice came to this particular approach, and not other ones, firstly because it was a participatory approach specifically made for NBS application purposes, matching perfectly the requests for the thesis's objective; secondly it offers, unlike other approaches used in Horizon 2020 projects, like RESINS and GREEN SURGE, a high level of participation to the citizens, that have the concrete possibility to shape a place of their city or neighbourhood. The tool in fact follows a similar model to the *Planning for real*[66] one, using a gameboard with the site plan as a model for the collaborative design of the park. The gamification tool guarantees a ready to use co-designed park plan, that can be easily transformed in pre-feasibility project and actually built once it is given to a technical studio. The citizen, divided in small groups can confront their ideas and discuss on the main problems of the requalification area and choose the solution they prefer. This way the tool opens the discussion allowing *Citizen's consultation* and *Co-decision*, as well as *Negotiation stategies* between the small groups. In the *Start Park* process there is also a dedicated moment for information sharing, before the start of the game, where the technicians explain what Nature based solutions are and how they can be used. This is, most of the times, a necessary confrontation since most of the participants have only a vague idea of what NBS and GBIs are. The process has thus also an educational value, promoting also sustainable good practices with the citizens. It has also a very intuitive mechanism, easy to understand, being organized as a board game, with a board, some cards and roles to play. It comes ready to use and with a pleasing graphical view, that intrigues and involves the users. Another good reason is its replicability ad adaptability, that we are going to test and demonstrate with its application in the workshop case study (5 RESULTS chapter).

66 See 3.1.3 Participatory approach examples

04

METHODOLOGY

4.1 Methodology



The methodology indicated and explained in the following was elaborated during the thesis development, after a comparison of different participatory processes and case studies. It is a general step by step methodology that could be applied to any case study project. In the following it is described more in detail the application to one particular selected case study, The Fioccardo park, that is going to be introduced in the following pages. The linear process remains anyway valid for more experimentation and future developments.

Explanantion of the methodology applied to the case study

00

Preliminary research

- Case study analysis
- Literature review

STEP 00 Preliminary research

The first part of the case study involved a case study analysis and literature review that was carried on both for Nature based solution projects and for participatory approaches, with a particular focus on participatory approaches used on NBS projects, like the Green Surge one. The preliminary analysis was helpful on individuating one particular methodology, the *Start Park* one, that was carefully addresses and experimented. All the results are reported of this first phase are reported in the first three chapters of the thesis.

01

Site analysis

- Climate policies
- Urban planning framework
- Site cartographic analysis
- In situ site inspection

STEP 01 Site analysis

The following step was the site analysis, that was carried on throw different actions: it starts with a review of the climate effects and policies the city of Turin is trying to address, then throw a preliminary urban planning and legislative analysis, after that with an online data analysis of the population and site specifics and then with an actual in situ site view and photographic report.

02

Citizen engagement

- Workshop
- Participatory gamification tool

STEP 02 Citizen engagement

The citizen engagement part was organized with a Participatory Workshop, held at the Polytechnic University of Turin, with the master students, that were asked to play with the selected participatory tool, Start Park. For the try out test of the tool it was asked the master students to play the roles of the hypothetic stakeholders involved in the process for the park regeneration. The workshop was articulated with different groups to have multiple tests and confront the results of different approaches to game playing. The preparation for the workshop required a slide presentation to explain what are NBS, the rules of the game and the site specifics.

03

Analysis

- Comparative and qualitative analysis

STEP 03 Analysis

Then it is made a report of the workshop's ideas, that are analysed with both quantitative and qualitative methodologies, confronting the group's works singularly and then contrasted together. At the end of this step it is drawn an overall consideration and a comparison table analysis.

04

Outputs

- Project idea

STEP 04 Outputs

Starting from the analysis' ideas, it is drawn a preliminary project idea of the park with the use of Nature based solutions, new furniture and with the activities chosen. All the design choices were made based on the workshop output and elaborated by logical evidence.

4.2 Case study

Site location

The site is located in the city of Turin, in the northern part of Italy, the capital of the Piedmont region. The location in particular is set inside an existing green area, the Fioccardo park, situated in the Southern part of the city.

The site consists of a green area situated alongside the Po river and it extends with the river on one side and Corso Moncalieri on the other. It's part of the 8 District of Torino, in the Nizza Millefonti neighbourhood, at the border with the Cavoretto one, that spreads throw the hill. While Cavoretto it's a quiet residential and historical neighbourhood, the Nizza Millefonti is a more dynamic and crowded center, provided with any kind of facilities. It is reachable by both private and public means of transport. The site itself will be described with more detail in the first step on the methodology, doing the Site analysis.

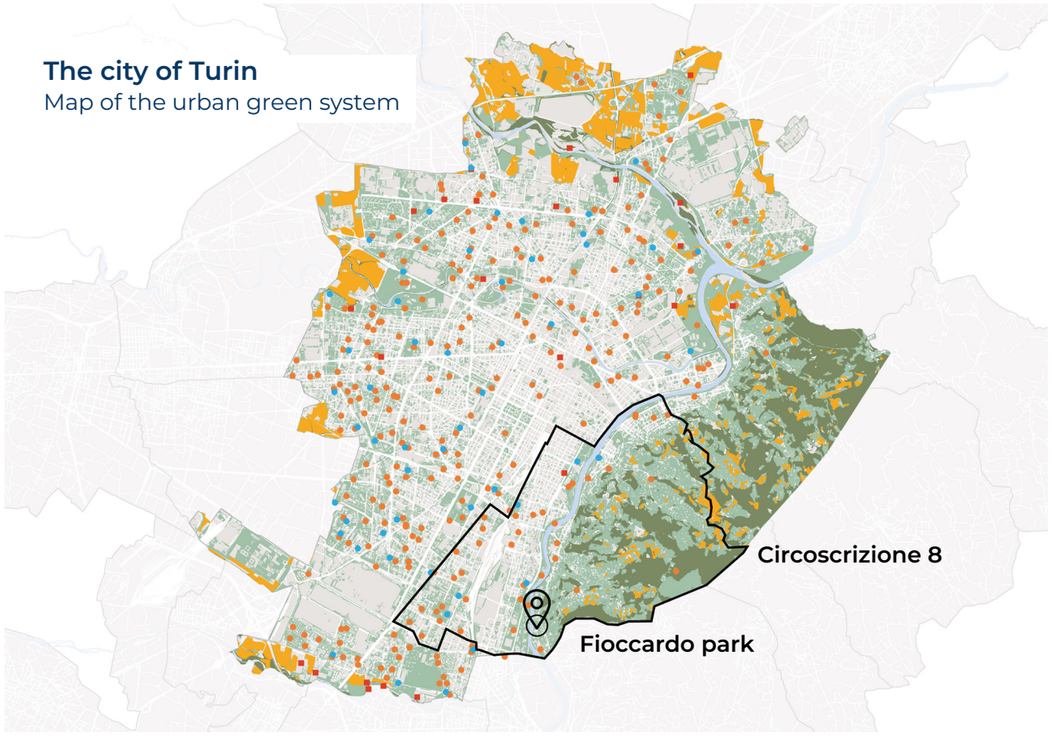


Figure 4.1 Map of the urban green system with indicated the site location. Image from the *Torino Atlas, mappe del territorio metropolitano, capitolo 09-Ambiente,* Torino Urban center,centro di ricerca Luigi einaudi, Rapporto Rota,IED, 2018

Why this site

The site was chosen for the case study experimentation for several reasons. The first and more important is because it was the same site area where the *Circoscrizione 8* had decided to make the purpose for the Simbiosi project, to which part of chapter 1 is dedicated (*1.2 Con.Nettare, Simbiosi competition participation*). This is particularly important not only because with the collaboration to the competition there was already a familiarity in the site study, but also because it was considered a site of interest by both Turin municipality and the *Circoscizione 8.* The mere fact that it had been candidate for a renewal process by the public administrators responds to the basic motivation to use it as the case study, the need for renewal. Furthermore, during the participation to the competition it had already been conducted a preliminary site view and site research that was then elaborated in the first part of the case study methodology application (See chapter 4).

The choice from the administration was fallen to this particular site not only because of the poor conditions, but also because of an already existing active citizenship in the area, that could be stimulated for the engagement part and could get interested into becoming a community. Also the position is strategic, because it is really close to other urban parks and also to different schools and sport centres that could be involved as stakeholders of the project. The stakeholders imagined in the case study are based on this previous experience, to simulate a real and possible participatory approach.

The objective of the application to this specific site is furthermore to demonstrate, with a simulation, the possibility of a real community engagement into the park renovation a co-design with Nature based solutions, to so validate the methodology and proceed in the real life project. The simulation and the thesis results could be in fact useful to a public administration that would like to try a participatory approach for a NBS urban park, so to promote and spread the good practices in the city of Turin but also in other and different cities.

4.3 The Start Park participatory tool

4.3.1 The creation of the tool

Start Park's beginning

Start Park is a participatory approach tool invented to help communities and public administrations codesigning urban parks with NBS technologies, like SuDs, sustainable water management and urban gardens, as expected from most city adaptation and mitigation plans.

The tool's goal is to enable the participants to design their community park while understanding key technical and scientific aspects of GBIs with the intent to leverage the empowerment of participants and help them become catalysts of sustainable urban practices. The game tool exploits both the NBS solutions and the participatory approach, seen as fundamental to addressing Climate Change adaptation: citizens are a fundamental part of the process, as they are the potential adopters of environmentally aware behaviours.

The overall ambition of the project is to create a series of widespread urban parks in different cities, as examples in terms of urban bottom-up regeneration and adaptation to climate change with SuDS, sustainable water management and urban gardens. The concept behind the idea is to give back public space, disused or badly kept, at the service of the citizens, either younger, older, students or families, to create an active community; the parks should not be intended only as of the first outposts of CC urban adaptation, but also a place for social aggregation and personal and collective well-being.

The design of the game resembles the one of a board game, with characters, activity cards and an interactive board with the site plan. The game aims to stimulate the discussion amongst the participants, to help them in the design process, focusing on their necessities and collective needs to decide together how they would like their park to be and how to manage a limited amount of money.

The Start Park tool was born to answer the following question: How to engage and encourage people to be aware of climate change and turn it into resilient actions? And a concept: to create a public/private service in widespread urban parks that activates resilience actions at home and in urban contexts. From these questions emerged the proposal to devise a service that favours the creation of widespread urban resilient parks.

Start Park is a project idea that emerged during the 2017 *Climathon*[67] in Florence, an international ideas hub orchestrated by *EIT Climate-KIC*, *GreenApes*[68] and *Codesign Toscana*, whose aim is to engage cities and citizens in climate actions. The aim of this kind of event, held all around the world, is to lay the foundations for tangible projects, start-ups and long-lasting conversations with decision-makers around city plans and policies. This is what happened also with the start park project, where two multidisciplinary groups made up of professionals, municipal technicians, individual citizens and students came out with the idea of Start Park.

After this first step, there has been another co-design event in January 2018, where the participants, selected with an open call, were divided into four thematic groups. They collaborated with the *Codesign Toscana* and *Iridra Srl* teams to optimize the concept from the point of view of products, artefacts and built spaces that make up the Start Park system, identify elements of community engagement, improve the business model and optimize the communication project, with a coordinated image and graphic form. The co-design methodology, human-centred approach, service design thinking and the *Double Diamond*[69], which are used in the Start Park process, have also been applied to co-create the game tool and product vision. Some of the tools used for this event were a Canvas Business model, a Stakeholders map and a user journey map.

The concept of the Start Park was analysed also from an architectonical point of view and four topics became clear objectives for the tool design:

- the necessity for the park to be a multi-functional space,
- the idea of a non-anthropic park, to leave nature space to get back it's
- the need to a have empty, non-designed space, for the park to be more adaptive to future challenges and changes
- the opportunity to enhance CC solutions, to better understand their importance with solutions that stimulate the five senses.

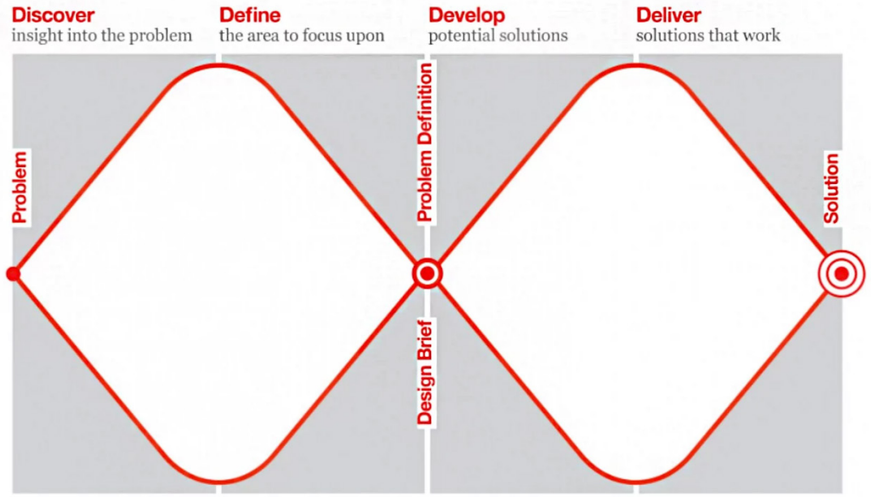


Figure 4.2 Double Diamond design model (https://www.justinmind.com)

W

68 GreenApes è una B Corp (Benefit Corporation) nata nel 2012, con sede vicino Firenze. È una piattaforma digitale che premia azioni e idee sostenibili allo scopo di promuovere stili di vita sostenibili nel mondo reale, accumulando punti (BankoNut) per ogni azione o sfida sostenibile portata a termine e condividendo idee e esperienze. I punti possono poi essere utilizzati per riscuotere premi, agevolazioni ed esperienze. (https://www.greenapes.com)

69 The Double Diamond design model has four stages: Discovery, Definition, Development and Delivery. Together, these stages work as a map designers can use to organize their thoughts to improve the creative process. (www.justinmind.com) See also Figure 3.6

Table 4.1 Details of the phases, activities and tools used ("Co-Design Report A Cura Di CodesignToscana e Iridra Srl CODESIGN Toscana," n.d.)

Fase	Attività specifica	Strumenti
Formazione dei tavoli di lavoro e briefing (Sessione tavolo per tavolo)	Ice-breaking	Dynamic Groups Brainstorming
	Briefing	Brief del tavolo
1° fase di sviluppo (Sessione tavolo per tavolo)	Individuazione delle caratteristiche e del posizionamento degli stakeholders	Stakeholders Map (tavolo)
		Personas
Confronto e allineamento (Sessione plenaria)	Confronto su profili personas e stakeholders individuati in ogni tavolo	Stakeholders Map (condivisa)
2° fase di sviluppo (Sessione tavolo per tavolo)	Attività specifica tavolo per tavolo in base agli obiettivi specifici	Strumento specifico tavolo per tavolo
Confronto e allineamento (Sessione plenaria)	Condivisione e feedback tra i diversi tavoli	Open Space Technology + Template

Start Park was funded with a European grant under the *Designscapes*[70] project (Horizon2020) and represents an innovative citizen-led process aimed at collaboratively re-designing underdeveloped urban green areas with Green and Blue Infrastructure by leveraging on design thinking methodologies, digital gamification[71] and STEM- environmental studies.

"Start Park addresses a diversified set of problems and pursues several objectives: first, Start Park tries to adjust the inadequate and not up-to-date design and architecture of the urban existing environment, in particular urban parks, when related to contemporary climate-related challenges and severe events. Second, it addresses citizens' unawareness about Climate Change and the generalized lack of education on tools and methodologies to become resilient organisms. Third, Start Park deals with the need to redesign our urban environment by exploiting nature-based solutions. Fourth, it boosts experimentation and new forms of design network, composed of public-private stakeholders, able to create new socio-economical value—e.g. social value with the Start Park participatory project, economic value with its legacy, namely the opportunity to create labour out of new major infrastructural works for urban resilient transformation."(Berni et al. 2022)

70 *Designscapes* is a H2020 European project approved under the topic CO-CREATION-02-2016- User-driven innovation: value creation through design-enabled innovation. The aim of the project is to exploit the generative potential of urban environments in the highest possible number of European Cities to encourage the uptake and further enhancement and up scaling of Design-enabled Innovations by existing enterprises, start-up companies, public authorities and agencies, and other urban stakeholders. (https://designscapes.eu)

71 *Gamification* by the Oxford Dictionary definition: "The application of typical elements of game playing (e.g. point scoring, competition with others, rules of play) to other areas of activity, typically as an online marketing technique to encourage engagement with a product or service." (*Oxford Dictionary*, 2022)

Start Park's stakeholders

In the ideation of the Start Park tool took part two different companies: the Codesign Toscana cultural association, and the Iridra s.r.l.

Codesign Toscana is a cultural association and multidisciplinary network of professionals under 35, active in Tuscany since 2017. They co-design and collaborate with citizens, and public and private entities for human-centred practices, dealing with socio-cultural research, engagement, co-design and design thinking for the development and innovation of the territory. They engage in research, participation and co-design Workshops, workshops and consultancy, strategic Socio-cultural planning and impact assessment. Their main fields of interest are:

- Design thinking, co-design and service design tools facilitation and support
- Consultancy in innovation management, urban regeneration, environmental sustainability
- Service and UX (user experience) design[72]
- Ethnography, user research and visual social research
- Management of culture and enhancement of cultural heritage
- Community design and stakeholder engagement, civic imagination, empowerment and citizenship active
- Drafting of social balance sheets and strategic plans
- Cooperative educational practices and collaborative training for all.

*Iridra s.r.*l. is an engineering company composed of a multidisciplinary group of professionals, with a focus on the implementation of interventions for the eco-sustainable management of water resources. In particular, IRIDRA has been recognized for years as a leading company in the sectors: NBS - Nature-based solutions and green-blue infrastructures, such as phytodepuration, urban drainage sustainable development (SuDS), ecosystem services and climate change adaptation and mitigation. They provide services such as:

- Design and construction management activities for public and private sectors,
- consultancy and feasibility studies and construction management,
- European projects, community and national funding programs design,
- Infrastructure management and maintenance,
- organization of conferences and seminars, teaching and research about NBS,
- international cooperation projects,
- territorial planning, design support and technical assistance,
- Environmental impact assessments

72 *User experience design* (UX design) is the process of creating evidence-based, interaction designs between human users and products or websites. Design decisions in UX design are driven by research, data analysis, and test results rather than aesthetic preferences and opinions. Unlike user interface design, which focuses solely on the design of a computer interface, UX design encompasses all aspects of a user's perceived experience with a product or website, such as its usability, usefulness, desirability, brand perception, and overall performance. (*Wikipedia, 2022*)

4.3.2 Start Park methodology

Start Park process

The Start Park process for a park design has been ideated and tested with a specific methodology based on a participatory approach and social studies, with a lasting of 6 up to 9 months for all the different activities. It comprehends several technical activities to properly design a GBI, but also social activities, based on a non-linear design thinking approach inspired by the double-diamond model. It uses gamified, design-based methodologies to fulfill its objectives.

Figure 4.3 StartPark process in a presentation for the *Giardini di Prossimità* project, image credit from The Start Park kindly concession

In terms of the design-thinking process, Start Park relies on the following phases which use different co-design tools (Table 4.2):

1. Exploration: a site-specific exploration of the context, looking up for opportunities and needs, using observation, interviews, focus groups, and world cafes. The insights from these activities are summarized within cultural probes, personas and stakeholders' maps;
2. Ideation: co-design workshops take place to generate ideas based on the insights gathered from the exploration part. Used mediation tools in this phase are brainstorming, scenarios, user journey map, and the Start Park game.
3. Test and validate: to collect feedback about the ideas of the previous stages, experience prototyping and service walkthrough tools are used.
4. Converge: the synthesis of a single design solution for the final output of a Start Park is essential for a clear and collaborative technical study of the area. In this phase public voting, debates and open space technology are properly used to collaboratively choose the best-developed scenario. The outcome of this phase, with the technical coordination from Iridra spa, is the delivery of a pre-feasibility technical proposal to public administrators and policy makers.

Figure 4.2 Service design and social sciences tools used for Start Park. (Berni et al. 2022)

	Exploration	Ideation	Test and validate	Converge
Personas	X			
Cultural probes	X			
Stakeholder map	X			
Design scenarios		X		
Start card game		X		
Co-creation workshop		X		
User journey map		X		
Service blueprint		X	X	
Experience prototyping			X	
Service walkthrough			X	
Business model canvas				X
Open space technology				X

The activities are organized in a minimum of 5 participatory events, divided into three typologies: animation, co-design and co-creation, required to give efficacy to the process (see the table below). In particular, it refers to methodological frameworks derived from participatory design practices and community engagement strategies focused on GBI. During both the experimented processes of Prato and Lucca, the Start Park process was conceived as follows:

- 1st event—Animation: Introductory launch of the project, aimed at highlighting the issues, necessities and ambitions for the park, the citizens and the surrounding area.
- 2nd event—Codesign: Codesign of the GBI, aimed at delivering codesigned GBI concepts for the park in response to specific social challenges.
- 3rd event—Animation: Hard-to-reach target, aimed at understanding and engaging marginalized user groups through socio-cultural research methods (i.e. in-depth interviews and on-site observation)
- 4th event— Co-Creation: GBI rapid prototyping, site-based, involving specific target groups to build collaboratively examples of nature-based solutions with the Start Park game tool.
- 5th event— Animation: closure party and final restitution, dissemination of the SP process output through offline and online events (e.g. live streaming presentation via Facebook, small groups guided tours in the park).

The Start Park process has been conceived with an adaptable and incremental process of co-design so that each phase of the process can be adapted to different contexts and situations, making replicability easier.

4.3.3 Start Park game tools and rules

As it was previously explained, the Start Park process, just as the Methodology that will be used for the case study (See 4.1Methodology), has a first Site research part, than there is the Co-design workshop and in the and the result's presentation. The first step, the site research is characterized by workshops and site analysis to understand the existing situation, focusing on the problems and needs. It is anyway in the second part, the co-design workshop, that the gamification Start Park tool is actively used. The tool, as will be explained in the following paragraph, has the form of a boardgame and is composed of a game board with the site and different cards that will help the participants in the codesign. The third part is the one of the results presentations, where it is elaborated the project's preliminary proposal. To understand how it works the second step of the Start Park methodology, the co-design workshop, the Start Park have created a manual for the gamification tool. A summary of the manual is going to be provided in the following, explaining the operation in the clearest way, starting from the explanation of the board and cards and than of the various steps of the tool, that compose the rules of the game.

Game rules

Each group of participants is given a site plan gameboard, the GBI cards, the activity, furniture and vision cards. The character cards are optional to the game, they can be given in a simulation of the process one to each player. The gamification process is divided in three turns:

1. Turn 1 (20 + 10 min) The team of players/co-designers has a first consultation in small groups of two. Each group selects the character they wish to play; empathizing with its needs, the sub-groups fill in a small plan of the park with at least: 2 Furnishings cards, 1 Activities card and maximum 2 GBI Punctual cards e 1 GBI Linear card. The players have to draw on the small plan gameboard where they would like to put each solution. After the activity in pairs, they have to discuss and motivate their choices to the rest of the group, based on the needs of the identified character.

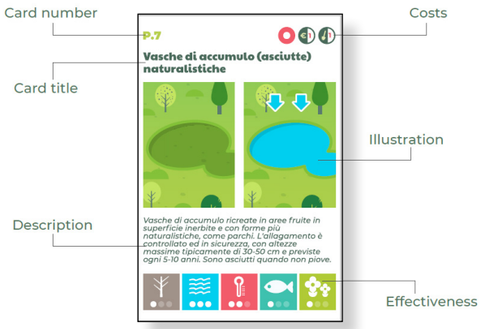
2. Turn 2 (45 min) The group draws a Vision card from the deck. The group will work together on the large Site Plan; the goal is to select together, starting from the small plans proposed by the subgroups, the GBI cards to create a plan shared by the whole group. For the rating of the project, the scores of the cards selected will have to exceed the following values, according to the chosen difficulty level and stay below the maximum spending scores indicated in the columns of the costs. (See Table 4.4 Game points)

3. Turn 3 (1 hour) The group draws the second Vision card. These Vision cards, together with your Super-Goal constitute the goals to strive for during the co-design phase: as a group, they have to choose furnishings and activities, taking into account the needs of the characters played. Use the large Plan on which you have already drawn the chosen GBI solutions and draw or write the selected Furniture and Activities cards.

Table 4.3 Start Park game points, image credit from The Start Park kindly concession

	Climate Change adaptation	Construction costs	Management fees
Easy level*	10	6	6
Medium level*	15	5	5
Difficult level*	20	4	4

The game tools



EFFECTIVENESS IN ADAPTING TO CLIMATE CHANGE RISKS

- Drought
- Flooding
- Heat waves
- Improvement of water quality
- Biodiversity support

COSTS FOR

- Construction costs
- Management fees

TYPE OF SOLUTION

- Linear solution
- Punctual solution
- Surface solution

card back view card front view

THE GBI CARDS

GBI cards refer to nature based solutions, the Green and Blue infrastructures, that are used by designers to adopt sustainable models for the management, collection and recycling of water in urban contexts, parks and gardens, and the same time enhance biodiversity. These cards will allow the players to design a park that is effectively able to adapt to climate change. Each card is distinguished by:

1. A value from 1 to 3 points to rate its effectiveness in adapting to the risks of climate change,

2. A value from 1 to 3 to indicate the costs that need to be sustained to use the card,

3. Three symbols indicating whether it is a Linear, Punctual or Surface solution.

If a card is Punctual, it means that it is a solution that the player can imagine in a specific point of the Plan (for example, a tank or an infiltration area); if a card is Linear, it means that it is used to transport the water from one point to another (eg. a pipe or a channel). A surface card is used for extensive surfaces, like parkings. Whenever you want to use a Punctual card, the player needs to ask its how the water can get there; if the point is close to the source of water generated, the Point card can also be played alone; if this is not the case, it is necessary to combine the Point card with a Linear one: the player must think of a recovery scheme,otherwise it will not be possible to transport the water to be recovered from the collection point to the place where the tip card has been inserted.

FURNITURE CARDS

These cards describe possible furnishings for the park that can be designed in more detail during the game to bring the park to life and encourage the construction of an active community around it. Some of these cards are left blank, to stimulate the creativity of the players that can add the furniture they like.

All the picture shown in this chapter are reported with the courtesy of the Start Park promoters, Iridra srl and Codesign Toscana, for more informations we remand to the Start Park website https://www.startpark.org/

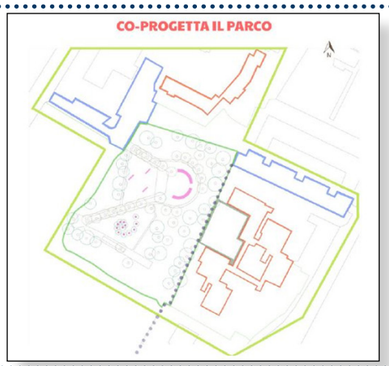
card back view card front view

ACTIVITY CARDS

These cards describe possible activities that can be designed in more detail during the game to bring the park to life and encourage the construction of an active community around it. Some of these cards are left blank, to stimulate the creativity of the players that can add chose the activities as they like.

VISION CARDS

These cards describe possible visions towards the renovation of the park. What do the players want to realize? What are the objective? What is designed with the Furniture and Activity cards must aim at reaching the Vision cards that the players will have in their hand. The Vision cards might seem a bit vague, so to leave the groupsthe possibility to decide how to interpret them.



THE SITE PLAN GAMEBOARD

It is a simplified plan of the green area to be transformed into a Start Park, in small and large format. in the picture we can see the one from the *Giardini Soccorso* co-design in Prato.

CHARACTER CARDS

The character cards are only used for simulations of the game, each player has to describe a possible character that could design a start park.

All the picture shown in this chapter are reported with the courtesy of the Start Park promoters, Iridra srl and Codesign Toscana, for more informations we remand to the Start Park website https://www.startpark.org/

4.3.4 Start Park applications

Start Park was prototyped and scaled in the municipalities of Prato and Lucca, in Italy, and it involved heterogeneous users from different contexts, so both the situations required co-design processes and they were perfect occasions to test the Start Park board game as a service design tool.

The goal in both cases was to activate local associations—i.e. CUT in Prato, Lucca Creative Hub in Lucca-, and with them to involve also the local neighbourhood committee, public administrators, local school students and parents, artists and activists, all kinds of stakeholders what could be interested in green and socially engaged practices. Another project goal was to spread environmental awareness among the citizens and the co-design of the two urban green areas was a great opportunity to gather around the questions. It was the perfect opportunity to take a close look and to experiment in person with the challenge of CC adaptation, specifically connected to water management, and understand the value of these actions of mitigation for the two cities.

Figure 4.4 Start Park road map for a Co-design process. Translation: Let's Start Park, opening event, Co-design of the objectives, Start Park open network, Jam on the future activities. Image from the StartPark Presentation for the *Giardini di Prossimità* project, image credit: The Start Park.

Start park co-design application
Giardini di prossimità

Project's Stakeholders: Iridra srl partner, Codesign Toscana, CUT Circuito Urbano Temporaneo, Prato municipality, Third sector associations Soccorso neighbourhood

Prato, IT

2020

Giardini di Prossimità, Prato

Project's Stakeholders*: Iridra srl (partner) - CUT | Circuito Urbano Temporaneo – Prato municipality - Tthird sector associations Soccorso neighbourhood*

In 2020, *Iridra Srl*, *Codesign Toscana* and *CUT- Circuito urbano Temporaneo*[73], won the *Designscapes, 2nd call Prototyping* project grant, so the first Start Park was successfully co-designed in a peripheral park, *Giardini di Prossimità*, in the Soccorso neighbourhood, in the Prato Municipality. The codesign process with the Start Park board game was organized during a workshop in February. It started with an introductory presentation of three projects and of the GBI infrastructure solutions to familiarize the participants with the rules of the games and explain to them what they were going to do. Then it proceeded by dividing the participants into four tables. Each of the tables had a game set and tried to design the GBI infrastructures for the park, to choose the furniture and the activities they wanted the park to host. The process was at any time followed by the facilitators from Iridra for the technical NBS part and from Codesign Toscana for the social part throw structured discussions, dot voting and other strategies to help the confrontation and the exposition of the necessities and solutions each participant referred.

As we can see from the pictures from the video report of the Codesign process (Start Park 2020), the objective of the game is to finish the first

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round by choosing three types of GBI cards: in this case a *Rain Garden* card, the *Wet Canals* and the *Naturalistic Pond*, to collect the rainwater from the school's rooftop, filter it throw natural systems and collect it in the storage pond in order to be reused and to avoid clogs in the existing drainage system. By counting the points of the cards the participants can easily measure the costs for the construction and maintenance and the effects on the Climate Change mitigation

73 *CUT-Circuito Urbano Temporaneo* has as its primary purpose to use the artistic medium as an engine of awareness and regeneration, aggregation and participation. It also aims to improve the use of places, with actions aimed at encouraging the growth of the collectivity; it promotes the territory, its people and the training of active citizenship, thanks methods linked to the teaching of art and dissemination of good practices, to make people understand that culture in a broad sense represents the first resource for the development of the society. (https://cutcircuitourbanotemporaneo.com)

4 5

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Co-design table, Credit: Start Park

2-3
Images from the Giardini di prossimità, Credit: Start Park

4
The first table's results for the board game after the first round, the GBI (Start Park video project, https://www.youtube.com)

5
Citizens in the consultation open air in the Giardini Soccorso, Credit: Start Park

6
The first table's results for the board game after the second and third rounds, furniture and activities (Start Park video project)

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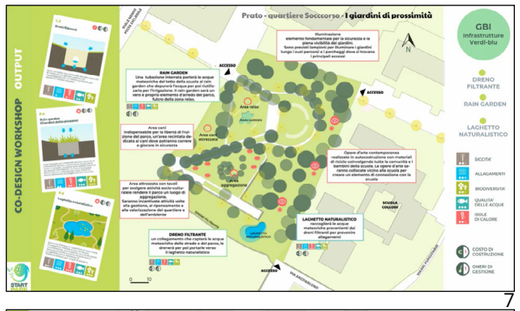
Figure 2.6 Mirafiori Sud Living lab in Turin (proGIreg project 2022)

they produce.

The second step is to choose furniture and activities for the community's inclinations and goals. The first table, in this case, choose the cards *Empty Space: Future change adaptation* and *Climate Change exaltation: Listening* and proposed, linked to the card's suggestions, an entrance path with attractive signals and temporary art pieces made with recycled materials, a sports path and an event area. In addition thy suggested organizing teaching activities in the benching area near the fruit trees. They also used a blank card to add inclusive furniture and playgrounds for the people with disabilities, one of these suggestions was about different sizes and heights for the benches so that they can be used without limitation from kids and adults. Another important part was to reserve an empty space in the middle of the park with multifunctional purposes, capable of changing and adapting to any kind of future situation, with temporary furniture, like the music hall. To stimulate the listening sense, they purposed to place frogs in the middle of the pond, but also a musical rainfall made with the GBI canals and to organize concerts and musical events in the empty music area. [74]

The other three groups turned out with different solutions in terms of solutions, landscape planning and of activities suggested offering a quite different and variable prospects of solutions to take into account for the final project. After this participatory part, the *Iridra S*rl will took charge of all the boards and suggestions to create a final version of the park's design, developing the project up to the Pre-Feasibility technical proposal, to give back to Prato's municipality a complete and round project ready to do. (Start Park, Iridra srl, and Codesign Toscana 2022; Berni et al. 2022; CodesignToscana and Iridra srl 2019)



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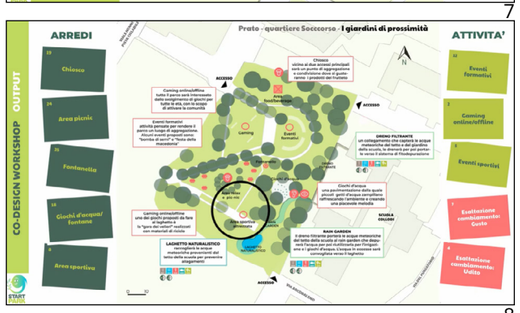

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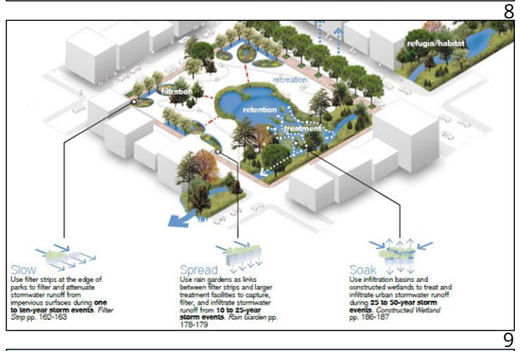

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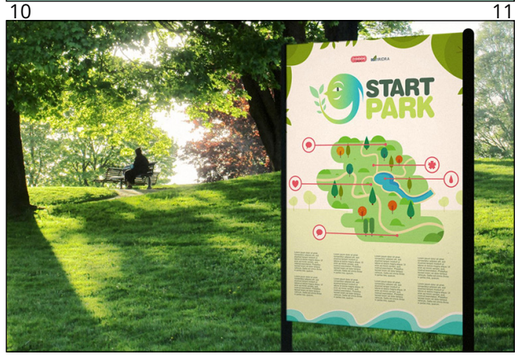

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7-8
Other solutions: The third table's results for the board game after the first round, the GBI fig.7 and the second's table's results for the second round fig.8 (Start Park video project, 2020)

9
Images from the presentation of the Nature based GBIs to the citizens, Credit: Start Park

10
Digital supports for the Start Park project network,Credit: Start Park

11
Start Park panels for the Giardini Soccorso, Credit: Start Park

74 *Start Park- Parchi resilenti* is a video project about the Prato, Giardini Soccorso experience on Youtube at this link https://www.youtube.com/watch?v=FOIfYrVsEM&list=PL7alElrbTt8IY 5yRL3fad 6xD_w_M3pcNf

Start park co-design application
Valgimigli Park

Project's Stakeholders: Iridra srl partner, Codesign Toscana, Lucca Creative Hub, ASP Carlo del Prete, Lucca Mnicipality, Third sector associations

Lucca, IT

2020-2021

The design process was once again scaled, in 2021, in the Lucca Municipality for the *Mura Urbane- Parco Valgimigli*, a green area near the historical city centre.

The overall process was quite similar to the one in Prato, starting with a first part of site study with a participatory site view as a launching event on the 7th of November 2020 and an online webinar on the 9th to introduce and explain the project's schedule. After this there was the codesign workshop, organized on the 12-14 December. In this case the workshop was held online due to COVID19 pandemic that forced all the community activities to find different ways of communication. Only in March the results of the codesign process could finally be shared in a public event in the park with the involved community and presented to the Lucca municipalitu and the public.

During the Covid pandemic, the codesign team had to face the urgency to re-design the activities with different methodologies and mediums, such as the collaborative platform *Google Jamboard* and *Mirò*, used to play with the Start Park game tool and different live streams of the event such as Facebook and Instagram streaming events. The social networks worked in this phase ad a process facilitator that would have otherwise had to be cancel due to the strictly covid restrictions and lockdown periods. The communication part is vital in this kind of bottom-up processes because it's very important to reach the wides number of people possible. One of the engagement tools used in this experience was a multiple-choice quiz launched every week in the *Facebook* page *Start Park Community,* regarding different topics such as climate change impact on water management, active citizens and climate change and design thinking and co-design in response to climate change, to be responded with short videos from the Start Park managers. These online methods had the positive side of a larger viewer community, open to all the online world and breaking the site specific and community borders.

Over the first two experiences in Prato and Lucca, Start Park has adopted different social research tools, design methodologies, usability and affordance strategies for effectively engaging audiences.

"For instance, in Prato and Lucca, hard-to-reach target groups were identified after an initial in-field research and observation. This allowed the Start Park team to understand the accessibility needs and

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format languages required for best engaging with the local target groups. […]Finally, the incremental structure of Start Park is highlighted when replicating the process in a new urban context. The design process takes the lesson learnt from the previous user research and co-design experiences as a starting point. During the practical cases in Prato and Lucca, each event was designed to progress and optimize the co-design of the GBIs for the parks as well as set up validated social science tools to build a resilient community, mixing several different activities related to multidisciplinary competencies and objectives—i.e.engagement, co-design, communication, design, engineering and architectural design" (Berni et al. 2022)

Another important aspect of the project it its educational value because it allows to every kind of user not only to understand the impact of CC on their lives and the value of the NBS solutions but to experiment them practically. The involvement in the participatory process puts any person directy in confront with water shortage problems, water bombs, droughts and helps them to understand the kind of solutions that are proposed to contrast them.

"Being part of an SP project enables participants to understand both the main constraints and threats of CC, the differences occurring between adaptation and mitigation strategies, discover GBI for water management and collaborative prototyping of NBS through design thinking tools." (Berni et al. 2022)

The Start Park game allows also to measure indicatively the construction and management costs of the park renovation, giving to the community the sense of the commitment the municipality has to face in order to realise the project. Other than that, The Start Park events are often oriented to schools and to kids, to grow their interest and understanding in the CC problem. (Start Park, Iridra srl, and Codesign Toscana 2022; Berni et al. 2022; CodesignToscana and Iridra srl 2019)

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Explanatory render of a GBI co-designed in Prato:
Phase 0: dry period, part of the wetland is dry and part is wet, the swale is dry;
Phase 1: during low-intensity rain events, the swale and all the wetland is wet;
Phase 2: during heavy rainfall, all the NBS elements, swale and wetland, are occupied by water at full lamination capacity;
Post Phase 2: the park is lived in safety (Berni et al. 2022)

5
Valgimigli co-designed site plan, Credit: Start Park

6
Kids envolvement in the co-design process, Credit: Start Park

Bibliography

Start Park, Iridra srl, and Codesign Toscana. 2022. *"Start Park Webpage."* 2022. http://www.startpark.org.

Start Park, Iridra srl, Codesign Toscana. 2020. *"Start Park-Parchi Resilienti: Video Project"* 2020. https://www.youtube.com/watch?v=1yGyM_iJEjY&list=PL7alElrbTt8IY5yRL3fad6xD_w_M3pcNf&index=4.

Berni, M., A. Rizzo, A. Menin, L. Bittini, E. Pacchierotti, R. Duina, and F. Masi. 2022. *"Start Park Project: Co-Designing Green-Blue Infrastructures to Build Resilient Communities to Climate Change."* In , 231–47. https://doi.org/10.1007/978-3-030-91843-9_15.

CodesignToscana, and Iridra srl. 2019. *"Co-Design Report."* www.codesigntoscana.org.

05

RESULTS

5 RESULTS

5.1 Site analysis

The site analysis was carried out throw different strategies, from the city's urban planning strategies and plans to demographic and population analysis, to a site view and in situ photographic report. The results of the analysis are reported in the following.

The city of Turin, how the climate changes

As it is reported in the first chapter *1.1.2 Climate change in cities and effects*, the previsions for the city of Turin in terms of climate change are highly dependent from the climate policies and strategies the city is going to activate in the next years. In the following image (5.1) is reported a summary of the main tools the city activated to tackle climate risks: the *Piano strategico dell'infrastruttura verde (Strategic plan for the green infrastructure), Progetto Disaster Risk Reduction Insurance (Disaster Risk Reduction Insurance project), the Piano per la resilienza climatica (Climate resilience city plan)* and the *Valdocco vivibile (Livable Valdocco project)*, that is centred in one particular neighbourhood of the city. For each tool are indicated the time frame, the main climatic risks the instrument responds to and the adaptation objectives. It is given with more detail a review of the *Climate resilience city plan*, which is considered one of the most important tools for the city, to direct sustainable actions towards city planning. (Spanoa et al. 2020; CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici 2020)

The negative impacts of Climate Change expected in the coming decades for the city are mainly related to two problems: firstly, an exceptional rise in average and maximum temperatures, especially in summer, which is going to cause an increase in frequency of extreme weather events, like heat waves, droughts and episodes of heavy rainfall; secondly, a reduction of average annual rainfall and river flows, resulting in a possible decline in agricultural productivity e loss of natural ecosystems. As it has been experienced in this late 2022, long periods of droughts and heavy rains are going to higher the possibility of landslides and other side effects, impacting on the city, which has already a fragile territory to take care of. The urban area of Turin is at the centre of a complex hydrological system and presents in its territory a hilly area with strong hydrogeological issues. The city has been reported to have 35 km^2 of riverside area exposed to flood risk, of which 29% at medium risk and 11% at high risk. Turin has already found itself having to cope with episodes of extreme events, like happened in 1994, 2000 and 2016 with extensive damage due to the flooding of

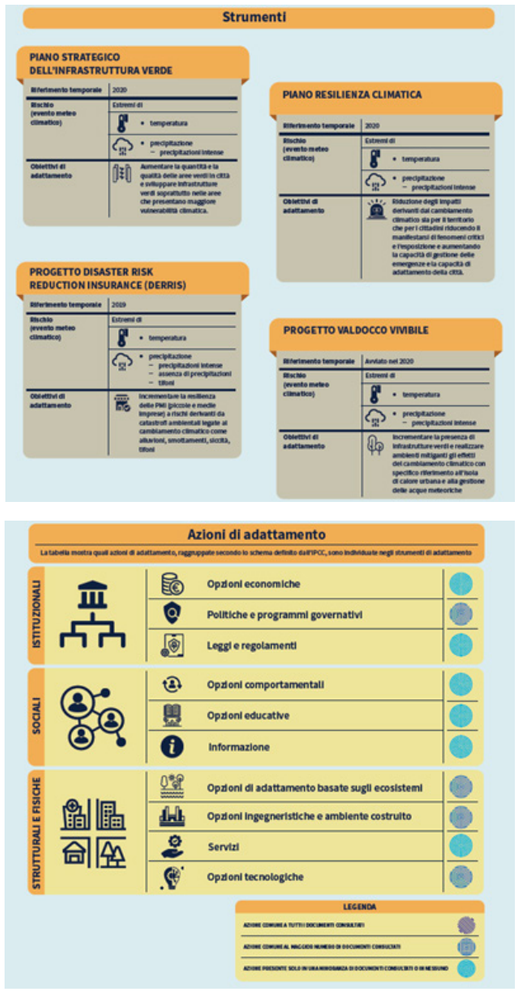


Figure 5.1 Summary of the climate strategies for the city of Turin (Spanoa et al. 2020; CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici 2020)

the city rivers and in 2003 with the first of many heat waves, that caused over the years a strong increase in the death rate in the city.

Torino's *Piano per la resilienza climatica*

To effectively combat climate change effects, it is necessary to change the development model and adaptation is a determining element of the 2019 *Turin 2030- Sustainable and Resilient* plan(Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020), which focuses on: climate resilience as both mitigation and adaptation, green infrastructures and Natured based solutions, a renewed public transport system, with electric and shared mobility, the circular economy, food and other waste reduction.

> *"Le azioni di adattamento hanno inoltre una ricaduta positiva in termini di miglioramento della qualità dell'ambiente urbano, si propongono di rendere le città più sicure e attrattive, di aumentare la qualità della vita dei loro abitanti e di chi le frequenta per lavoro, studio o per i servizi, rendendole più eque, solidali e capaci di innescare un processo di rivitalizzazione economica, sociale e culturale. [...] Per una corretta progettazione degli spazi pubblici è, dunque, fondamentale un'azione sinergica, che consenta di integrare azioni di mitigazione e adattamento. Un parco urbano, ad esempio, svolge un'azione di riduzione della CO2 (che può essere sequestrata dagli alberi, dal suolo e dall'acqua) e al tempo stesso riduce l'impatto delle ondate di calore, contribuendo al benessere termico delle persone che in esso si possono rifugiare."*[75](Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020)

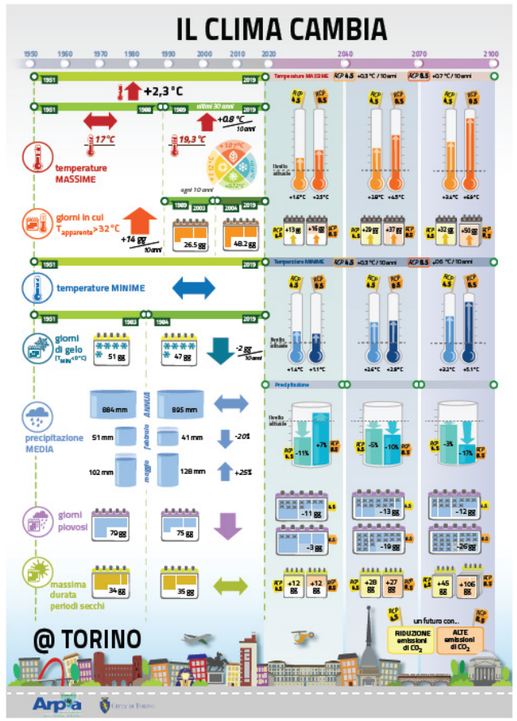


Figure 5.2 In the picture an infographics of the past climatic trends for the city of Turin and their future projections from ARPA Piemonte (Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020)

The Adaptation Plan aims to reduce the impacts deriving from climate change for both the territory and for the citizens; this general objective is divided into further purposes:

- Prevention: to reduce the occurrence of critical phenomena: heat islands, floodings etc.
- Management: adapt the urban environment and services to manage disasters and climate emergencies.
- Adaptation: adapt the buildings to improve the quality of life and contain the energy demand, manage the evolution of urban transformations to develop a culture of climate risk in the design of public works
- Information: to prepare citizens to face the new conditions.

In particular, urban adaptation, can be faced with green interventions (Nature based solutions

75 Translation: *"The adaptation actions also have a positive impact in terms of improving the quality of the urban environment, they aim to make cities safer and more attractive, to increase the quality of life of their inhabitants and of those who attend them for work, study or for services, making them more equitable, supportive and capable of triggering a process of economic, social and cultural revitalization.[...]For the correct design of public spaces, therefore, synergistic action is essential, which allows for the integration of mitigation and adaptation actions. An urban park, for example, carries out a CO2 reduction action (which can be sequestered from trees, soil and water) and at the same time reduces the impact of heat waves, contributing to the thermal well-being of the people who they can take refuge in it. "*

are cited in the Plan's text, gray (traditional technical interventions) or soft, meaning actions ranging from training to informing, from citizen participation to the use of ICT (Information and Communications Technology), to alert systems.

In the Plan is also reported a series of solution on how the administrations intend to adapt the city to CC towards:

1. *A cooler city*: a set of actions aimed at counteracting the impacts caused by heat waves and heat islands, reducing the component of solar radiation absorbed by the materials that make up urban surfaces thanks to the use of materials with high albedo index and the greater presence of shaded spaces.

   a. Green shading: in line with the *Piano strategico dell'infrastruttura verde*, the number of trees will increase in the city, using tree species more resistant to new climatic conditions and, therefore, able to overcome the conditions of summer heat stress.

   b. Building for freshness: involves the use of cool materials[76] characterized by high values of solar reflectance, and therefore able to reduce the temperature rise, for urban pavements (like coloured cements or draining materials) and roofs of buildings.

2. *A more livable city* - set of actions aimed at making the different moments of life comfortable daily life (work, leisure, travel and home life) even during heat waves.

   a. Cool and comfortable public transport: mainly involves interventions capable of ensuring usability of local public transport even on the hottest days, redesigning the stops to reduce the waiting time and realizing systems of shading, natural or artificial.

   b. The public green as a climatic refuge: the green, of any type, plays an important role in the regulation of temperature and the hill side of the city covered in woods is fundamental for this function; interventions will be carried out to increase its usability, providing rest areas, verifying the access routes and increasing the services.

   c. Fresh and comfortable schools and public services: it involves the implementation of interventions aimed at improving the thermal insulation of the buildings, making the internal temperature more comfortable in summer and limiting the energy demand for cooling. (Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020)

76 For a more detailed overview of different types and characteristics of *Cool Materials* it is suggested the consultation of the Emilia Romagna guide *Rigenerare la città con la natura:strumenti per la progettazione degli spazi pubblici tra mitigazione e adattamento ai cambiamenti* (Dessì et al. 2017) cited in chapter *1.1.2 Climate change in cities and effects*

Urban heat island risk for the city of Turin

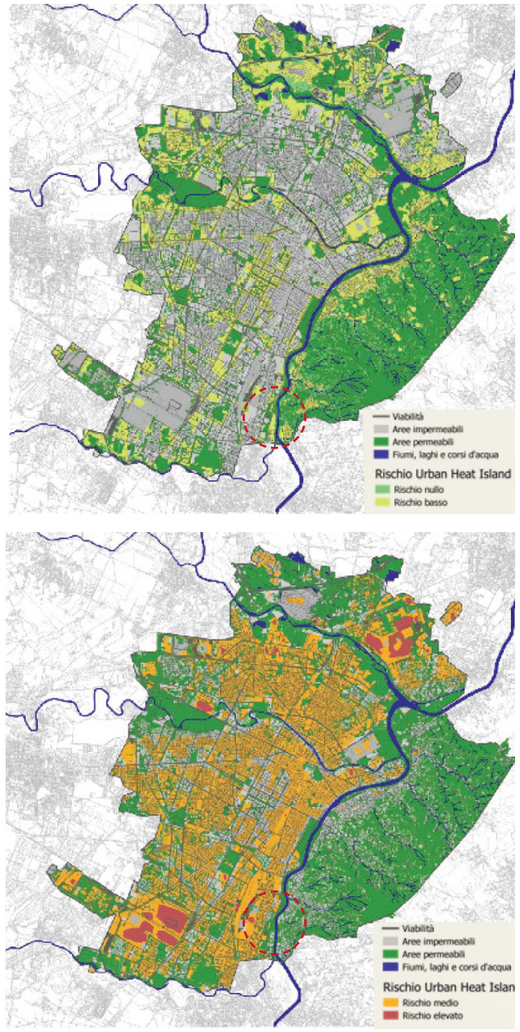


Figure 5.3-4 NBS and low risk of heat islands (left) and NBS and medium-high risk of heat islands (right) Site area in the round. (Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020)

Torino's legislative and urban planning framework

The area of the site Parco del Fioccardo:

1. Is classified by the Municipality of Turin by the P.R.G. as "Aree per Servizi pubblici S"(area for public services) and destined to public urban park an green area "Spazi pubblici a parco, per il gioco e lo sport" (lettera "v" art. 21 L.U.R.)
2. is included in the river buffer zone (art. 29 L.R. 56/77);
3. is included in subclass of hydro geomorphological risk (IIIb4a (P)) and falls in band "A" and "B" of the Extract Plan for the Hydrogeological Asset P.A.I. (DPCM of 24/05/2001 and subsequent amendments);
4. is within the areas classified with "high" probability of flooding (TR 10/20) e "Average" (TR100 / 200 years) according to the Direttiva alluvioni (Floods Directive);
5. is subject to restrictions " as it is included in the range of 150 meters from the shore of the river Po" (Legislative Decree 42/2004 "Code of Cultural Heritage and of the Landscape and subsequent amendments, art.142 letter c),
6. is included within the Piano d'Area del Sistema delle Aree Protette della Fascia Fluviale del Po (Area's Plan for System of the Protected Areas of the River Band of the Po) (L.R. 19/2009);
7. falls within a protected area "Dichiarazione di notevole interesse pubblico delle sponde del Po nel tratto che il fiume attraversa la città di Torino" (Declaration of notable public interest of the banks of the Po in stretch that the river crosses the city of Turin) (art. 142, c. 1, letter c) and 136 of Legislative Decree 42/2004 and subsequent amendments Code of cultural heritage and landscape under the D.M.11/01/1950.

The analysed plans are the following:

- Piano Territoriale Regionale P.T.R. (Regional Territorial Plan) of the Piedmont Region;
- Piano Paesaggistico P.P.R. (Landscape Plan) of the Piedmont Region ;
- Piano Regolatore Generale P.R.G. General Town Plan (P.R.G.) of the Municipality of Turin.

Landscape Plan P.P.R of the Piedmont region

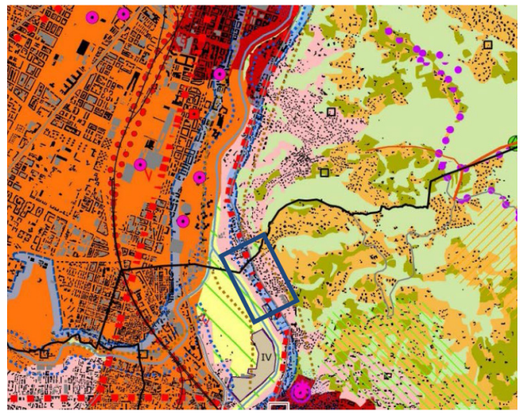


Figure 5.5 In the picture an extract of the P.P.R. plan, https://www.regione.piemonte.it/web/temi/ambiente-territorio/paesaggio/piano-paesaggistico-regionale-ppr

Inland river area P.P.R.

From the reading of the Landscape plan, the site area falls into the *"Zona fluviale interna"* (Inland river area) regulated by the Article 14 of the Implementation Rules of the P.P.R., in paragraph 7, that reads:

"Per garantire il miglioramento delle condizioni ecologiche e paesaggistiche delle zone fluviali, [...] nelle zone fluviali "interne" i piani locali, [...] provvedono a:

- *limitare gli interventi trasformativi [...] che possano danneggiare eventuali fattori caratterizzanti il corso d'acqua, quali cascate e salti di valore scenico, e interferire con le dinamiche evolutive del corso d'acqua e dei*

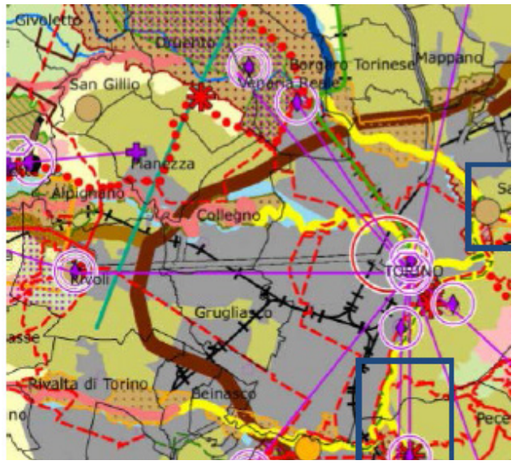


Figure 5.6 In the picture an extract *rete di connessione paesaggistica* of the P.P.R. plan, https://www.regione.piemonte.it/web/temi/ambiente-territorio/paesaggio/piano-paesaggistico-regionale-ppr

Flooding risk for the city of Turin

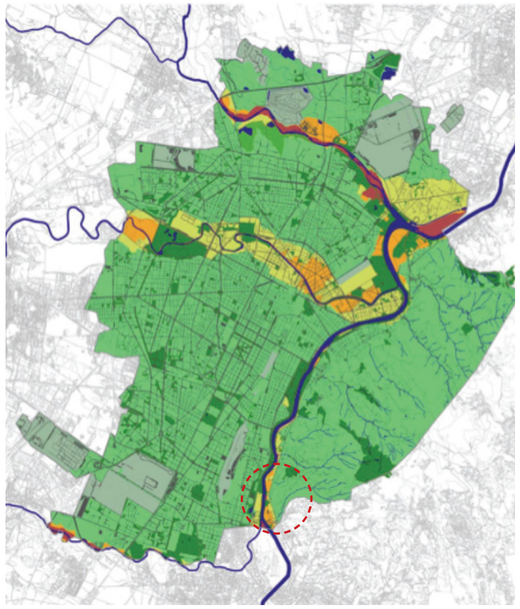


Figure 5.7 Flooding risk. Site area in the round. (Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020)

connessi assetti vegetazionali;

- *assicurare la riqualificazione della vegetazione arborea e arbustiva ripariale e dei lembi relitti di vegetazione planiziale [...];*
- *favorire il mantenimento degli ecosistemi più naturali, con la rimozione o la mitigazione dei fattori di frammentazione e di isolamento e la realizzazione o il potenziamento dei corridoi di connessione ecologica, [...];*
- *migliorare l'accessibilità e la percorribilità pedonale, ciclabile e a cavallo, nonché la fruibilità di eventuali spazi ricreativi con attrezzature e impianti a basso impatto ambientale e paesaggistico."*[77]

Landscape network plan P.P.R.

From the reading of the *Rete di connessione paesaggistica,* ecological connections network (fig 5.6), it is highlighted:

Network of pedestrian and cycle paths that insist along the Po river, like the regional Green Ways (Vento), and the other path network that affects the river system or the urban area characterized by tree-lined pedestrian walkways;

Areas of environmental redevelopment: peri-urban contexts of regional importance that affect the pre-eminently hilly area of the Turin Po basin;

Elements of the ecological network: the Meisino one and the area where the Po river meets the Sangone. Near the Confluence Park and the Mesino Park, a secondary node of the ecological

77 Traduction: *"To ensure the improvement of the ecological and landscape conditions of the river areas, [...] in the" inland "river areas the local plans [...] provide for:*
- *limit the transformative [...] interventions that may damage any factors characterizing the watercourse, such as waterfalls and jumps of scenic value, and interfere with the evolutionary dynamics of the watercourse and the related vegetation structures;*
- *ensure the requalification of riparian arboreal and shrub vegetation and of the relict strips of plain vegetation [...];*
- *favor the maintenance of the most natural ecosystems, with the removal or mitigation of fragmentation and isolation factors and the creation or strengthening of ecological connection corridors, [...];*
- *improve pedestrian, cycle and horse accessibility and practicability, as well as the usability of any recreational spaces with equipment and systems with low environmental and landscape impact. "*

General town plan P.R.G. of the city of Turin

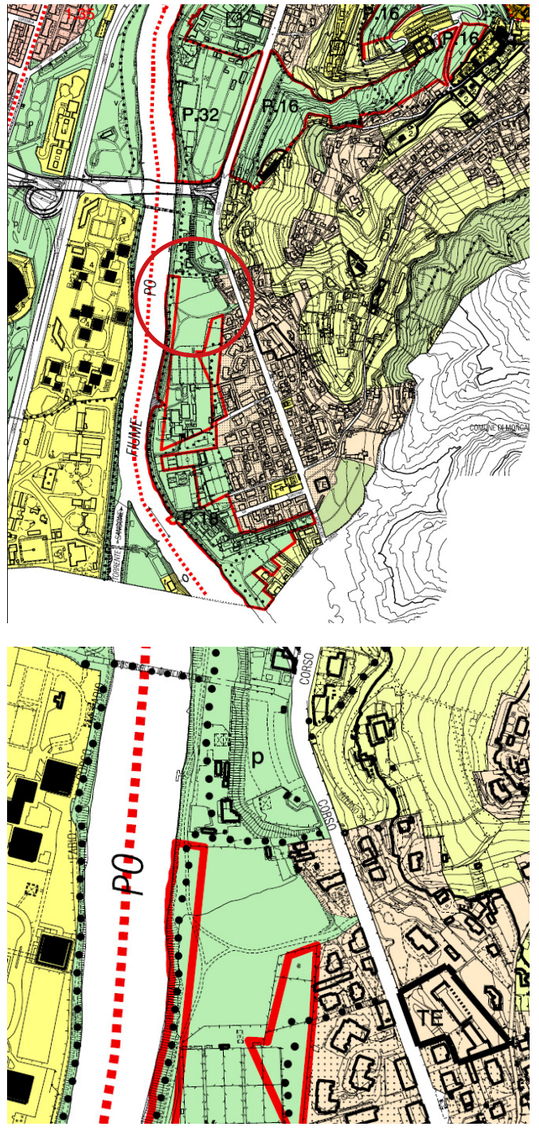


Figure 5.8-9 In the picture an extract of the P.R.G. General town plan, The site area in the circle is better shown in the fig 5.9 below. http://geoportale.comune.torino.it/web/azzonamento-2021

network is indicated.

Ecological connections: the need to reconstitute the ecological corridors along the Turin hydrographic system, in particular along the Po river course;

Historical cultural network: system of Savoy residences along the river system or within the Po basin.

General town plan P.R.G

As from the reading of the P.R.G Town plan, the site is indicated as a green area, that has a special constraint along the riverside, due to the possibility of flooding.

In the '70s and' 80s a gradual modification of the riverside morphology of the banks was carried out, with raising of the edge of the bank, modifications of the "land plan", filling of natural bends, which also led to changes in the river dynamics in case of flood, as was evident in the flood phenomena of November 1994 and October 2000. After that, the area has been subjected to engineering maintenance works in 2000 and 2008.

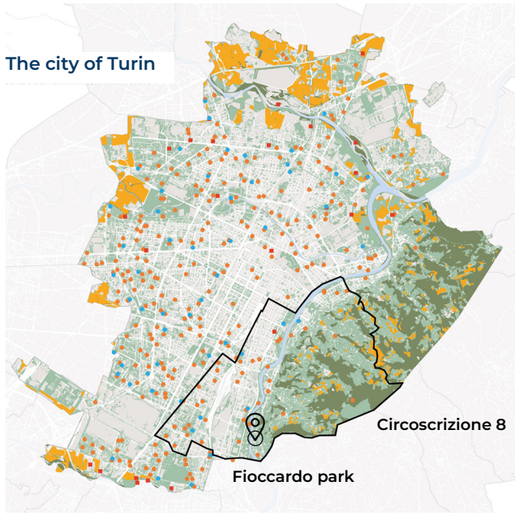


Figure 5.10 Map of the urban green system with indicated the site location. Image from the *Torino Atlas, mappe del territorio metropolitano, capitolo 09-Ambiente,* Torino Urban center,centro di ricerca Luigi einaudi, Rapporto Rota,IED, 2018

Figure 5.11 Historic picture of the Fioccardo neighbourhood from the '50, Archivio Giorgio Pelassa immagini del cambiamento, https://areeweb.polito.it/imgdc/schede/BP05.html

Figure 5.12 Actual picture of the Fioccardo neighbourhood from the '50, Archivio Giorgio Pelassa immagini del cambiamento, https://areeweb.polito.it/imgdc/schede/BP05.html

Site location, the city

Turin is one of the greenest cities in Italy with 55 m^2 of green spaces , both public and private per resident. The city can count a series of large parks and greenways that has inherited from its baroque past, united to the strong commitment from the 90s to today to convert brownfields into green areas, to recover river corridors as ecological belts and to create neighbourhoods' green spaces with each redevelopment project. Today, in Turin, 93% of the city's inhabitants can reach a green recreation area within 300 meters from home. (Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente 2020)

The neighbourhood

The site area is inserted in one of the largest natural areas of the city, along the Po River and near the hill side of Turin. The Fioccardo park is a long, green and partly wild area, that runs along with the Po River from the North to the South of Turin, from the Valentino Castle to the area Expo '61. The area has always been a point of passage from one banks to the other. Until the 1950s, the two banks of the Po were joined by numerous "cable" ferries, operated by boatmen of the Po river. Along this stretch of the shore, there was no significant industrial development, only a mill and various sand and gravel selection plants are worth mentioning; the regulatory plans of the time did not allow the development of major interventions. In the 70s and 80s, on the other hand, sports clubs began to develop, both in private areas and in municipal areas sold to third parties under concession. We have thus gradually witnessed the progressive occlusion of the accesses to the river and the almost total privatization of the banks, and finally the modification of the same morphology of the banks: with the pedestrian walkway that unites "Italia 61" with the Fioccardo curve, with the raising of the edge of the shore, modifications of the "countryside plan", filling of natural bends, which also led to changes in the river dynamics in the event of a flood. In the intermediate areas phenomena of environmental degradation, unauthorized landfills, illegal gardens, new illegal buildings have developed. The Fioccardo district, born on the river, has thus found itself devoid of any access to the banks, and deprived of the same "visibility" of the river, to which even the new residential settlements dating back to the early 90s of the hamlet turn their backs. Fioccardo. With the inclusion of the redevelopment of this stretch of shore as part of the "Turin City of Water" project, an attempt was made to recover the practicability of the bank and the reopening of the accesses to the river implemented with multiple lots of environmental redevelopment.

Figure 5.13 Historic picture of the Italia '61 site park near the Fioccardo park, source https://www.torinotoday.it/

Figure 5.14 Historic picture of the cable way for the Italia '61 park near the Fioccardo one, source http://www.perotorino.it/

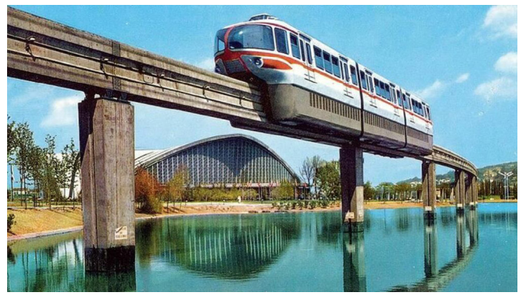


Figure 5.15 Historic picture of the Italia '61 railway near the Fioccardo park, source https://www.torinotoday.it/

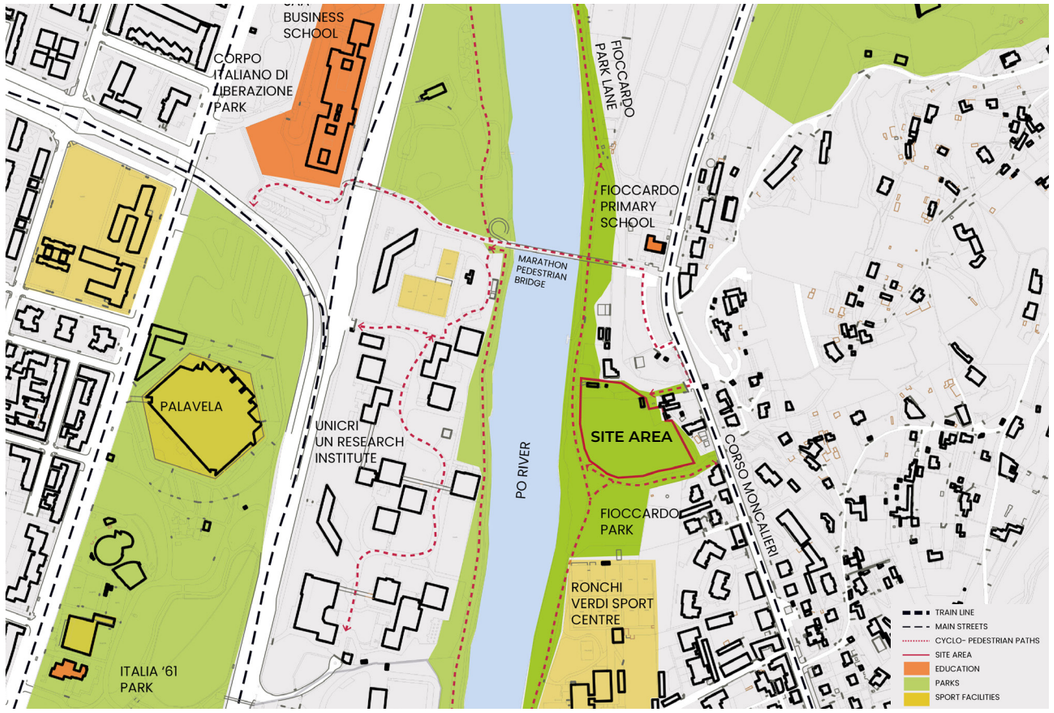
The Fioccardo park and the other parks

The Fioccardo area comes under the property of Turin's Municipality and refers to the Public Green administration office since it is part of the urban green areas and gardens. However, the budget for maintenance is always pretty small and some sites more than others tend to be unclean and less appealing, such as in the site case. On the other side of the river looking from the site one can see the Regione tower with its new administration neighbourhood and the Italia '61 park.

The Italia Park '61 is an important and historical site for Turin since it hosted *Expo 1961 (officially the International Labor Exhibition - Turin 1961*), which was held in Turin to celebrate the first centenary of the Unification of Italy. After the event, the exhibition facilities, such as the park, the Monorail and the Ovovia were used for further events and some of them have been converted to new purposes, with many difficulties and discussions and after long periods of inactivity. For example, the XX Olympic Winter Games of Turin 2006 allowed the conversion of the Palavela into a sports building, hosting the skating arena.

For all the historical and natural reasons, the area Parco Italia '61 on the right and the Parco Fioccardo have remained quite green and free from edification, being one of the sportive areas of the city, with pools, tennis courts and other facilities. The two riverside parks are united by the Maratona pedestrian walkway bridge near the Fioccardo primary School. The school does not have a big green area to use for recreational use, thereby the need for a dedicated park area.

Site location



Location site plan Graphic elaboration by the thesis'author

Figure 5.16 The Fioccardo Park site area in an aerial photo from Google Earth (https://www.google.it/intl/it/earth/)

Figure 5.17 The Fioccardo Park view.

Figure 5.18 People fishing and relaxing in the Fioccardo park.

Site specifics

The site was studied in a first moment from an empirical study, looking at the site throw aerial pictures and street views systems and in a second moment it was conducted an *in situ* site inspection. To study the altimetry of the site it was really helpful the use of the CTR technical regional cartography, downloaded from the regional website of the Piedmont region. it is reported a summary of the graphical studies carried for the site in the following pages. The site, as it was said in the previous pages, has an important path, that runs from North to South and easily connects it to the other city major parks. The accesses and the riverside street were recently restored, in the 80s and 90s, with the aim of giving the Fioccardo district access to the river again. The main driveway access to the site, however, still remains a private road, 442 street, closed by a gate. As the park is owned by the municipality, a right of passage has been established along the road. As for the site, the most important characteristics noted are:

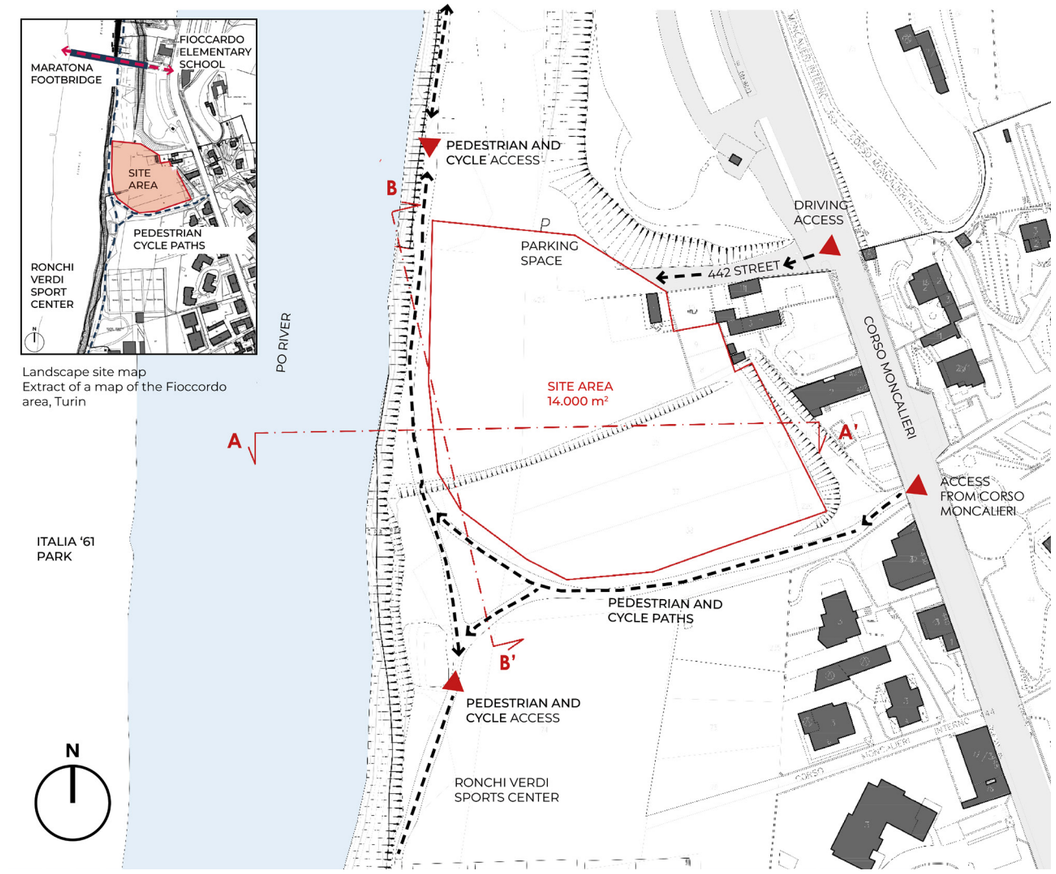
The accesses to the area of the Fioccardo park, the site has four different entrances:

- From the North coming from the Maratona cyclo pedonal bridge. It is a street for light passage, bikes and pedestrian only.
- From the South coming from the Ronchi Verdi sports center
- From the North-East with a semi-private street, 442 street, that conducts to an unused parking area
- From the South-East with another private access for pedestrians.

The pathways along the site have a gravel paving, but they are not well maintained, having lots of waste, holes on the ground and a general unappealing view. Along the site area, near the Maratona bridge there is an illegal landfill that should be reclaimed by the municipality.

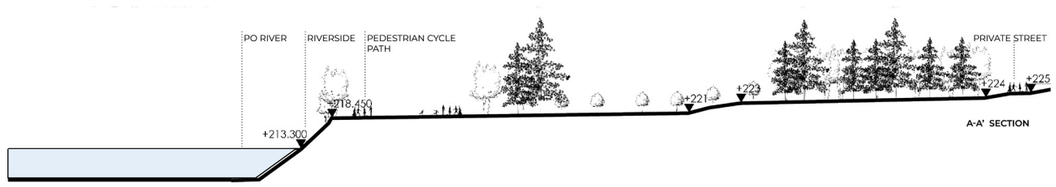
The site, being near the Po River and subjected to flooding events, suffered from several problems. During the years there have been several engineering interventions to higher the site on the river level, that now reports a very steep slope. Also inside the site area is reported a significant altitude difference.

Site specifics: location, entrances, site altimetry

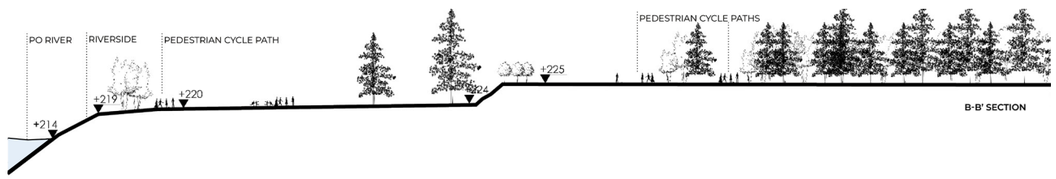


Landscape site map
Extract of a map of the Fioccordo area, Turin

Site location and site plan
Graphical elaboration from the CTR regional map

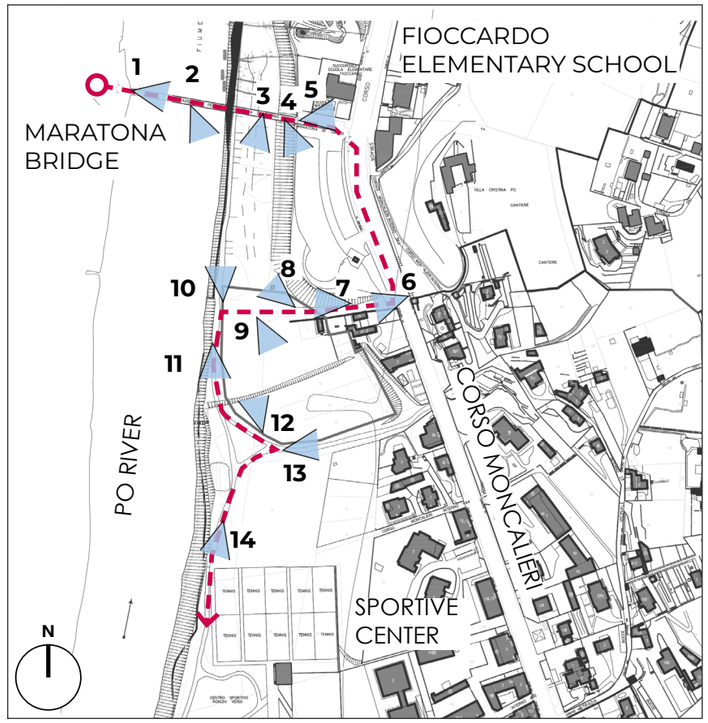


Site section
Graphical elaboration from the CTR regional map altimetry data



Site section
Graphical elaboration from the CTR regional map altimetry data
Images by the thesis'author

In situ site inspection and photographic report



The site inspection was organized during March, along with the Biomimesis referents, when the site was going to be studied for the Con.Nettare project. Then, when it was chosen as thesis case study it was done a second site inspection. All the pictures reported in the following are taken are from the March site view, as it is evident by the tree's condition.

Map of the site inspection with the order the pictures are reported. all the pictures and the graphical elaboration is from the thesis' author.

1. MARATONA BRIDGE

View from the Maratona bridge that connects the two banks of the Po just north of the intervention site, on the left among the trees the Fioccardo Elementary School, on the right side of the site.

2. PEDESTRIAN PATH

View of the cycle pedestrian path leading to the intervention area, with the current protection nets on the right of the path and the caravans at the top of the altitude difference on the left.

3. SITE NORTH ENTRANCE

View from the marathon walkway towards the cycle / pedestrian entrance to the intervention area, with the current safety nets

4. GARBAGE

View from the Maratona bridge towards the entrance to the area and the hill with abandoned waste.

5. FIOCCARDO ELEMENTARY SCHOOL

View of the Fioccardo Elementary School from the arrival of the Maratona bridge

6. SITE CAR ENTRANCE

Entrance to the site from Corso Moncalieri, via the internal road at number 442

7. PRIVATE STREET 442

Entrance road to the site from Corso Moncalieri, from number 442.

8. CAR PARKING AREA

View from the open space of the dirt car park towards the Po river, with the region's skyscraper and the cycle and pedestrian path in the background.

9. HEIGHT DIFFERENCE

Height difference inside the park that crosses the entire area longitudinally.

10. NORTH-SOUTH PATH

Cycle and pedestrian path inside the site with the marathon walkway in the background looking to the North of the area.

11. NORTH-SOUTH PATH

View of the intervention area from the cycle / pedestrian path looking to the south of the area.

12. RIVERSIDE BANKS

View of the project bank with the cycle / pedestrian path.

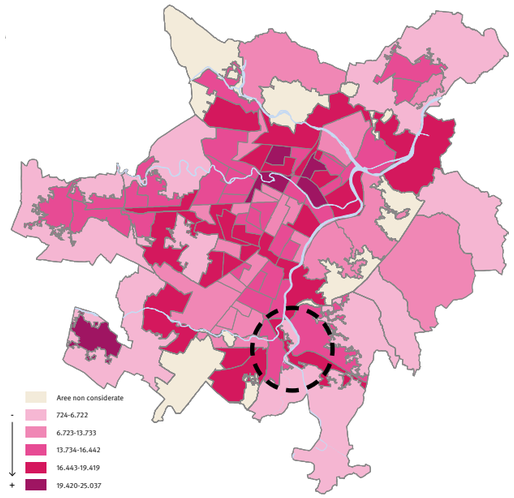
13. SECOND ENTRANCE

The second entrance from Corso Moncalieri

14. SOUTH ENTRANCE FROM THE SPORTS CENTER

View from the cycle / pedestrian path that continues from the intervention area towards the Ronchi Verdi sports center.

Turin resident population



Population analysis

The population of Turin, as well as the Fioccardo neighbourhood is growing older over the years, following the trend present in almost all european countries.

The families are often made by couples, mono parenthal families (single parents with one child), or singles, with a size that goes from 1 to 3 people, in rare cases up to 4 or more.

The Fioccardo neighbourhood is one of the most densely inhabited by foreign families in Turin. The rate of foreign people moving in the neighbourhood had a stable increase over the years from 1991 to 2011, ending with up to 7 times the number it was before. The main groups of foreign residents are Romanians, Moroccans, Chinese and Peruvians. another peculiar aspect is the internal migration, the residents who come from Southern of Italy are quite few in comparison to other neighbourhoods.

Old age index

RAPPORTO ANZIANI > 64 /GIOVANI < 15, PER 100 | FONTE: ELABORAZIONE RAPPORTO ROTA SU CENSIMENTO POPOLAZIONE

Average family size

NUMERO COMPONENTI | FONTE: ELABORAZIONE RAPPORTO ROTA SU CENSIMENTO POPOLAZIONE

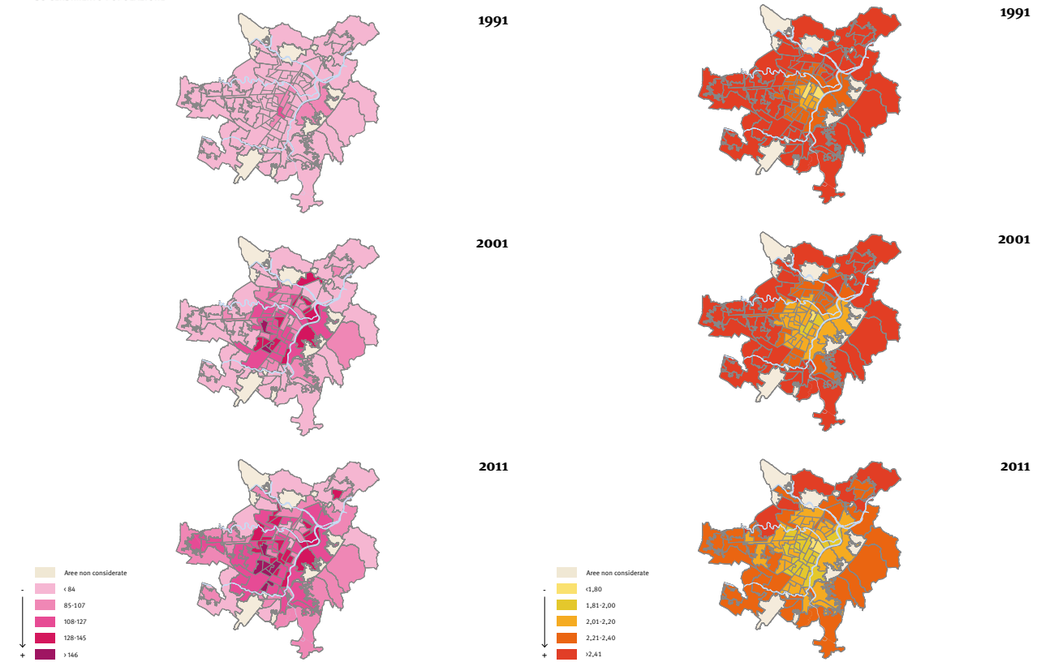


Figure 5.19 Different graphical maps fro the city of Turin used to study the population of the case study. Graphs from the *Torino Atlas, mappe del territorio metropolitano, capitolo 09-Ambiente,* Torino Urban center,centro di ricerca Luigi einaudi, Rapporto Rota,IED, 2018

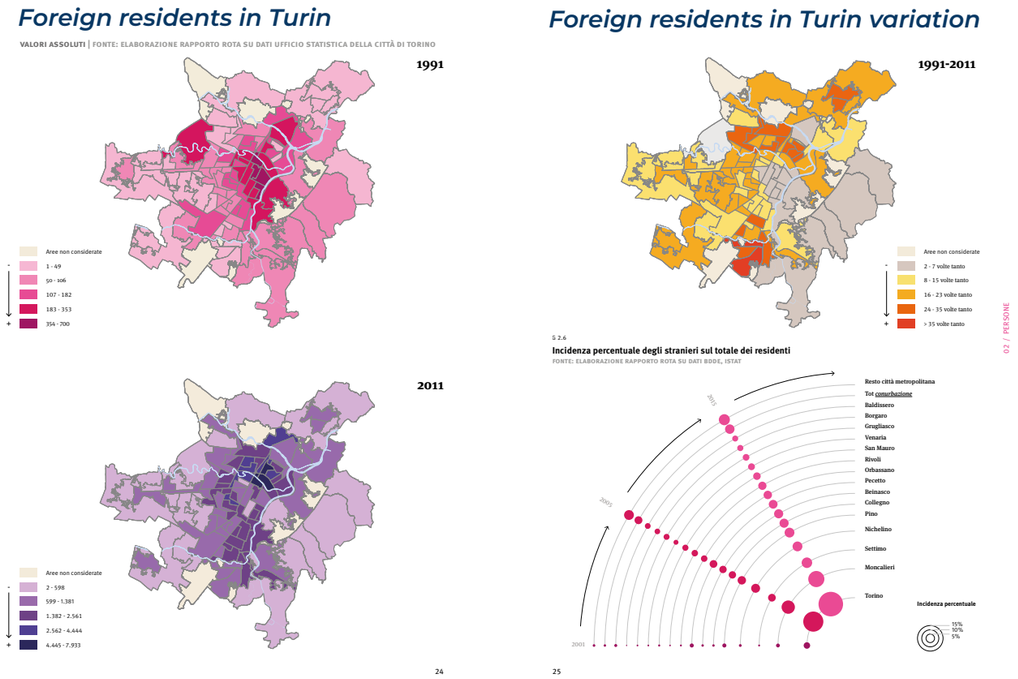


Figure 5.19 Different graphical maps fro the city of Turin used to study the population of the case study. Graphs from the *Torino Atlas, mappe del territorio metropolitano, capitolo 09-Ambiente,* Torino Urban center,centro di ricerca Luigi einaudi, Rapporto Rota,IED, 2018

5.2 Citizen engagement

The citizen engagement was simulated during a participatory workshop held in the university's rooms, with the use of the Start Park tool, described in the *4.3 The Start Park participatory tool* chapter. For the try out test of the tool it was asked the master students to play the roles of the hypothetic stakeholders involved in the process for the park regeneration.

Design thinking approach

The workshop was organized as a simulation of a real participatory process. Due to lack of timing all the different processes that in a real engagement would have been planned in different moments were reunited in one full morning of activities.

The first part of the workshop was held by the professors Patrizia Lombardi and Sara Torabi Moghadam with the explanation of the participatory processes and the theoretical introduction of both the concept of Nature based solutions and the rules of the game. This part in a real participatory process would have had the objective of informing the citizens and different stakeholders of the objectives of the participatory process: the park's regeneration through Nature Based Solution and illustrating the involved stakeholders of the project like the municipality, the facilitators of the process and the European, regional or private founders of the initiative. This first part plays in a real participatory process a relevant role of both:

- Education, because allows the involved citizens and stakeholders to understand what are Nature Based Solutions and GBIs and their role. Most of the times, as demonstrated also by the *Unalab* project, the citizens have only a vague or none understanding and knowledge of this topics. Also with the understanding of this solutions are also divulged sustainable practices.
- Knowing each other, to form a good collaboration and build trust between the different stakeholders for a sharing of ideas it would be useful to have at least one confrontation moment. This is extremely important in a real participative approach because it's were the stakeholders put the basis to work together in the project's ideation and maintenance.

For timing problems and because all the students knew themselves and were used to groupwork, this first activities were reduced to education purposes with a slide presentation.

The second part was held by the three students who presented their specific case studies. For the workshop purpose in fact the game was experimented in three different sites: one in Turin, at the Fioccardo park, that is going to be presented in this thesis, one in India, for a urban park regeneration using NBS and another one, slightly different in Turin where the same Start park approach was used to design sustainable solutions for the *Barriera di Milano* neighbourhood with the resident's engagement. The different case studies were presented with a slide presentation illustrating the site area and the site analysis, reported for the Fioccardo case study in the *5.1 Site analysis* chapter.

The third part was open to the student's work. They were divided and assigned in three groups for the Fioccardo case study, two groups each for the other two case studies and had 15 minutes to familiarize with the board and the cards and ask questions. They were also asked to select each a stakeholder's card and to act and defend their choices as they were that particular stakeholder. Then the participative work was divided in rounds:

1. In the first round they had to address the problem by using GBI cards. They could use a maximum of 2 punctual GBI card, 1 Linear GBI card and 1 Surface GBI card. The participants was asked to select where to put each solution and justify each choice with a sticky notes, sketches or notes on the board.
2. In the second round they had 30 minutes to address the problem by using the FURNITURE cards, using maximum 3 Furniture cards and justifying the solution with sticky notes.
3. for the third round they had to do the same using the ACTIVITIES cards, with maximum 3 Activities cards to select which happenings they wanted in the park.

At the end of the process it was given an extra 15 minutes to draw the conclusions on the board and prepare the presentation.

The fourth part of the process was indeed the presentation of the process results and conclusions to the class. Each group was asked to select a leader to express their ideas for each case study and summarize the major negotiations they had to do to arrive at the final choice. It was also drawn a summary of the sustainable points of each solution chosen, in order to give a comparison of both the GBIs efficacy and costs for the construction and maintenance of the park.

Workshop logistics

The workshop was organized during one of the last lessons of the course *Decision Making for Sustainable Development Goals* for the Master School in *Territorial, urban, environmental and landscape planning* on the 10th of June 2022. The course was held by the professors Patrizia Lombardi and Sara Torabi Mohadam and involved the participation of different stakeholders: the *Politecnico di Torino* and *Università degli studi di Torino*, with the *Dist department*, *Start Park*, with *Iridra Srl* and *Codesign Toscana* and the *New European Bauhaus*.

The *New European Bauhaus*, as it is reported in the previous chapter *3.2 Participatory approach for NBS design* (page 101), is an interdisciplinary initiative promoted by the European Union. The workshop took part of the initiative of *The Festival of the New European Bauhaus*[78], held from the 9th - to the 12th of June, as one of the more than 200 co-created side events independently organised by partners. The Fair and the Fest were organized both online and in site, with Brussels as the main location and a lot of other side events spread on all Europe continent. Some delegated from the movement took part to the Participatory Workshop as hosts of the event in Turin.

Workshop schedule

The day of the workshop had the following schedule:

78 For more on *The Festival of the New European Bauhaus,* 9-12 June 2022, look at the website https://new-european-bauhaus-festival.eu/home

- 8:30-9:00: Presentation of the project's stakeholders and introductory lecture to the participatory approach, the methodology and the rules of the workshop.
- 9:00-10:00: Presentation of the three case studies, the first one in the Fioccardo park in Torino, the second one in India and the third in the Barriera di Milano neighbourhood, in Torino. Explanation of the history site, the location and the main characteristics of the site in order to familiarize the students with the site problems and what they were going to do.
- 10:00-12:15: The class was divided in 7 groups of 7/8 students each and started the group work part
- 12:15-13:00: at the end of the group work the boards were pinned to the blackboard and each group called to present the results pointing out the reasons why they had each particular decision. For each case study different key words were selected in order to summarize the experience to the audience.

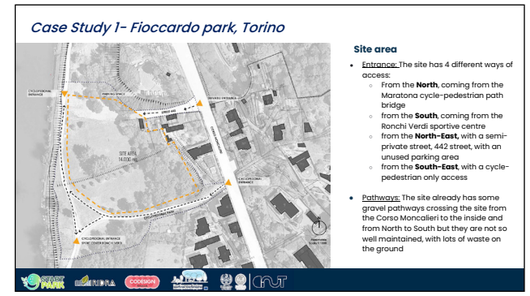
Figure 5.20 Poster for the workshop, graphic elaboration by the thesis' author

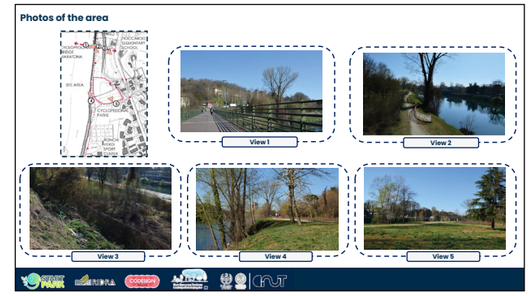
Workshop presentation

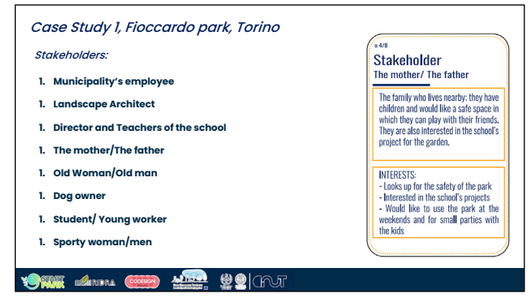
As said in the previous paragraph the workshop required the preparation of different co-design tools, that was carried by the thesis author in collaboration with the DIST professors, Sara Torabi and Chiara Genta and the other students who were experimenting the participatory approach for the other case studies. It was a team work to build the different materials and presentations that allowed for an exchange of thoughts that was itself participative.

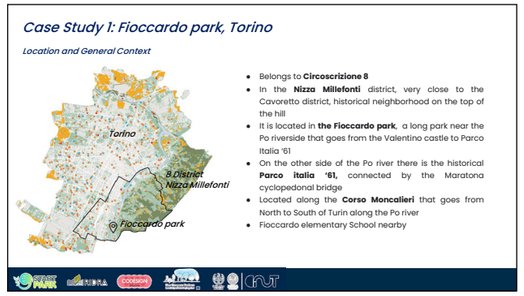
In the following it is going to be presented the outputs produced for the case study 1, the Fioccardo park, but a similar set of materials was produced also for the other case studies.

The presentation, after the first part held by the professors Patrizia Lombardi and Sara Torabi Moghadam with the explanation of the participatory processes and the introduction to the rules of the game, moved to the site presentation. The slides tried to summarize briefly the work of the *5.1 Site Analysis* and introduce the site problems and needs to the students, as well as the stakeholders they were going to play. They are here reported partially as examples as well as the other workshop materials in the following pages.









Figures 5.21 Slides for the workshop, graphic elaboration by the thesis' author

The participatory workshop tools

The game board

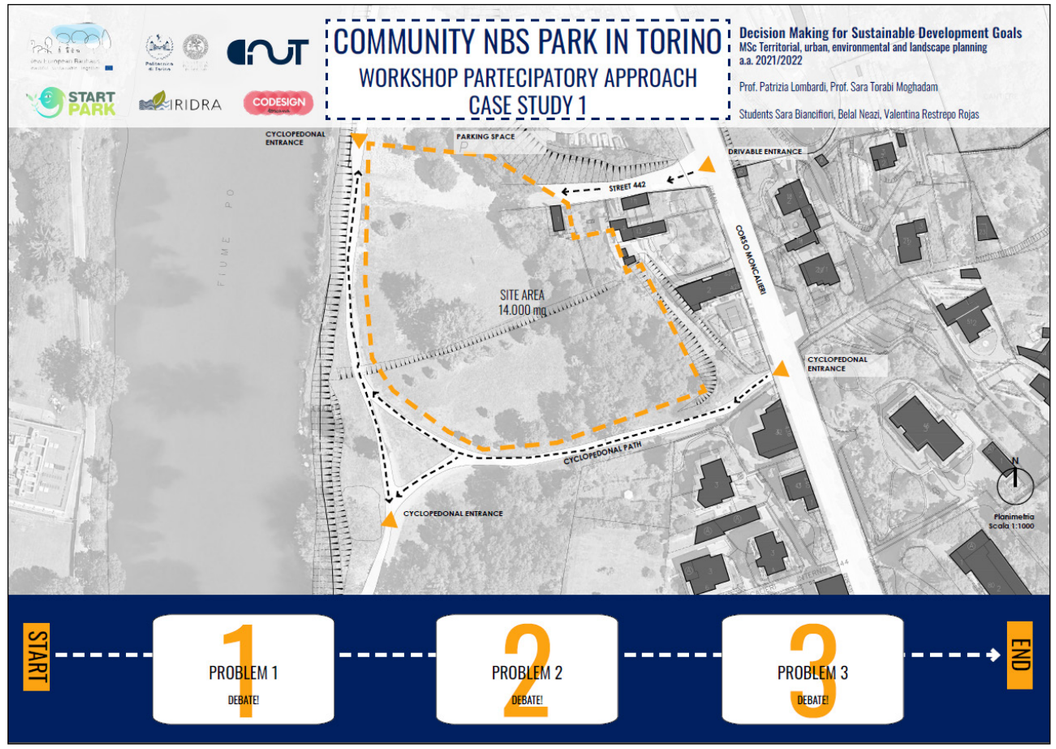
The game board, justa s the Start Park one is a simplifyed site plan indicating the entrances and main characteristics of the site to help the players during the gamification experience.

It was used during the gamification part of the workshop and all the groups was asked to draw, put stickers and note to it in order to decide together were to put each solution (each card) chosen. The board has a visualization part because it helps the participants to focus on the site plan and co-design better. The same approach is used with the construction of a model instead of a plan for *The planning for real* participatory approach described in chapter 3.

on the bottom of the board it was decided to add a blue strip to place each set of cards and guide the participants in the codesign process.

The *Problem 1* white spot it was going to be placed the *Start Park GBIs* set of cards, in the *Problem 2,* the *Furniture* set, and in the *Problem 3 the Activities* ones.

The process was guided with the use of the presentation, showing the timings and the cards required for each step of the co-design process.



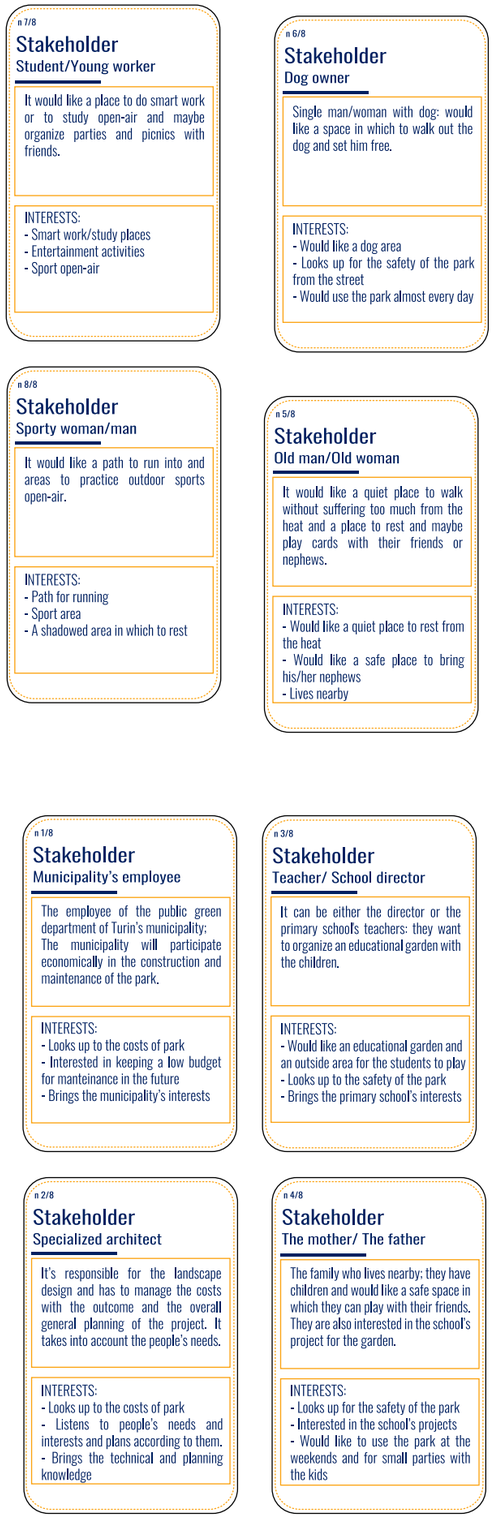
Figures 5.22 The site plan board game for the workshop, graphic elaboration by the thesis' author

The Stakeholders cards

For the simulation of the citizen engagement were selected different types of citizens, living in the neighbourhood, based on the site and population research. In each one of the three groups of the workshop was distributed this pack of cards and each member had to choose one and behave like the current stakeholder during the hole workshop process.

The Stakeholders selected for the case study were the following:

1. Municipality's employee: the municipality it will participate economically in the construction and management of the park
2. Architect: responsible for the design, has to manage costs and the overall planning of the project
3. Director and Teachers of the school: they want to organize an educational garden with the children
4. Mother/father: they have children and would like a safe space in which to do play their children
5. Old Woman/old man: would like a quiet place to walk without suffer too much heat and maybe play cards with friends
6. Dog owner: would like a space in which to walk and let the dog free
7. Student/ young worker: would like a place to do smartworking in the open air and maybe organize parties of Neighborhood
8. Sporty woman/men: he would like areas in which to practice outdoor sports open.



Figures 5.23 The stakeholders cards for the workshop, graphic elaboration by the thesis' author

The Start Park tools for the Participatory workshop

For the gamification part of the workshop, as we have said previously it was selected and tested the Start Park gamification tool. The Start Park responsibles, the Iridra srl and Codesign Toscana allowed the try out test for the workshop and give the permission to print and use the following set of cards, used for the co-design process.

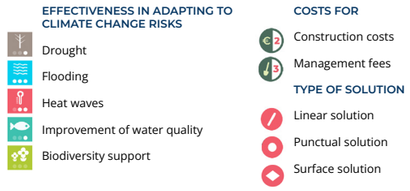
The cards, as well as the Start Park gamification tool and its partners are explained better in the methodology chapter *4.3 The Start Park participatory tool,* here it is just reported the three sets of cards that were used in the workshop, one for each turn of the game.

It was selected only this three sets of cards and not the fourth one, *The Vision cards,* just because of timing problems, since the workshop was going to be held in one lesson time, so with all the morning, and the cards were indicated in the manual as optional for the game execution.

All the cards and manuals from Start Park were translated in English since the workshop took place in an international course taught completely in English.

THE GBI CARDS

GBI cards refer to Nature based solutions, the Green and Blue infrastructures, that are used by designers to adopt sustainable models for the management, collection and recycling of water in urban contexts, parks and gardens, and the same time enhance biodiversity.



FURNITURE CARDS

These cards describe possible furnishings for the park that can be designed in more detail during the game to bring the park to life and encourage the construction of an active community around it. Some of these cards are left blank, to stimulate the creativity of the players that can add the furniture they like.

ACTIVITY CARDS

These cards describe possible activities that can be designed in more detail during the game to bring the park to life and encourage the construction of an active community around it. Some of these cards are left blank, to stimulate the creativity of the players that can add chose the activities as they like.

All the picture shown in this chapter are reported with the courtesy of the Start Park promoters, Iridra srl and Codesign Toscana, for more informations we remand to the Start Park website https://www.startpark.org/

The co-design process

During the co-design process all the groups were guided by the three undergraduates, each one following the groups working on its case study. A graphical presentation a graphic presentation projected in the classroom helped to mark the times and phases of the co-design process. In any case, the process followed the following steps, explained in the first phase of introduction to the workshop:

- Step 00: the groups were able to read the cards and clarify any doubts, also proceeding with the choice of a stakeholder card each.
- Step 01: after a discussion about the pros and cons of each card, which each group brought about with different methodologies, the goal was to choose the GBIs cards.
- Step 02: choice and motivation of furniture cards
- Step 03: choice and motivation of the activity cards.

The groups were all very participatory and willing to enter the role of simulation, showing great interest and often asking for further explanations regarding the nature based solutions used.

The presentation moment

At the end of the gamification process it was given some more time to organize a presentation of the outputs from each group and prepare to show the board to the rest of the class. During the presentation, each group was asked to select a leader to express their ideas for each case study and summarize the major negotiations they had to do to arrive at the final choice. It was also drawn a summary by post its and key words pointed at the class's blackboard, to analyse the sustainable solution chosen. Each group was asked to count the GBIs points for each solution in order to give a comparison of both the GBIs efficacy and costs for the construction and maintenance of the park they had designed.

1

2

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1 The professor Torabi explaining the rules of the gamification process to the class

2 The class during the lesson, with the students, professors and the Bauhaus stakeholders

3 The students during the gamification part of the workshop

4 The blackboard full of sticky notes at the end of the presentation

All the picture shown in this page and the following are reported from the participatory workshop approach, photos by the thesis' author.

5

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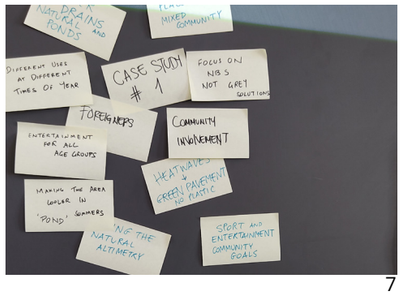

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12

5
The workshop materials and cards.

6
The printing and cutting phase before the workshop, to prepare the cards.

7
Sticky note on the brackboard after the presentation

8
The class during the presentation of the case studies

9
One group's leader presenting their co-designed project.

10
One of the groups during the gamification phase

11
Workshop board, cards and other tools in the class

12
The thesis' author explaining the case study to the class.

5.3 Analysis

Group 1, analysis of the co-designed park

1

The first group was composed by six students impersonating just as many stakeholders: a Sporty woman, a dog owner, a young worker, a specialized architect, the Fioccardo elementary school director and an old woman.

Together they evaluated the GBIs cards individually, and then after consultations, they opted for a system of filter drains to collect all the area's rainwater and address it to the naturalistic pond. On the other side they chose to use some raingardens help the infiltration of the water underground, because of their low cost for construction and maintenance.

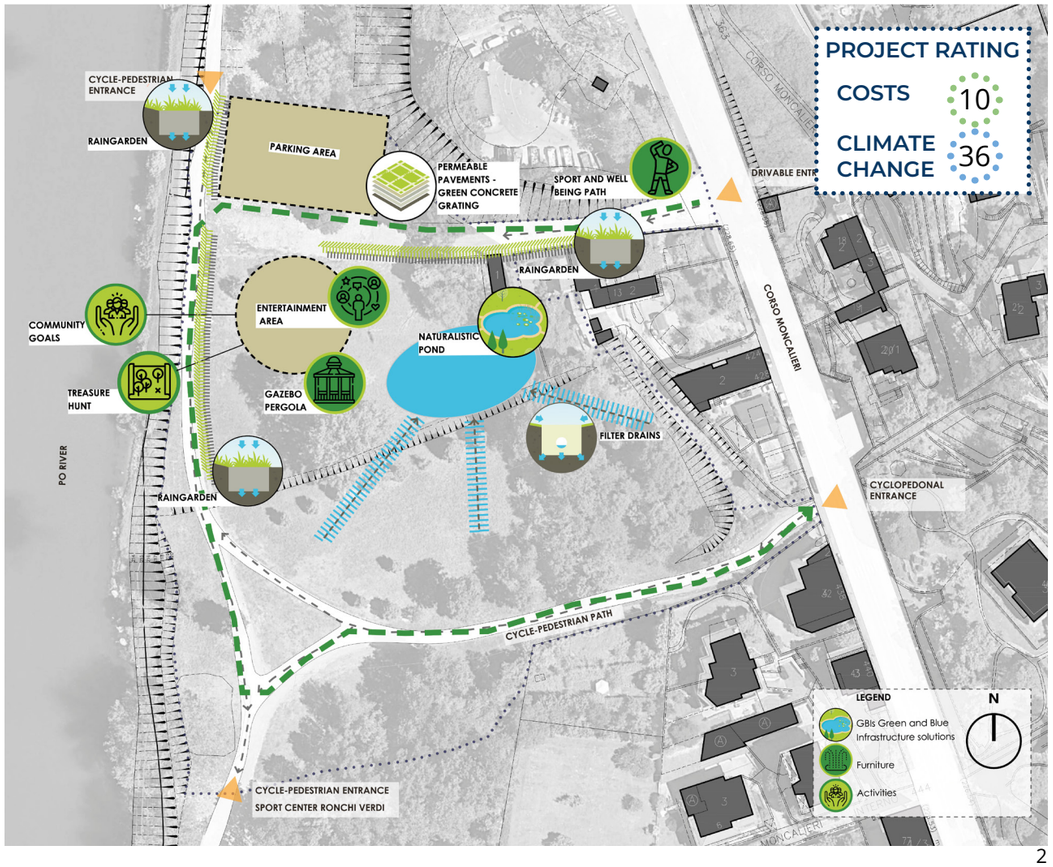
As for the furniture for the park, the group chose to place a pergola, which could be used for events to gather the community and for the students and elderly to have a place to rest and spend some time chatting with their nephews, friends or for the workers to do smart working open air. They also promoted the creation of a sport well being-path, with small exercising machines open air, based on the existing paths crossing the area, that was going to respond to the needs of the the kids and the sports people.

The activities that everyone agreed upon were the treasure hunt and the community goals, which were considered fun events to discover the park for the kids of the neighbourhood and to be able to worship a sense of community between the other members.

1
Group 1 game board from the Participatory Approach workshop.

2
In the other page a representation of the group 1 park project, graphic elaboration by the thesis' autor.

GROUP 1
Participatory Approach workshop



2

6 STAKEHOLDERS

1. A Sporty woman
2. A dog owner
3. A young worker
4. A specialized architect
5. The Fioccardo elementary school director

An old woman.

GBI SOLUTIONS

- *2 punctual solutions:* Naturalistic pond and a Raingarden
- *1 linear solution:* Filter drains
- *1 surface solution:* Green plastic gratings

FURNITURE

- A Gazebo/pergola
- A sport and well being path
- An entertainment area

ACTIVITIES

- Treasure hunt
- Community Goals

Group 2 analysis of the co-designed park

3

The second group was made by seven people, playing the roles of the seven stakeholders: the Municipality's employee, the schoolteacher, a landscape architect, a mother living in the neighbourhood, a student, a runner and an old man.

Throw participative discussion the group tried to address the problems of the first round by using GBI cards to design a green and blue infrastructure in the park. Evaluating the possibilities, they choose 2 punctual GBI cards: the creation of a naturalistic pond and the use of a phytodepuration for gray water treatment, also a Linear GBI card, the filter drains, to collect the water and move it to the pond and phytodepuration systems. They preferred the natural pond over the naturalistic dry storage pond, which was the preferred alternative since the site project is a green area, because being full of water all the time it could help with the climate mitigation and at the same time be more appealing for the people and for the site biodiversity. The choice of the phytodepuration was driven by the will to treat rainwater and wastewater maintaining an appealing view of the park and offering the possibility to see the technology behind it. Adding to this they choose to use a Surface GBI card, the green concrete grating for the pavements, which they imagined for the common parts of the park.

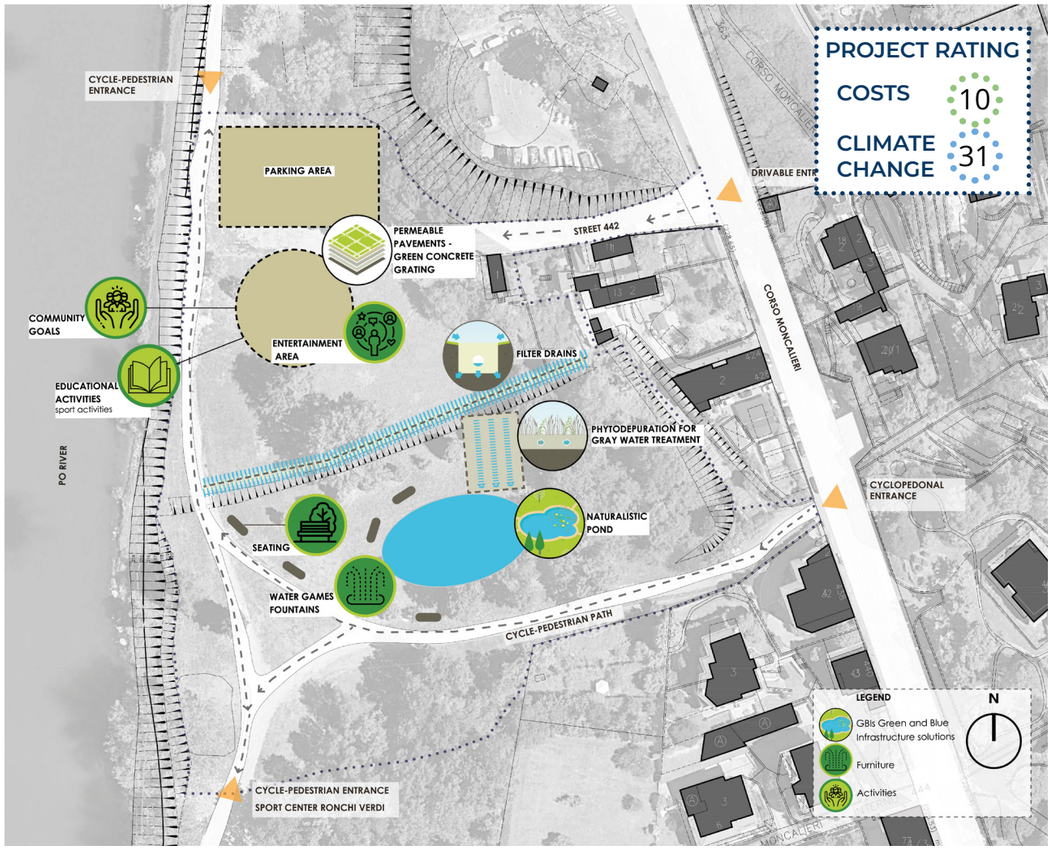
As for the park's furniture the group chose for the park, they wanted to explore the fountains and water games which could help in the mitigation purpose, seatings as the old man wanted and an entertainment area, which was something they were all pretty much agreeing on.

The activities preferred were Educational activities, suggested both by the mother and the teacher, sport events as the runner suggested and the community goals card. This card was judged capable of renewing the sense of community gathering around the park because all of the stakeholders wanted to be more involved on climate change actions and were willing to do it together. Some of the community goals they suggested was to organize a recycling activity for the kids of the school and to organize a separate collection of the park's garbage.

3
Group 2 game board from the Participatory Approach workshop.

4
In the other page a representation of the group 2 park project, graphic elaboration by the thesis' autor.

GROUP 2
Participatory Approach workshop



4

7 STAKEHOLDERS

1. The Municipality's employee
2. The schoolteacher
3. A landscape architect
4. A mother living in the neighbourhood
5. A student
6. A runner

An old man.

GBI SOLUTIONS

- *2 punctual solutions:* Naturalistic pond and Phytodepuration for gray water treatment
- *1 linear solution:* Filter drains
- *1 surface solution:* Green concrete gratings

FURNITURE

- Water games and fountains
- Seating
- An entertainment area

ACTIVITIES

- Educational activities
- Community Goals

Group 3 analysis of the co-designed park

5

The third group had 8 stakeholders involved: the municipality's employee, a schoolteacher, the landscape architect, a father, a student, a dog owner, a sporty man and an old woman. To simulate the participatory meeting the group used a voting-based approach to the decision making: it involved each on talking in turn and voting 3 cards each, explaining their reasons to the other stakeholders.

With this method they draw their choices to four GBI cards: a naturalistic pond in the upper part of the site, wet canals along the pathway and filtering boxes in the southern part of the park. They also thought about creating a safe green pavement area for the parking area, to improve the park's accessibility using Green plastic gratings.

For the furniture they decided for seating to place along the pathways and in the picnic area. They also imagined bringing a lighting system to illuminate the park at night alongside the path and placing also single lights near the picnic area.

The activities chosen for the park were educational activities to explain the water systems to children and adults and sport activities, which were imagined with the collaboration of the sports center nearby.

5
Group 3 game board from the Participatory Approach workshop.

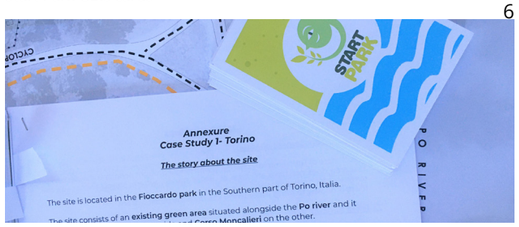
6
Picture from the material prepared for the workshop

7
Start Park GBIs cards

8
Group 3 playng with the Start Park game

9
In the other page a representation of the group 3 park project, graphic elaboration by the thesis' autor.

6



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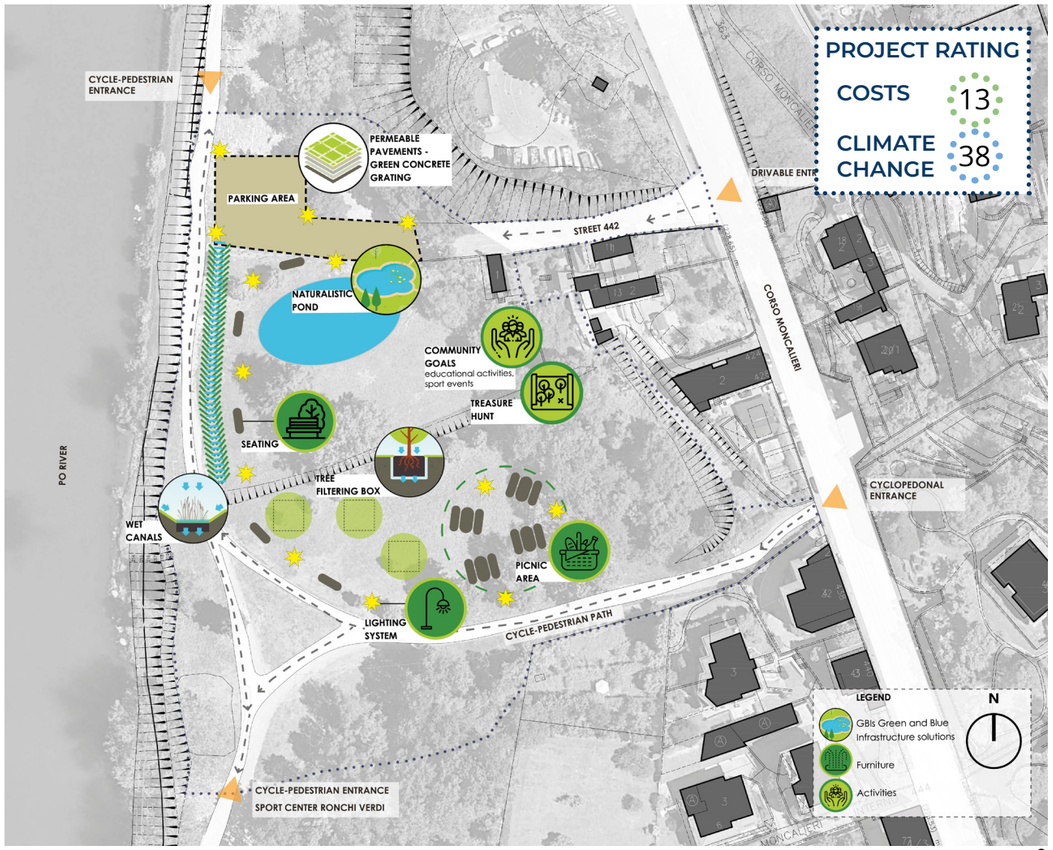
8

GROUP 3
Participatory Approach workshop



9

8 STAKEHOLDERS

1. The municipality's employee
2. A schoolteacher
3. A landscape architect
4. A father
5. A student
6. A dog owner
7. A sporty man
8. An old woman

GBI SOLUTIONS

- *2 punctual solutions:* Naturalistic pond and Tree-lined Filtering boxes
- *1 linear solution:* Wet canals
- *1 surface solution:* Green plastic gratings

FURNITURE

- Street lighting system
- Seating
- Picnic area

ACTIVITIES

- Treasure hunt
- Community Goals

Overall considerations and comparison table analysis

The output analysis was carried throw a contrast and comparison method, with the idea of using all the common ideas as the basis for the final project. All the groups in general focused on similar topics, like the need of filtering systems to help water management, even if they choose different solutions to address it, with Filter drains, Wet canals or Tree-lined Filtering boxes. Another common point was the need for pavement solutions for the parking area, in order to make the area accessible easily by car, both for the activities imagined in the area, but also for any kind of person with mobility problems, for either old people or wheelchair users and injured ones. The GBIs cards used for the construction of the green and blue infrastructure have a point-based system that evaluates the Nature Based Solutions chosen strategy for five parameters. In the same way every card is assigned a rate from 1 to 3 for the construction and maintenance costs. This way each group's project can be evaluated for its efficacy in the adaptation to climate change and in particular towards the contrast of droughts, flooding and heat waves risk, but also towards the improvement of water quality and support of biodiversity. The results have been elaborated and are reported in the *Green and blue infrastructure comparison table* below. All the groups were generally very careful with the costs management, from 10 to 13 points, obtaining significantly different results in terms of CC adaptation, from 31 to 38 points. Another important idea commonly expressed by all the groups in the presentation is the need to create a gathering point for the community, where events of different kind could be organized, some groups though about a picnic area, others at a platform area, but the main challenge was the same. It was also, pointed out the need for shadowed seating area to rest, work or have picnics, with attention to the elderly ones. Important attention was carried to the kids of the community because almost every group proposed educational activities, like urban gardens in collaboration with the local school, or treasure hunts and sport activities. A good importance was given also to the nearby sportive center, one group even proposed a collaboration for the sportive activities to develop. To sum up, the game had a good participatory level, all the students generally appreciated the opportunity and had fun developing the ideas, very actively engaging with each other. The solutions proposed by each group were very different one from the other even with very similar starting point: all the groups had the same gameboard and cards, but the choice made came to be multiple, giving evidence of the variability of the process. The cards and solutions that all the groups had in common were the Naturalistic pond and the Community Goals. Multiple cards were anyway chosen by two groups out of three: Filter drains, Green plastic gratings, Seating, Entertainment area and Treasure Hunt ones. These solutions are the ones that are surely going to be taken into account in the project idea, while the others are going to be used as suggestions. The analysis is summarized in the following *Comparison Table Analysis*.

GBIs Green and blue infrastructure comparison table

		GROUP 1	GROUP 2	GROUP 3
COSTS FOR	Construction	6	6	7
	Maintenance	4	4	6
RESILIENCE TO CLIMATE CHANGE RISKS	Drought	6	5	5
	Flooding	7	5	7
	Heat waves	8	7	10
	Improvement of water quality	9	9	8
	Biodiversity Support	6	5	8
	OVERALL RESULTS	10 / 36	10 / 31	13 / 38

COMPARISON TABLE ANALYSIS
of the groups' Participatory Approach workshop

GROUP 1

6 STAKEHOLDERS

1. A Sporty woman
2. A dog owner
3. A young worker
4. A specialized architect
5. The Fioccardo elementary school director
6. An old woman.

GBI SOLUTIONS Costs 10 pt / Climate change 36 pt

- *2 punctual solutions:* Naturalistic pond and Raingarden
- *1 linear solution:* Filter drains
- *1 surface solution:* Green plastic gratings

FURNITURE

- A Gazebo/pergola
- A sport and well being path
- An entertainment area

ACTIVITIES

- Treasure hunt
- Community Goals

PARTICIPATORY METHODOLOGIES USED

- Discussion of advantages and disadvantages of each solution
- Negotiation between the group members

GROUP 2

7 STAKEHOLDERS

1. The Municipality's employee
2. The schoolteacher
3. A landscape architect
4. A mother living in the neighbourhood
5. A student
6. A runner
7. An old man.

GBI SOLUTIONS Costs 10 pt / Climate change 31 pt

- *2 punctual solutions:* Naturalistic pond and Phytodepuration for gray water treatment
- *1 linear solution:* Filter drains
- *1 surface solution:* Green concrete gratings

FURNITURE

- Water games and fountains
- Seating
- An entertainment area

ACTIVITIES

- Educational activities
- Community Goals

PARTICIPATORY METHODOLOGIES USED

- Solution comparison over efficacy and maintenance costs
- Organized discussion: participants talking in turns

GROUP 3

8 STAKEHOLDERS

1. The municipality's employee
2. A schoolteacher
3. A landscape architect
4. A father
5. A student
6. A dog owner
7. A sporty man
8. An old woman

GBI SOLUTIONS Costs 13 pt / Climate change 38 pt

- *2 punctual solutions:* Naturalistic pond and Tree-lined Filtering boxes
- *1 linear solution:* Wet canals
- *1 surface solution:* Green plastic gratings

FURNITURE

- Street lighting system
- Seating
- Picnic area

ACTIVITIES

- Treasure hunt
- Community Goals

PARTICIPATORY METHODOLOGIES USED

- Organized discussion: participants talking in turn
- Voting-based approach to the decision making: each participant had to vote 3 cards in turn, explaining their reasons

SOLUTIONS IN COMMON BETWEEN 3 GROUPS

- Naturalistic pond
- Community Goals

SOLUTIONS IN COMMON BETWEEN 2/3 GROUPS

- Filter drains
- Green plastic gratings
- Seating
- Entertainment area
- Treasure Hunt

THINGS ALL GROUPS GENERALLY CONCORDED ABOUT

- The need of filtering systems to help water management
- The need for pavement solutions for the parking area
- An event area for the community events
- A shadowed seating area to rest, work or have picnics
- The need to gather the community: with games, educational or sportive activities

5.4 Output

5.3.1 The project's idea

The project's idea started from the citizen's consultation analysis, just like every participatory process should do. Starting from the given suggestions and necessities coming out from the workshop, the effort was to try to put them all together in the form of a preliminary project.

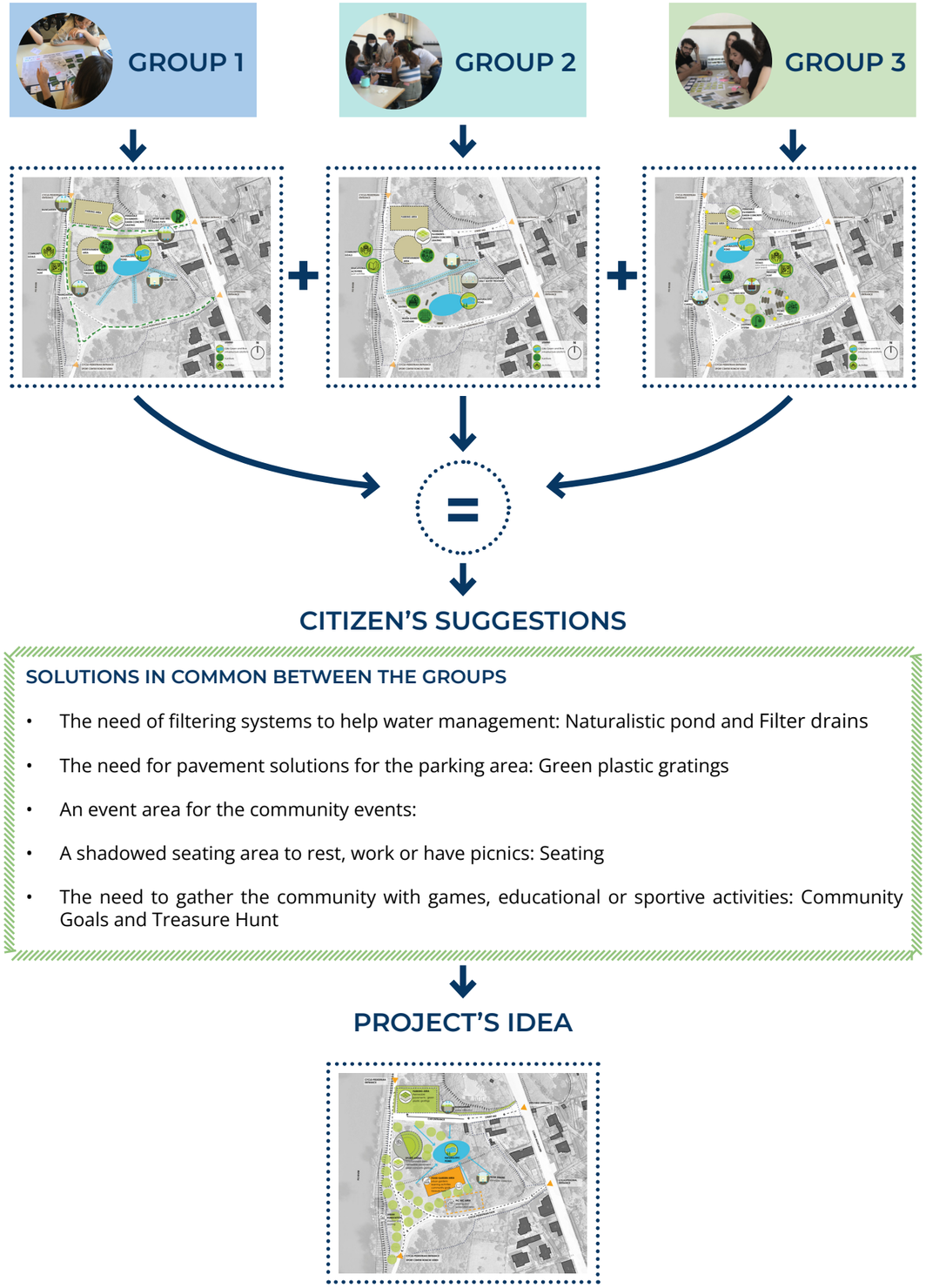
For the design of the water management part of the park, the solutions all the groups preferred were the creation of a naturalistic pond and the use of filter drains. The naturalistic pond was placed in the middle of the site area right below the height difference, in order to facilitate the water natural collection. Furthermore, it has been disposed of five filter drains to collect and convey the water from every part of the site area and to bring it to the pond. To these two measures, it was also added a linear stripe of raingarden, along the asphalt road, as suggested by group 1. This way the existing entrance, a private steep street, will be able to conduct the water runoff to the sides in case of rain extreme events, where the raingarden on one side and the filter drains on the other are going to infiltrate and resolve the problem. The raingardens are imagined also around the parking area that is going to be prepared with green plastic pavements. The raingardens are going to be filled with appropriate plants and local species tolerant to live o drought and inundation. The parking area was considered very important by the citizen's consultation to facilitate the access both for safety reasons, but also to make the area accessible to any kind of person with mobility problems, either old people, wheelchair users or injured ones.

Another important solution shared by all the groups was the need for an event area to organize community events and gather the community. In response to this request, it has been developed the idea for an open-air arena, with three terraced steps, realized with a dry-stone wall and soil, to have a natural looking and permeable structure, to reduce the runoff to the minimum, and fully integrated into nature. All the paths inside the park are going to be renewed with clay and calcestre paving to have a new look and to be easily maintained but at the same time have a high water infiltration rate.

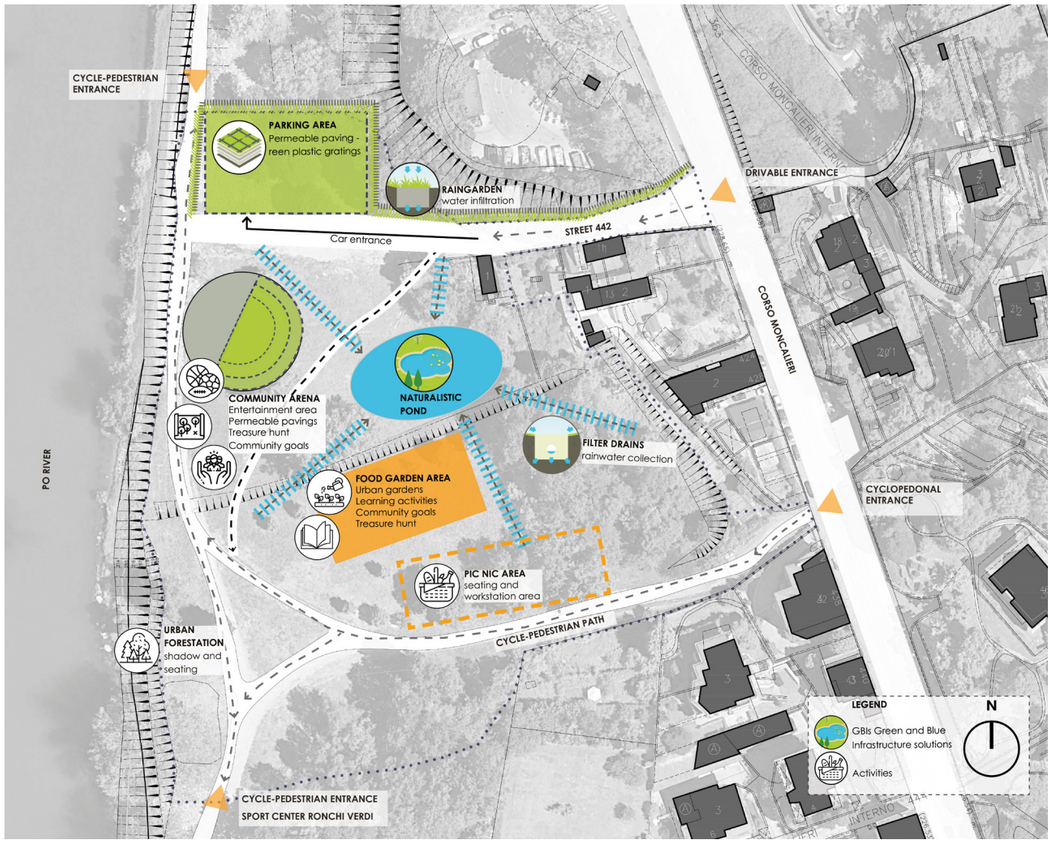
All around the arena are going to be placed high trees, along with the existing ones, to provide a shadowed area in which anyone can take a rest and enjoy the view of the river. The arena is going to host all the community events that are going to take place in the park, like games such as the treasure hunt and other educational activities for the younger ones, but also the organization of creative recycling activities for the whole community, time banking activities and other community goals. A thing that was suggested and could be actually improved would be a collaboration with the Ronchi Verdi sportive centre or music, and theatre companies to organize sportive activities and music events in the park arena that could involve the local community but also attract other users from all over the city. The park community could benefit from these events with entrance tickets or cocktail selling and gain the money to provide itself for the maintenance costs. In this, the Circoscrizione 8 and the local stakeholders, like the Casa del quartiere (neighbourhood house) would be vital in the creation of a collaboration pact between the park community and the municipality.

In the south part of the park, the one that is already the wilder and fuller of trees, it is going to be created a picnic area, with benches and tables, to host Sunday community lunches and other activities, like open-air smart working and cards or chess competitions for the elderly. Near this area it is going to be cultivated a small urban garden, both by the community and the Fioccardo Elementary school, that is going to use it as a learning activity to teach the students about the importance of biodiversity, food quality and spread sustainable good behaviours.

From the consultation process to the project's idea



The project's idea and Nature based solutions

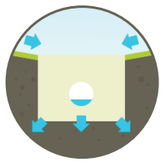


RAINGARDEN

Area along the street 422, filled with gravel and sand to filter and clean the rainwater. It is covered with plants and flowers adapted for either wet or dry periods. It will fill itself of water and return dry within a day from the rain event.

GREEN PLASTIC GRATINGS

For the parking area it was used a pavement solution made with plastic gratings, able to support the weight of the parked car and grassed to ensure the infiltration of rainwater.



FILTER DRAINS

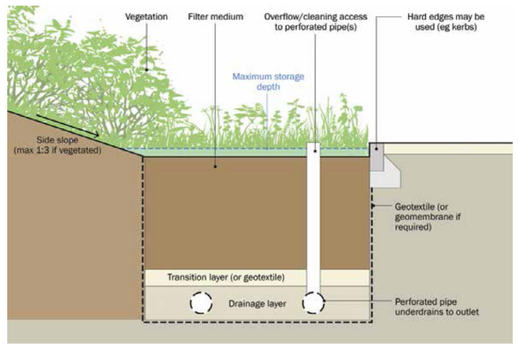
This linear drain areas, filled with material with gravel and sand, are equipped with a drain on the bottom to move the collected water and collect it to the natural pond.

NATURALISTIC POND

The inland of the park will host a wild area with the pod. It will have the function of phitodepuration for the rainwater and at the same time grow a wide variety of aquatic plant species, increasing biodiversity and the appealing of the area.

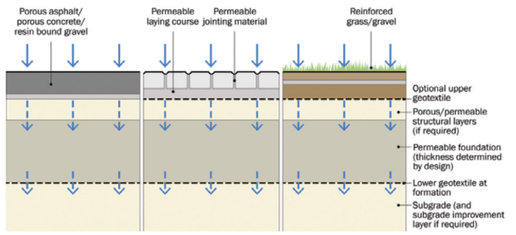
Nature based solutions functioning

Figures 5.22 Example of a raingarden along the street, https://www.progettareinverde.com/



Figures 5.22 Raingarden section, from Woods Ballard et al. 2015. *"The SuDS Manual"*

Figures 5.22 Concrete and plastic pavings ,http://www.paviblok.it http://www.bestprato.com



Figures 5.22 Pervious paving section, from Woods Ballard et al. 2015. *"The SuDS Manual"*

RAINGARDEN

Raingardens or bio-retention areas are slight depressions in the soil covered with green plants, aimed at harvesting and allow treatment of rainwater drained from the surrounding impermeable surfaces by filtration and removal of pollutants.

These systems therefore allow a completely natural filtering and purification of the collected water with excellent removal of the main pollutants carried by runoff rainwater, more than the 90%. In addition, the areas of bio-retention have a beneficial effect also in terms of reduction of hydraulic risk and increase of biodiversity.

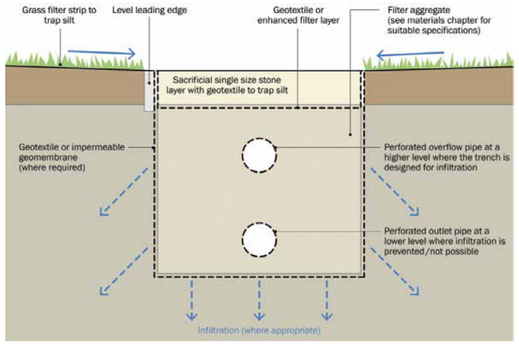
The run-off waters coming from the Corso Moncalieri street and the entrance street 442 are going to be conveyed through the asphalt's surface runoff to the vegetated bio-retention area at th side of the street. The strip with grass cover will performs a filtering action of the bigger material is going to slow down the flow rate. In the raingarden stagnation area the water is going to accumulate and sediment the transported material. The layer of organic material carries out a first filtration of rainwater and promotes the growth of microorganisms that provide for degradation of the transported organic matter. The thickness of vegetative soil will perform the function of a filtration system and the clay in the soil will provide for the adsorption of pollutants.

GREEN PLASTIC AND CONCRETE GRATINGS

The pavement system of the parking area is going to be made with draining surfaces, to guarantee the outflow surface of rainwater, that permeates into the ground. Through modular plastic mat elements, the rainwater will have the possibility to infiltrate on the ground without creating clogs. The plastic grating is usually filled with organic soil and grass. The green percentage for this solutions exceeds 90%, giving the area a very natural feeling.

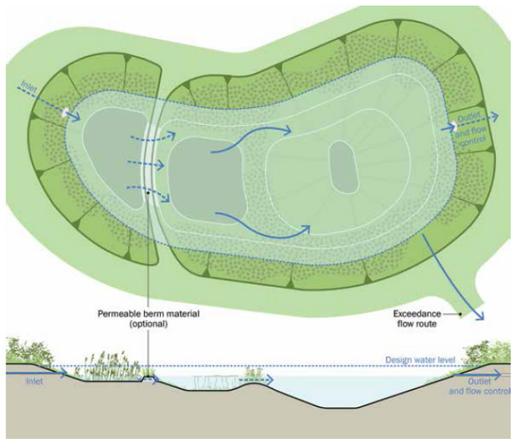
The concrete gratings are going to be used fro the arena with the same principles, but have a smaller percentage of green area, thus a longer infiltration time.

Figures 5.22 Filter drain, from Woods Ballard et al. 2015. *"The SuDS Manual"*



Figures 5.22 Filter drain section, from Woods Ballard et al. 2015. *"The SuDS Manual"*

Figures 5.22 Naturalistic pond, www.susdrain.org/



Figures 5.22 Pond plan and section, from Woods Ballard et al. 2015. *"The SuDS Manual"*

FILTER DRAINS

The filter drains are trenches lined with geotextile and filled with gravel, capable of containing, storing and temporarily filter rainwater and drained surface waters. During extreme rainstorm events they are going to absorb the runoff water from the park area and drain it to the naturalistic pond. In this case they are chosen as waterproof, to fill the pond, but they could also been designed to allow infiltration into the soil. At the bottom of this channels is going to be placed a filtering trench which guarantees a certain filtering of the runoff, capturing sediments, organic substances and oil residues and cleaning the runoff water.

NATURALISTIC POND

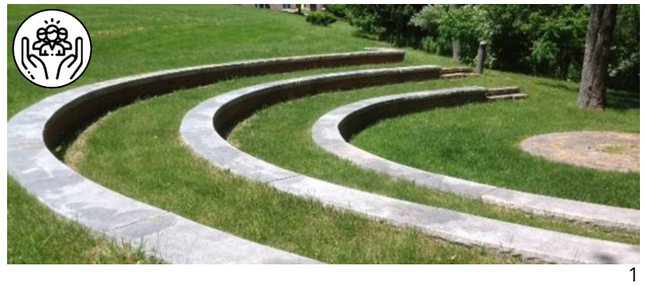
Ponds and wetlands are basins with a permanent body of water into which the rainwater and can be designed to provide multiple objectives such as lamination, water treatment rainwater and increase in biodiversity. The pond area is going to host the storm water carried out from the filter drains. it will have areas at different depths, to favour the plantation of different so plant species, and also to help the sedimentation a purification of the water. The pond anyway won't have points deeper than 1meter for safety reasons, since the whole area is going to be designed for kids as well.

The free surface of the pond could be used to accumulate the rain waters for the irrigation of the area around in case of droughts. the filter drains system, the filtering trench at the entrance of the pond and the pond itself are going to provide for the depuration from biological pollutants of the water through natural processes. It is going to be used for this purpose a kind of vegetation emerging and sub-emerging aquatic, phytodepuration plants.

The area is going to have a really naturalistic and wild feeling, surrounded by the existing trees and new vegetation, with the goal of making it an important green infrastructure for any kind of biodiversity animal.

All around the pond are going to be inserted really natural paths, created just by the cutting of the grass, so that the area remains accessible to the citizens and becomes a green oasis in the city.

Project's suggestions board



1

2

3

4

5 6

1
Suggestion for the green arena

2
Raingarden plants and flowers, https://blog.casanoi.it

3
Urban community garden, view of the community garden Horta das Corujas Credits: Gustavo Nagib http://journals.openedition.org

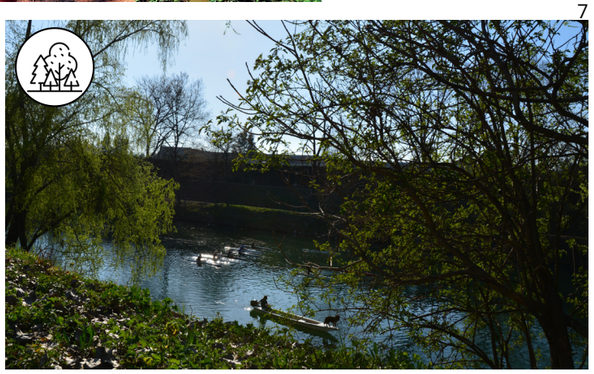
4
The naturalistic pond, www.susdrain.org

5
Urban educational garden, Credits: Gustavo Nagib

6
Pic nic area, from EVA-Lanxmeer project in Culemborg, https://www.urban green bluegrids.com

7
Urban forestry, tree plantation along the river banks, thesis's author

8
The thesis' author explaining the case study to the class.



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Indicators analysis

To understand the participatory design output and its value a public administration could decide to go for the study of and Impact assessment. Of course the procedure for a complete Impact assessment is extremely complicated and for more information on the subject it is recalled the chapter *2.1.5 Nature Based Solutions' effectiveness,* but in order to complete the steps of a participatory process, it will be given an example of indicators that could be useful on the evaluation of the project by a public administration. The aim of this chapter is to try to select the most appropriate indicators to assess the performance and impact of the NBS park project, based on the participation outputs.

The reference texts are the *Evaluating the impact of nature-based solutions* and *An impact evaluation framework to support planning and evaluation of nature-based solutions projects* (European Commission. et al. 2021; Raymond et al. 2017), published on the subject by the European Commission.

Approach to impact assessment

To analyse the effects of the project's Nature based solution implementations and of the participation process, it could be followed the example of the ProGIreg project, where it was measured the status quo before the participation process and after some month or a year of use of the new NBS, using mixed methods. A summary is reported in the following.

For the project the impact of the NBS, they were evaluated over four assessment domains: benefits in social aspects, health, environment and economy.

"At the district level, spatial data from existing administrative databases and GIS-derived data are used to evaluate indicators in the four domains all along the project, on a yearly basis. A general population survey aimed at collecting data on social, health, and economic indicators at the district level is performed before and after the implementation of the NBS and compared with analogous results obtained in a control district, having similar characteristics with respect to the Living Lab, but where no NBS (or minimal NBS) are planned. Ten tools and specific monitoring plans have been developed to monitor the impact of the single NBS (e.g., life-cycle assessments, NBS-users' questionnaires, or observational tools), taking into account cost-effectiveness and gathering comparable data." (European Commission. et al. 2021)

In proGIreg, the so-called quadruple-helix model, elaborated by the Living Labs (chapter 3)was adopted throughout the project, from co-design to impact evaluation. The quadruple-helix approach consists of four key stakeholder groups: civil society (NGOs and individual citizens), academia (universities and research institutions), governmental institutions (local governments and other public authorities) and the private sector (especially SMEs). This thriving collaboration was very useful for the organization of all the monitoring and evaluation parts of the ProGIreg project.

For this project, like for the ProGIreg one, it could be useful to evaluate indicators in different sectors. The areas the project challenges the most, out of the 12 purposed[79] by the book *Evaluating the impact of nature-based solutions* are:

1. Water Management
2. Natural and Climate Hazards
3. Green Space Management
4. Biodiversity Enhancement
5. Place Regeneration
6. Knowledge and Social Capacity Building for Sustainable Urban Transformation
7. Participatory Planning and Governance.

79 The 12 challenge areas are :1. Climate Resilience, 2. Water Management, 3. Natural and Climate Hazards, 4. Green Space Management, 5. Biodiversity Enhancement,6. Air Quality,7. Place Regeneration,8. Knowledge and Social Capacity Building for Sustainable Urban Transformation 9. Participatory Planning and Governance,10. Social Justice and Social Cohesion,11. Health and Wellbeing, 12. New Economic Opportunities and Green Jobs

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CONCLUSIONS AND FUTURE DEVELOPMENTS

6 CONCLUSIONS AND FUTURE DEVELOPMENTS

Comparison between the intended purposes and the results obtained

As described in the first chapter, the thesis aimed to explore the participatory approaches applied to Nature Based Solution projects, analysing their advantages and disadvantages, in order to involve the stakeholders in the decision-making process.

Along with the research, the thesis tried to focus on the various aspects of both Nature-Based Solutions literature, with the comparison between urban case study projects, and the Participatory Approach to design think processes, using co-design methodologies. The literature review was extremely useful to understand the limits of both cases, looking at existing papers but also confronting different methodologies. The elaboration of a clear methodology for the case study application was driven by the confrontation of this first research part. This preliminary research, which even if extensive is still considered partial and subjected to improvements, was indeed helpful in individuating the most important steps to elaborate a participatory engagement approach towards NBS application and conducted to the choice over one particular tool, the gamification one, that was practically tested. All the results are reported of this first phase are reported in the first three chapters of the thesis. The methodology elaborated by the candidate in chapter four was then applied to the chosen case study, throw the following steps:

1. Site analysis was carried out with different actions: throw a preliminary climate, urban planning and legislative analysis, with online data analysis of both the population and the site specifics and then with an actual site view and photographic report.
2. Citizen engagement was organized with a Participatory Workshop, held at the Polytechnic University of Turin, with the master class students, who were asked to play with the selected participatory gamification tool, Start Park. For the try-out test it was asked the master students to play the roles of the hypothetic stakeholders involved in the process of the park regeneration.
3. Analysis was carried out with a qualitative confrontation of the workshop outputs and the articulation of a summary of conclusions on the activity and solutions ideated.
4. Output was elaborated throw a preliminary project idea of the park renovation, build with NBS. All the design choices were made based on the workshop output and elaborated by logical evidence.

The application of the methodology to the case study was indeed considered valid in conducting to the desired final output, the citizen and stakeholder's engagement and the park's project idea with the use of the citizen's suggestions and Nature-based solution strategies.

Critical comment on the obtained results

The obtained results can be considered the end of the citizen's engagement part but the beginning of the administration and design work. The methodology structured for the case study is indeed able to realize a complete output from the participants, that are able not only to express their ideas but to actually understand the mechanism on which the nature-based solutions are chosen and therefore appreciate the advantages. In addition, the tested gamification tool effectively allows designing its own park, giving citizens the feeling that they are their "own home's designers". Furthermore, this aspect was considered decisive in the choice of Start Park for the case study compared to the other participatory methodologies, because it is innovative and highly engaging, both for the participants and for the administrations that find themselves, in fact with a project ready to be implemented. This is considered to be the greatest advantage of the process and its added value.

The importance of experimenting with participatory processes for administrations is in fact manifold,

because it re-establishes the lost contact between citizenship and the government, strengthening the trust of both parties and allowing to effectively realize the needs of end users with a bottom-up process instead of the common top-down one.

Critical comment of the parts just mentioned and possible further research developments

Obviously, in the context of the thesis, there are still aspects to be clarified that would have been worth investigating further, such as the bureaucratic and timing obstacles to the use of participatory approaches in the field of European projects such as Horizon 2020 or engagement strategies of stakeholders and private lenders through this type of participatory approaches, the possibility of developing this type of experience also with active agreements between citizens and administrations, such as citizenship pacts etc.

Further study could be carried in the research towards the elaboration of an Impact assessment, which is of critical importance in the comparison and evaluation over different solutions and also to have an overview of the positive benefits both nature based solutions and participatory approaches could carry. In the last paragraph of this thesis, the author tried to confront itself with the theme that was too vast and complicated to be confronted in the master thesis but could be an opening point for further researches.

The theme is very topical, with over 200 Nature Based projects active at the European and global level and there is still a lot to study and implement in the field of both NBS and participatory approaches. What could be useful for future research developments for more in-depth analysis is reported below.

An important thing could be the development of guidelines at the European level for this type of participatory approach, to have a clear indication from the point of view of administrations to facilitate their application. Furthermore, the study of bureaucratic obstacles to this type of process could streamline and speed up the application, encouraging its use.

In this, the New European Bauhaus movement project could be very fruitful because, as a networking platform at the European level, could facilitate both the development of common guidelines based on the type of project and the sharing of good practices and research in this regard.

Another path that could be followed is the one of developing an application for digital experimentation of participatory approaches, which can create greater trust in the administration and create a sense of unity and appearance towards one's community.

BIBLIOGRAPHY

Arnstein, Sherry R. 1969. “A Ladder Of Citizen Participation.” *Journal of the American Planning Association* 35 (4): 216–24. https://doi.org/10.1080/01944366908977225.

Balboni Alessandro, and Comune di Ferrara. 2022. “Scegli La Nuova Piazza Cortevecchia.” 2022. https://www.comune.fe.it/it/b/25610/scegli-la-nuova-piazza-cortevecchia.

Berni, M., A. Rizzo, A. Menin, L. Bittini, E. Pacchierotti, R. Duina, and F. Masi. 2022. “Start Park Project: Co-Designing Green-Blue Infrastructures to Build Resilient Communities to Climate Change.” In , 231–47. https://doi.org/10.1007/978-3-030-91843-9_15.

Bioeconomy team. 2022. “Bioeconomy Strategy Webpage.” Knowledge4Policy. 2022. https://knowledge4policy.ec.europa.eu/bioeconomy/bioeconomy-strategy.

Bjerknes, Gro, and Tone Bratteteig. 1995. “User Participation and Democracy: A Discussion of Scandinavian Research on System Development Participation in Participatory Design View Project Enquiry into PBC Practice: Phase 2 Assessment of PBC Practice in Defence View Project.” *Article in Scandinavian Journal of Information Systems*. Vol. 7. https://www.researchgate.net/publication/243774285.

Centro Ricerca per l’interazione con le industrie culturali e creative (CRICC), and Fondazione Innovazione Urbana (FIU). 2021. “Fondazione Innovazione Urbana, Visioni e Azioni Dell’istituzione Dedicata Alle Trasformazioni Di Bologna 18-21.” Bologna.

Città di Torino, Assessorato per le Politiche Ambientali, and Area Ambiente. 2020. “PIANO DI RESILIENZA CLIMATICA.” Torino. www.comune.torino.it/ambiente.

CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici. 2020. “ANALISI DEL RISCHIO. I Cambiamenti Climatici in Sei Città Italiane BOLOGNA VENEZIA ROMA TORINO MILANO NAPOLI.” https://doi.org/10.25424/cmcc/analisi_del_rischio_2021.

CodesignToscana, and Iridra srl. 2019. “Co-Design Report.” www.codesigntoscana.org.

Coent, Philippe le, Nina Graveline, Monica A. Altamirano, Nabila Arfaoui, Camilo Benitez-Avila, Thomas Biffin, Javier Calatrava, et al. 2021. “Is-It Worth Investing in NBS Aiming at Reducing Water Risks? Insights from the Economic Assessment of Three European Case Studies.” *Nature-Based Solutions* 1 (December): 100002. https://doi.org/10.1016/j.nbsj.2021.100002.

Commission, European. n.d. “EVALUATING THE IMPACT OF NATURE-BASED SOLUTIONS.” https://doi.org/10.2777/2219.

Connecting Nature. 2020. “Connecting Nature Website.” 2020. https://connectingnature.eu/.

Dessì, Valentina, Elena Farnè, Luisa Ravanello, Maria Teresa Salomoni, Politecnico di Milano DAStU, and Emilia-Romagna (regione). 2017. *Rigenerare La Città Con La Natura : Strumenti per La Progettazione Degli Spazi Pubblici Tra Mitigazione e Adattamento Ai Cambiamenti Climatici*. Edited by Fantini G and Punzo L. 2 edition. Santarcangelo di Romagna: Maggioli.

Dinter, Mayke van, and Abdolrasoul Habibipour. 2019. “Co-Creation Workshops Report.” www.UNaLab.eu.

Directorate-General for Communication. 2022. “The EU and Nature-Based Solutions Webpage.” June 20, 2022. https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en.

Directorate-General for Research and Innovation. 2022. “Nature-Based Solutions Research Policy Webpage.” 2022. https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions/research-policy_en#what-is-the-eus-policy.

Directorate-General for Research and Innovation Climate Action, Environment, Resource Efficiency and Raw Materials. 2015. “Towards an EU Research and Innovation Policy Agenda for Nature-Based Solutions & Re-Naturing Cities, Final Report of the Horizon 2020 Expert Group on ‘Nature-Based Solutions and Re-Naturing Cities.’” Luxembourg. https://doi.org/10.2777/765301.

Eklipse. 2022. “Eklipse Webpage.” 2022. https://eklipse.eu/process/.

Emilia-Romagna, Regione, and Paolo Tamburini. 2009. *Partecipare e Decidere. Insieme è Meglio Una Guida per Amministratori e Tecnici*. Edited by Educazione alla sostenibilità Servizio Comunicazione and Tiziana Gardini. Bologna: Centro Stampa Regione Emilia-Romagna.

European Commission, and Directorate-General for Communication. 2022. “Next Generation EU Webpage.” 2022. https://europa.eu/next-generation-eu/index_en.

European Commission. Directorate-General for Research and Innovation. n.d. *Biodiversity and Nature-Based Solutions : Analysis of EU-Funded Projects.*

European Commission., Directorate-General for Research and Innovation, Directorate C — Healthy Planet, and Unit C3 — Climate and Planetary Boundaries. 2021. *Evaluating the Impact of Nature-Based Solutions : A Handbook for Practitioners.* Luxemburg: Publications Office of the European Union.

European Commission, Directorate-General for Research and Innovation, Directorate Dir A — Policy Development & Coordination, and Unit A.5 — Better Regulation. 2018. *A NEW HORIZON FOR EUROPE Impact Assessment of the 9th EU Framework Programme for Research and Innovation*. Brussels: European Union. https://doi.org/10.2777/978720.

European Commission, Directorate-General for Research and Innovation, Directorate I — Climate Action and Resource Efficiency, and Unit I.3 — Sustainable Management of Natural Resources. 2015. *Towards an EU Research and Innovation Policy Agenda for Nature-Based Solutions & Re-Naturing Cities : Final Report of the Horizon 2020 Expert Group on ‘Nature-Based Solutions and Re-Naturing Cities’(Full Version)*. Luxembourg: Publications Office of the European Union.

European Commission, Joint Research Centre. 2022. “The New European Bauhaus Webpage.” 2022. The new European Bauhaus.

European Commission, and Secretariat-General. 2019. “COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The European Green Deal.” https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52019DC0640.

European Environment Agency. 2021. *Nature-Based Solutions in Europe: Policy, Knowledge and Practice for Climate Change Adaptation and Disaster Risk Reduction*. Luxemburg: Publications Office of the European Union. https://doi.org/10.2800/919315.

Faivre, Nicolas, Marco Fritz, Tiago Freitas, Birgit de Boissezon, and Sofie Vandewoestijne. 2017a. “Nature-Based Solutions in the EU: Innovating with Nature to Address Social, Economic and Environmental Challenges.” *Environmental Research* 159: 509–18. https://doi.org/10.1016/j.envres.2017.08.032.

———. 2017b. “Nature-Based Solutions in the EU: Innovating with Nature to Address Social, Economic and Environmental Challenges.” *Environmental Research* 159: 509–18. https://doi.org/10.1016/j.envres.2017.08.032.

FIU. 2022. “Fondazione Innovazione Urbana Website.” 2022. https://www.fondazioneinnovazioneurbana.it.

Fondazione Compagnia di San paolo. 2022. “Simbiosi Webpage.” 2022. https://www.compagniadisanpaolo.it/it/contributi/simbiosi-insieme-alla-natura-per-il-futuro-del-pianeta/.

Fung, Archon. 2006. “Varieties of Participation in Complex Governance.” *Public Administration Review*, December 2006.

Grow Green. 2020a. “Citizen Engagement for Nature-Based Solutions.”

———. 2020b. “Stakeholder and Citizen Engagement Processes within an NBS City Strategy.”

Hanania, Serene, Barbara Anton, Deliverable No, Author Serene Hanania, Co-Author Vasileios Latinos, Bettina Wilk, Rieke Hansen, Axel Timpe, and Riccardo Saraco. 2019. “Co-Designing Nature-Based Solutions in Living Labs, Deliverable 2.4 on Workshop Round 2 in Frontrunner Cities (Dortmund, Turin, Zagreb).” www.proGIreg.eu.

IPCC. 2022. “Climate Change 2022 Impacts, Adaptation and Vulnerability; Working Group II Contribution to the Sixth Assessment, Report of the Intergovernmental Panel on Climate Change.” www.ipcc.ch.

Iridra srl, Atkins, European investment bank, and Comune di Bologna. 2018. *Linee Guida Sull’adozione Di Tecniche Di Drenaggio Urbano Sostenibile per Una Città Più Resiliente Ai Cambiamenti Climatici*.

Mahabadi, Shahab Mirzaean, Hossein Zabihi, and Hamid Majedi. 2014. “Participatory Design; A New Approach to Regenerate the Public Space.” *International Journal of Architecture and Urban Development*.

Nanz, Patrizia, and Miriam Fritsche. 2014. *La Partecipazione Dei Cittadini: Un Manuale Metodi Partecipativi: Protagonisti, Opportunità e Limiti*. Edited by Alessandro Mengozzi, Alessandro Mengozzi, and Alessandro Mengozzi. Italian Edition. Bologna: Assemblea legislativa della Regione Emilia-Romagna . https://www.researchgate.net/publication/272418040Lapartecipazionedeicittadini:unmanuale.Metodipartecipativi:protagonisti,opportunita'elimiti.

Nature4Cities. 2017. "Nature4Cities Webpage." https://www.nature4cities.eu/.

NetworkNature. 2022. "NetworkNature Webpage." 2022. https://networknature.eu/.

Participedia. 2022. "Participedia Website." 2022. https://participedia.net/.

proGIreg project. 2022. "ProGIreg Webpage." 2022. https://progireg.eu/.

Raymond, Christopher M, P M Berry, Margaretha Breil, Mihai Razvan Nita, N Kabisch, M de Bel, V Enzi, et al. 2017. "An Impact Evaluation Framework to Support Planning and Evaluation of Nature-Based Solutions Projects." https://doi.org/10.13140/RG.2.2.18682.08643.

Secretariat of the Convention on Biological Diversity. 2004. "The Ecosystem Approach (CBD Guidelines)." Montreal. www.biodiv.org.

Serena Fiorelli. 2021. "Biopad Mobili e Città Biofiliche, FreeDOME Abitare Il Futuro." *Bioarchitettura Abitare La Terra* 1277 (March): 20–26.

———. 2022. "Biomimesis Design Web Page." 2022. https://www.biomimesisdesign.com/blog.

Spanoa, D, V Mereu, Marras S., Trabucco A., Adinolfi M., Barbato G., Bosello F., et al. 2020. *Analisi Del Rischio. I Cambiamenti Climatici in Italia*. https://doi.org/10.25424/CMCC/ANALISI_DEL_RISCHIO.

Spinuzzi, Clay. 2005. "The Methodology of Participatory Design." *Technical Communication* 52 (2): 163–74.

Start Park, Iridra srl, Codesign Toscana. 2020. "Start Park-Parchi Resilienti: Video Project:" 2020. https://www.youtube.com/watch?v=1yGyM_iJEjY&list=PL7alElrbTt8IY5yRL3fad6xD_w_M3pcNf&index=4.

Start Park, Iridra srl, and Codesign Toscana. 2022. "Start Park Webpage." 2022. http://www.startpark.org.

SuSD. 2022. "Sustainable Urban Drainage Website." https://www.susdrain.org.

Torino city lab, and Città di Torino. 2022. "ProGIreg.Torinocitylab Webpage." 2022. https://www.torinocitylab.it/it/progireg.

UK Green Building Council. 2021. "Principles for Delivering Urban Nature-Based Solutions Funding Partner." London, UK.

UN environment program. 2022. "Nature-Based Solutions for Climate Webpage." 2022. https://www.unep.org/nature-based-solutions-climate.

United Nations. 2015. "TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT UNITED NATIONS UNITED NATIONS TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT." New York. www.sustainabledevelopment.un.org.

———. 2019. "The Nature-Based Solutions for Climate Manifesto." In *UN Climate Action Summit* . https://www.unep.org/nature-based-solutions-climate.

United Nations Office for Disaster Risk Reduction. 2015. "Sendai Framework for Disaster Risk Reduction 2015 - 2030." Sendai, Japan.

Wendling, Laura, Joan Garcia, Danie Descoteaux, Barbara Sowińska-Świerkosz, Timon McPhearson, Niki Frantzeskaki, Daniele la Rosa, et al. 2021. "Editorial: Introduction to the Nature-Based Solutions Journal." *Nature-Based Solutions* 1 (December): 100003. https://doi.org/10.1016/j.nbsj.2021.100003.

Wild, Tom, Tiago Freitas, Sofie Vandewoestijne, Harriet. Bulkeley, Sandra. Naumann, Zoran. Vojinović, Carlo. Calfapietra, Kym. Whiteoak, and European Commission. Directorate-General for Research and Innovation. 2020. *Nature-Based Solutions : State of the Art in EU-Funded Projects*. Luxemburg: Publications Office of the European Union.

Woods Ballard, B. (Bridget), and Construction Industry Research and Information Association. 2015. *The SuDS Manual*. CIRIA.

World Bank. 2021. "A Catalogue of Nature-Based Solutions for Urban Resilience." Washington, D.C. www.worldbank.org.